

# ENVIRONMENT MASTER PLAN NATURAL RESOURCE MANAGEMENT (BASELINE)



**GOVERNMENT OF HIMACHAL PRADESH  
DEPARTMENT OF ENVIRONMENT, SCIENCE & TECHNOLOGY**



## Table of Contents

<b>INTRODUCTION</b>	<b>16</b>
<b>CHAPTER 1 FORESTS &amp; WILDLIFE</b>	<b>18</b>
1.1 Resource inventory of the existing assets of the sector	18
1.2 Patterns of planning and development in the sector	59
1.3 Technology adopted in the sector along with any changes in technology	66
1.4 Stakeholder involvement in environment preservation and restoration	67
1.5 Critical environment issues / hotspots associated with the sector	68
1.6 Environment initiatives taken by the sector to address critical environment issues	73
1.7 Environment monitoring (key parameters) carried out for activities related to the sector	76
1.8 Institutional Mechanism within the sector to address identified environmental issues	79
1.9 Data / documentation pertaining to addressing demographic issues in the context of the sectors, such as population changes; requirements of population and changing lifestyles; migratory population including tourists; transhumants; transit labour population; pressures felt by communities due to degraded environment conditions	72
1.10 Information on human resource management issues (which may have relevance to environment management) in the sector such as: manpower, vocational training, awareness levels etc.	83
1.11 Regulatory analysis to identify any regulations that have implications on the environment (negative or positive), and compliance with the same	86
1.12 Inventory of flora, fauna, aquatic species, inventory of habitats, existing species, endangered species, exotic species, inventory of migratory species and information on biodiversity losses.	86
<b>CHAPTER 2 WETLANDS</b>	<b>119</b>
2.1 Resource Inventory of Existing Assets of the Sector	119
2.2 In addition to the above listed common parameters, those specific to NRM sectors, covering flora, fauna and aquatic species are as follows	122
2.2.1 Inventory of habitats and existing species	122
2.2.2 Inventory of endangered species	122
2.3 Patterns of Planning and Development in the Sector	139
2.4 Technology Adopted in the Sector along with any Changes in Technology	140
2.5 Stakeholder Involvement in Environment Preservation and Restoration	142
2.6 Critical Environment Issues / Hotspots Associated with the Sector	144
2.7 Environment Initiatives taken by the Sector to Address Critical Environment Issues	146
2.8 Environment Related Studies Carried out in the Sector	148
2.9 Environment Monitoring (key parameters such as Air and Water Pollution) carried out for activities related to the sector	148
2.10 Institutional Mechanisms within the Sector to Address Identified Environment Issues	149
2.11 Data / Documentation Pertaining to Addressing Demographic Issues in the Context of the Sectors, such as Population changes; Requirements of Population and Changing Lifestyles; Migratory Population Including Tourists; Transhumants; Transit Labour Population; Pressures Felt by Communities due to Degraded Environment Conditions	154
2.12 Information on Human Resource Management issues (which may have relevance to environment management) in the sector such as: manpower, vocational training, awareness levels, etc.	155
2.13 Regulatory analysis to identify any regulations that have environment implications (negative or positive), and compliance with the same	158
2.14 Inventory of flora, fauna, aquatic species, inventory of habitats, existing species, endangered species, exotic species, inventory of migratory species and information on biodiversity losses have been given in the above sections. Further, a detailed list of avifauna and plants found in Pas is given in baseline of Forests and Wildlife (section 1.12)	159

<b>CHAPTER 3 FISHRIES</b>	<b>160</b>
3.1	Resource inventory of existing assets of the sector 160
3.1.1	Trout & Carp Fish farms in Himachal Pradesh 161
3.1.2	Angling in Himachal Waters 166
3.1.3	Status of Fish Ponds 166
3.1.4	Introduction of new species 170
3.1.5	District wise status of fisheries 171
3.1.6	Convenience fisheries of Himachal Pradesh 170
3.1.7	Reservoirs 176
3.1.8	Threat and the recent status of mahseer catches 185
3.2	In addition to the above listed common parameters, those specific to fisheries are as follows: 186
3.3	Inventory of threatened species and area of occurrence 187
3.4	Patterns of planning and development in the sector 189
3.4.1	Mahseer Fish 192
3.4.2	Fisheries Conservation 192
3.4.3	Reservoir Management 193
3.5	Technology adopted in the sector along with any changes in technology 193
3.5.1	Technology Dissemination: 193
3.5.2	Hatchery practice 194
3.5.3	Farming Cycle 194
3.6	Stakeholder involvement in environment preservation and restoration 195
3.6.1	Major Stakeholders and their current role 195
3.7	Critical environment issues /hotspots associated with the sector 197
3.8	Environment initiatives taken by the sector to address critical environment issues 199
3.8.1	State Government Sponsored Welfare Schemes 199
3.8.2	Central Govt. Sponsored Welfare Schemes 200
3.8.3	Schemes for Youth 201
3.8.4	Strategy of the 11th FY Plan 201
3.8.5	Extension & Training 202
3.8.6	Strategy/ action plan of State Government for rehabilitation of mahseer stock in lentic & lotic waters 203
3.8.7	GoI grant for Establishment of Pathological Laboratory 204
3.8.8	NHPC sponsored project Stage-II 204
3.8.9	Care & Maintenance of Trout Farms 204
3.9	Environment related studies carried out in the sector 205
3.9.1	An Evaluation Study of Community Fish Ponds Programme in Himachal Pradesh 205
3.9.2	Gaps in information 206
3.10	Environment monitoring (key parameters such as air and water pollution) carried out for activities related to the sector 207
3.10.1	Surface Water Quality. 207
3.11	Institutional mechanisms within the sector to address identified environment issues 211
3.12	Data / documentation pertaining to addressing demographic issues in the context of the sectors, such as population changes; requirements of population and changing lifestyles; migratory population including tourists; transhumants; transit labour population; pressures felt by communities due to degraded environment conditions 213
3.13	Information on human resource management issues (which may have relevance to environment management) in the sector such as: manpower, vocational training, awareness levels etc. 226
3.14	Regulatory analysis to identify and regulations that have environment implications (negative or positive), and compliance with the same 227
<b>CHAPTER 4 AGRICULTURE</b>	<b>229</b>
4.1	Resource inventory of existing assets of the sector 229
4.1.1	District wise Status of Agriculture 224

4.1.2	Area and production of cash crops	256
4.1.3	Land holding size	257
4.1.4	Mushroom Farming	259
4.2	Pattern of Planning and Development in Sector	259
4.3	Technology/schemes adopted in sector along with any change in technology	272
4.4	Stakeholder involvement in environment preservation & restoration	274
4.5	Critical Environment Issues/ Hotspots Associated With Sector	275
4.6	Environment initiatives taken by the sector to address critical environment issues	280
4.7	Environment related studies carried out in the sector	283
4.8	Environment monitoring (key parameters such as air and water pollution) carried out for activities related to the sector	283
4.9	Institutional mechanisms within the sector to address identified environment issues	301
4.10	Data / documentation pertaining to addressing demographic issues in the context of the sectors, such as population changes; requirements of population and changing lifestyles; migratory population including tourists; transhumant; transit labour population; pressures felt by communities due to degraded environment conditions	305
4.11	Information on human resource management issues (which may have relevance to environment management) in the sectors such as: manpower, vocational training, awareness levels, etc.	310
4.12	Regulatory analysis to identify any regulations that have environment implications (negative or positive), and compliance with the same	311
<b>CHAPTER 5 HORTICULTURE</b>		<b>313</b>
5.1	Resource inventory of existing assets of the sector	313
5.1.1	Horticulture Resource	314
5.1.2	District level information of horticulture sector resources are described below	316
5.1.3	Horticultural Production Infrastructure	322
5.2	Patterns of planning and development in the sector	332
5.3	Technology adopted in the sector along with any changes in technology	345
5.4	Stakeholder involvement in environment preservation and restoration	358
5.5	Critical environment issues /hotspots associated with the sector	360
5.6	Environment initiatives taken by the sector to address critical environment issues	366
5.7	Environment related studies carried out in the sector	370
5.8	Environment monitoring (key parameters such as air and water pollution) carried out for activities related to the sector	372
5.9	Institutional mechanisms within the sector to address identified environment issues	373
5.10	Data / documentation pertaining to addressing demographic issues in the context of the sectors, such as population changes; requirements of populations and changing lifestyles; migratory populations including tourists; transhumants; transit labour population; pressures felt by communities due to degraded environment conditions	376
5.11	Information on human resource management issues (which may have relevance to environment management) in the sector such as: manpower, vocational training, awareness levels etc.	384
5.12	Regulatory analysis to identify any regulations that have environment implications (negative or positive), and compliance	384
<b>CHAPTER 6 ANIMAL HUSBANDRY &amp; LIVESTOCK</b>		<b>386</b>
6.1	Resource inventory of the existing assets of the sector	386
6.1.1	District wise Status of Animal Husbandry	388
6.1.2	Status of Livestock and Animal Husbandry	395
6.1.3	Livestock Species	397
6.1.4	Animal Husbandry and Livestock Produce in Himachal Pradesh	400
6.2	Patterns of planning and development in the livestock sector	403
6.3	Technology / Schemes adopted in the livestock sector along with any changes in technology	411
6.4	Stakeholder involvement in environment preservation and restoration	411
6.5	Critical environment issues /hotspots associated with the livestock sector	412

6.6	Environment initiatives taken by the livestock sector to address critical environment issues	414
6.7	Environment related studies carried out in the livestock sector	415
6.8.	Environment monitoring (key parameters such as air and water pollution) carried out for activities related to the livestock sector	416
6.9	Institutional mechanisms within the sector to address identified environment issues	416
6.10	Data / documentation pertaining to addressing demographic issues in the context of the sectors, such as population changes; requirements of population and changing lifestyles; migratory population including tourists; transhumants; transit labour population; pressures felt by communities due to degraded environment conditions	420
	6.10.1 Milk Based Industries in Himachal Pradesh	426
6.11	Information on human resource management issues (which may have relevance to environment management) in the livestock sector such as: manpower, vocational training, awareness levels etc.	427
6.12	Regulatory analysis to identify any regulations that have environment implications (negative or positive), and compliance with the same	428

## List of Tables

<b>CHAPTER 1 FORESTS &amp; WILDLIFE</b>	<b>18</b>
Table 1: Forest Cover Change Matrix	19
Table 2: Forest Classification- 2006-07	19
Table 3: Forest Resources in Himachal Pradesh	20
Table 4: Species-wise area, Growing stock and Yield of important species - 2006-07	20
Table 5: Outturn of Forest Produce and their contribution to Forest Revenue	21
Table 6: Sources of Forest Revenue	21
Table 7: Forest Produce of Himachal Pradesh from 1991-2000	22
Table 8: Plantations of different species are being raised in Himachal Pradesh under various schemes	22
Table 9: District-wise forest cover in 2007	23
Table 10: Altitude zone wise forest cover	23
Table 11: Forest & Tree Cover	23
Table 12: Status of Recorded Forest Area in Himachal Pradesh	24
Table 13: Forests Area/ Growing Stock of important tree species	24
Table 14: Forest types with dominant tree species occurring in Himachal Pradesh	25
Table 15: Western Himalayan oaks	26
Table 16: Protected Areas in Himachal Pradesh	27
Table 17: District wise List of National Parks and Wildlife Sanctuaries	29
Table 18: Critically Endangered (CR)	31
Table 19: Endangered (EN)	31
Table 20: Vulnerable (VU)	31
Table 21: Forest Area According to Classification (ha)	33
Table 22: Output and Value of Major Forest Products	33
Table 23: Production of Rosin, Turpentine and Cement	34
Table 24: Forest cover during 1998-99	35
Table 25: Value of forests products-1998-99	35
Table 26: Plant species found in Chamba	37
Table 27: Species of fauna found in Chamba	38
Table 28: List of Birds	42
Table 29: Forest Product and Revenue	44
Table 30: Forest Area under control of Forest Department, during year 1999-2000	45
Table 31: Species of plants & forest trees found in Kinnaur	46
Table 32: Faunal species found in Kinnaur	46
Table 33: Forest cover in kullu district (km <sup>2</sup> )	48
Table 34: Species of plants & trees found in Kullu	48
Table 35: Forest area in Hectares	51
Table 36: Classification of forest with area in hectares	52
Table 37: List of trees shrubs & grasses found in Shimla	52
Table 38: List of animals & birds found in Shimla	54
Table 39: Plants found in Sirmaur district	55
Table 40: Area under Forest during 1998-99	58
Table 41: Forest Products and their Value, During Year 1998-99	58
Table 42: Development Schemes in the Forestry Sector	62
Table 43: Forest as Per Crown Density (SFR-FSI-2008) (Area in km <sup>2</sup> )	76
Table 44: Changes in Forest Cover of Himachal Pradesh since 1972	77
Table 45: Based on Forest Survey of India, SFRs district wise forest cover change in dense and open.	77
Table 46: Changes in Growing Stock of commercially important species	78
Table 47: NTFPs of Himachal Pradesh from 1995 to 2003-04 Quantity in Tonnes and Value in '000'	78
Table 48: Forest Area and Population of districts of Himachal Pradesh (Area in km <sup>2</sup> )	72
Table 49: Cadre Position of the IFS, HPFS and other Officers	83
Table 50: Staff Position of Field, Technical, Ministerial & Class-IV cadre	84
Table 51: Forestry Administrative Units As On 31.03.2008	84
Table 52: Forestry Personnel in Position as On 31-03-2008	85

**CHAPTER 2 WETLANDS****119**

Table 1:	Area Estimates of Wetlands in HP (Area in ha)	121
Table 2:	Wetland distribution in Himachal Pradesh (Area in Ha)	121
Table 3:	Endangered (EN)	127
Table 4:	District-wise wetland area	127
Table 5:	Area estimates of wetlands in Bilaspur (ha)	128
Table 6:	Area estimates of wetlands in Chamba (ha)	129
Table 7:	Area estimates of wetlands (ha)	130
Table 8:	Area estimates of wetlands (ha)	130
Table 9:	Area estimates of wetlands (ha)	131
Table 10:	Area estimates of wetlands in Kullu (ha)	132
Table 11:	Area estimates of wetlands in Lahaul & Spiti (ha)	133
Table 12:	Area estimates of wetlands in Mandi (ha)	135
Table 13:	Area estimates of wetlands in Shimla (ha)	136
Table 14:	Area estimates of wetlands in Sirmaur (ha)	137
Table 15:	Area estimates of wetlands in Solan (ha)	138
Table 16:	Area estimates of wetlands in Una (ha)	139
Table 17:	Water quality of Lakes Wetland in HP (Year2006)	148
Table 18:	Cadre Position of the IFS, HPFS and other Officers	155
Table 19:	Staff Position of Field, Technical, Ministerial & C lass-IV cadre	156
Table 20:	Forestry Administrative Units As On 31.03.2008	157
Table 21:	Forestry Personnel in position as on 31-03-2008	157

**CHAPTER 3 FISHERIES****160**

Table 1:	List of Fish found in HP	160
Table 2:	Trout and Carp farms under the control of Fisheries Department, Himachal Pradesh	162
Table 3:	Area and Year wise distribution of sampled fish ponds	166
Table 4:	Types of Construction of Fish Ponds	166
Table 5:	Source of water supply to Fish Ponds	167
Table 6:	Status of Functional and Non-Functional Fish Ponds	167
Table 7:	Reasons for Non-functionality of Ponds	168
Table 8:	Public Perception about Non Functionality of Ponds	168
Table 9:	Maintenance of Fish Ponds	169
Table 10:	Source of procurement of Fish Seed	170
Table 11:	Average Cost of production / pond	170
Table 12:	Fish Varieties	175
Table 13:	Status of Fisheries in H.P	187
Table 14:	Changes in the Pong reservoir fisheries	189
Table 15:	Expected production plan of one tonne of portion si ze fish in 10 to 12 months	194
Table 16:	Progress under SJVN sponsored project	196
Table 17:	Progress under BBMB sponsored project	196
Table 18:	Progress under NHPC sponsored project Stage-II	204
Table 19:	Details of Survey	206
Table 20:	River Quality Data (Annual Avg.)Year 2003	207
Table 21:	River Quality Data (Annual Avg.)Year 2004	207
Table 22:	River Quality Data (Annual Avg.)Year 2005	208
Table 23:	River Quality Data (Annual Avg.)Year 2006	209
Table 24:	River Quality Data (Annual Avg.)Year 2010	209
Table 25:	Lakes Water Quality Data Year 2003	210
Table 26:	Lakes and Reservoir Water quality data 2004	210
Table 27:	Lakes /dam water Quality data 2005	210
Table 28:	Lakes/ Reservoir Water quality data 2006	211
Table 29:	Fishing activities in Bilaspur district	213
Table 30:	Number of licensed fishermen and production of fish in Chamba district	214



Table 31:	Production and value of catch fish from 1991-92 to 1999-2000 Fisheries	214
Table 32:	Production and value of fish in Kangra district	214
Table 33:	Fisheries status in Kangra district	214
Table 34:	Fisheries status in Kinnaur district	215
Table 35:	Fisheries activities in Mandi district during the year 1998-99	215
Table 36:	Fisheries activities in Shimla district during the year 1998-99	215
Table 37:	Fishing activities during the year 1999-2000	215
Table 38:	Fishermen, fish production, income etc. in Solan district	215
Table 39:	Fisheries status in Una district	215
Table 40:	Statistical Summary of source wise Production & Values of Fisheries Department of Fisheries for the month March 2007	216
Table 41:	Statistical Summary of source wise Production & Values of Fisheries Department of Fisheries for the month March 2008	216
Table 42:	Statistical Summary of source wise Production & Values of Fisheries Department of Fisheries for the month March 2009	217
Table 43:	Statistical Summary of Fish Production (Riverine), Department of Fisheries for the month March 2007 to 2009	217
Table 44:	Statistical Summary of Fish Production (Reservoir), Department of Fisheries for the month March 2007 to 2009	217
Table 45:	Statistical Summary of Production (Trout), Department of Fisheries for the month March 2007 – 2009	218
Table 46:	Statistical Summary of Production/Sale (Trout), Department of Fisheries for the month March 2007 – 2009	218
Table 47:	Statistical Summary of Total Production (Carp), Department of Fisheries for March 2007–2009	218
Table 48:	Carp Farms Stocking Details (Fry/Fingerlings in lakhs) 2007- 09	219
Table 49:	Trout Farms Stocking Details (Fry/Fingerlings in lakhs) 2007 – 09	219
Table 50:	Revenue from Riverine for the Month of March (2007 to 2009)	220
Table 51:	Revenue from Reservoir for the Month of March 2007 to 2009	220
Table 52:	Revenue from Trout for the Month of March (2007 to 2009)	221
Table 53:	Revenue from Carp Farms for the Month of March (2007 to 2009)	221
Table 54:	Statistical Summary of Licenses (Riverine), Department of Fisheries for the month March 2007 to 2009	222
Table 55:	Statistical Summary of Licenses (Reservoir), Department of Fisheries for the month March (2007 to 2009)	222
Table 56:	Statistical Summary of Licenses (Trout), Department of Fisheries for the month March (2007 to 2009)	222
Table 57:	Target and Achievements in licence upto March (2007to 2009)	222
Table 58:	Achievements in Illegal Cases upto March (2007 to 2009)	222
Table 59:	Target and Achievements in Fish production from March (2007 to 2009)	223
Table 60:	Target and achievements in revenue from March (2007to2009)	223
Table 61:	Target and Achievements in Carp Farm Production from March, 2007 to 2009	224
Table 62:	Target and Achievements in Trout Farm Production from March (2007 to 2009)	224
Table 63:	Reservoirs Species-wise Catch statistics (Qty in tonnes) 2007 to 2009	234
Table 64:	Statistical Summary of Illegal Cases (Riverine), Department of Fisheries for the month March 2007 to 2009	225
Table 65:	Statistical Summary of Illegal Cases (Reservoir), Department of Fisheries for the Month March 2007 to 2009	225
Table 66:	Statistical Summary of Illegal Cases (Trout), Department of Fisheries for the Month March 2007 to 2009	225
Table 67:	Statistical Summary of Co-op. Societies (Reservoir), Department of Fisheries (March 2007 – 2009)	225
Table 68:	Manpower status (as on 31-10-2009) in Department of Fisheries	226

**CHAPTER 4 AGRICULTURE** **229**

Table 1:	Salient features of Different agro-climatic zones of Himachal Pradesh	230
Table 2:	Suitable Crops under Agro Climatic Zones in State	230

Table 3:	Districts and Tehsils in Different Agro-Climatic Zones	231
Table 4:	Details of soil quality and area	232
Table 5:	Irrigation in Himachal Pradesh (Km <sup>2</sup> )	233
Table 6:	Source of Water Supply and Area Irrigated	233
Table 7:	Net Irrigated Area in Himachal Pradesh (ha)	233
Table 8:	Irrigated areas covered under HYV and other cereal varieties (1995-99) (Km <sup>2</sup> )	234
Table 9:	Tehsil wise area under principal crops	234
Table 10:	Area under major crops for the year 1999-2000	234
Table 11:	Profile of Agriculture in Bilaspur District (Km <sup>2</sup> )	235
Table 12:	Land utilization statistics for the 1997-98	236
Table 13:	Area and production of principal crops	236
Table 14:	Profile of Agriculture in Chamba District	236
Table 15:	Tehsil Wise Land Utilization Statistics for the Year 1999-2000 (ha)	238
Table 16:	Area under different major crops and production, 1996-97	238
Table 17:	Profile of Agriculture in Hamirpur District	238
Table 18:	Land utilization statistics for the year 1998-99	239
Table 19:	Area under different crops and production	239
Table 20:	Tea Production 1998 -1999	240
Table 21:	Profile of Agriculture in Kangra District	240
Table 22:	Land utilization statistics for the year 2010-11	241
Table 23:	Sowing and harvesting period of important crops	241
Table 24:	Production and Export of Potato (MT)	241
Table 25:	Area and production of major crops during 1999-2000	241
Table 26:	Profile of Agriculture in Kinnaur District	242
Table 27:	Land utilisation statistics for the year 1998-99	243
Table 28:	Tehsil wise area under Main Crops (ha)	243
Table 29:	Production and Export of Potato (MT)	243
Table 30:	Crop Coverage area and Production of District Kullu	243
Table 31:	Profile of Agriculture in Kullu District	243
Table 32:	Tehsil wise area under main crops in Lahaul & Spiti District during 1999 -2000	245
Table 33:	Profile of Agriculture in Lahaul & Spiti District	245
Table 34:	Sown area and area under major crops in Mandi district during the year 1997-98	247
Table 35:	Type and number of holdings in ha 1995-96	247
Table 36:	Profile of Agriculture in Mandi District	247
Table 37:	Land utilisation pattern in Shimla district during the year 1998-99 (ha)	248
Table 38:	Area and production under major crops in Shimla district during the year 1998-99	249
Table 39:	Profile of Agriculture of Shimla District	250
Table 40:	Land use classification and crop production during the year 1999-2000.	251
Table 41:	Profile of Agriculture of Sirmaur District	251
Table 42:	Tehsil wise cultivated area under the major crops in Solan district in the year 1999-2000 (ha)	253
Table 43:	Profile of Agriculture in Solan District	254
Table 44:	Crop Yield (Kg/ha) During 1993-94 to 1995-96	255
Table 45:	Land utilization statistics for the year 1999-2000	255
Table 46:	Tehsil wise area under main crops (ha) during 1999-2000	255
Table 47:	Area under different crops and production	255
Table 48:	Profile of Agriculture in Una District	256
Table 49:	Year wise production of cash crops	256
Table 50:	District and Year Wise Production of Potato (MT)	257
Table 51:	Year wise area of cash crops	257
Table 52:	District and year wise area of potato (ha)	257
Table 53:	Production potential of exotic vegetables	257
Table 54:	Number & area of operational holdings by size class of holding 2000-01	258
Table 55:	Distribution of land holdings	258
Table 56:	District wise operational holdings and area-2005-06	258
Table 57:	Suitable Temperature for Mushroom Farming	259

Table 58: Change in Cropping Pattern	262
Table 59: Progress in Production of Crops	262
Table 60: Year wise area under High Yielding Variety crops	262
Table 61: Food grains production (In '000 tonnes)	263
Table 62: List of Watershed Identified for Tenth five Year Plan	263
Table 63: Present Method of Irrigation	272
Table 64: District-wise farm machinery use and gap in Himachal Pradesh	273
Table 65: District-wise Rainfall (in mm)	275
Table 66: Season-wise shift in cropping pattern	276
Table 67: Consumption of Fertilizer (MT)	277
Table 68: Damage Due to Drought Conditions in Himachal Pradesh	278
Table 69: Distribution of Post Harvest Facilities in Himachal Pradesh, 2005-06	279
Table 70: Distribution of Land Holdings	279
Table 71: List of Bio-gas Plants in State	280
Table 72: Consumption of Fertilizers (in metric tonnes)	283
Table 73: District-Wise Fertilizer Consumption per ha (MT)	284
Table 74: District Wise utilisation of fertilizers in terms of Nutrients (MT)	284
Table 75: Year wise utilisation of fertilizers in terms of Nu trients (MT)	284
Table 76: Pesticide Consumption in Himachal Pradesh	284
Table 77: Pesticide Residue in H.P.	285
Table 78: Status of Pesticide Residues in Food	285
Table 79: Waiting Period in Days after Last Pesticide Application before Harvesting	286
Table 80: River Quality Data (Annual Avg.)Year 2003	286
Table 81: River Quality Data (Annual Avg.) Year 2004	287
Table 82: River Quality Data (Annual Avg.)Year 2005	287
Table 83: River Quality Data (Annual Avg.)Year 2006	288
Table 84: River Quality Data (Annual Avg.)Year 2010	288
Table 85: Lakes Water Quality Data 2003	299
Table 86: Lakes and Reservoir Water Quality Data 2004	299
Table 87: Lakes /Dam Water Quality Data 2005	299
Table 88: Lakes/ Reservoir Water Quality Data 2006	300
Table 89: Ground Water Quality Data 2003	300
Table 90: Ground Water Quality Data 2004	300
Table 91: Ground Water Quality Data 2005	300
Table 92: Ground water Quality Data 2006	301
Table 93: Distribution of Population by Workers in Himachal Pradesh (number)	305
Table 94: Composition of Total Workers in Himachal Pradesh (number)	306
Table 95: Year wise No. of Operational Holdings and Area Operated by Size Class in H.P.	306
Table 96: District wise No. of Operational Holdings and Area Operated by Size Class in H.P.	306
Table 97: Changes in Land Utilization Pattern in Himachal Pradesh, 2001-02 to 2005-06 ('000 ha)	307
Table 98: Food grains Area and Production	308
Table 99: Year wise Area, Production and Productivity of Rabi and Kharif Crops	308
Table 100: District wise Fertilizer Consumption in MT (2006-07)	308
Table 101: Agricultural Wages per Days (°) in the Month of July-June	309
Table 102: District wise area under high yielding variety crops	309
Table 103: District wise crop intensity	309

## **CHAPTER 5 HORTICULTURE**

**313**

Table 1: Fruit Production	313
Table 2: Fruit Production ('000 tonnes)	313
Table 3: District Wise Area (ha) under different fruit crops bearing trees (1998-99)	314
Table 4: District-wise bearing and non-bearing area (ha) under fresh fruits, dry fruits and vegetables (1998-99)	314
Table 5: Horticultural resources (crops) and Zones in Himachal Pradesh	314
Table 6: Fruits Production (MT) /ha	316
Table 7: District wise Progeny-cum Demonstration Orchards (PCDOs)/Nurseries	322
Table 8: District wise private registered nurseries	322

Table 9:	Status of Olive Stations	323
Table 10:	Status of Walnut Station	323
Table 11:	Status of plant protection centre	323
Table 12:	Present capacity of fruit and vegetable processing units	323
Table 13:	Improved plant materials	323
Table 14:	Gross Value Added of Horticulture, 1999-2000 to 2006-07 in Himachal Pradesh (at 1999-2000 prices)	324
Table 15:	Decadal Variation of Areas under different fruits	326
Table 16:	Decadal variation in production of different fruits	326
Table 17:	Year wise Area & Production of different fruits in Himachal Pradesh	327
Table 18:	Area under Fruits 1994-2007 (Km <sup>2</sup> )	327
Table 19:	Production of Fruits ('000 tonnes)	327
Table 20:	District wise fruit production in 2005-06 (in tonnes)	328
Table 21:	Production of fruits (2006-07) (in tonnes)	328
Table 22:	Crop wise production in tonnes (2008-09)	329
Table 23:	District wise area under different fruits (2005-06) (Km <sup>2</sup> )	329
Table 24:	Crop wise Area (ha)- (2007-08)	330
Table 25:	Comparison of Area Production and Productivity of fruits in the Himachal Pradesh	330
Table 26:	District wise Bearing & Non bearing Area (Km <sup>2</sup> ) under Fresh fruits, Dry fruits & Vegetables (1988-99)	331
Table 27:	Major Medicinal Herbs Exported From Himachal Pradesh (Quintal)	332
Table 28:	Area under fruits and production	334
Table 29:	Location & Activities of Plant Tissue Culture Lab	347
Table 30:	Available Subsidies for individual orchards	349
Table 31:	Available Subsidies for Garden Colonies	350
Table 32:	Training Programs during 2007-12	359
Table 33:	District wise Rainfall (in mm)	360
Table 34:	Consumption of Fertilizer (MT)	361
Table 35:	Damage Due to Drought Conditions in Himachal Pradesh	364
Table 36:	Distribution of Post Harvest Facilities in Himachal Pradesh, 2005-06	365
Table 37:	Subsidy / Incentives for Mushroom Developments	369
Table 38:	Farmers Response (%) for the use of chemicals	370
Table 39:	Intensity of chemicals used for the different variety of apple trees & vegetable being grown	370
Table 40:	Farmer's response (%) on awareness of chemicals use & precautions while using them	370
Table 41:	Farmer's response (%) on health imbalances/problems caused by chemicals	370
Table 42:	Possible introduction of diseases	371
Table 43:	Salt tolerance of crops	371
Table 44:	Suitable plants for different pH	371
Table 45:	Consumption of Pesticides	371
Table 46:	List of tolerant trees in and around industrial areas	372
Table 47:	Gross Value Added of Horticulture, 1999-2000 to 2006-07 in Himachal Pradesh (at 1999-2000 prices)	376
Table 48:	Decadal Variation of Areas under different fruits	378
Table 49:	Decadal Variation in production of different fruits	378
Table 50:	Year wise Area & Production of different fruits in Himachal Pradesh	378
Table 51:	Area under Fruits 1994-2007 (Km <sup>2</sup> )	378
Table 52:	Production of fruits ('000 tonnes)	379
Table 53:	District wise fruit production in 2005-06 (in tonnes)	379
Table 54:	Production of fruits (2006-07) (in tonnes)	379
Table 55:	Crop wise production in tonnes (2008-09)	380
Table 56:	District wise area under different fruits (2005-06) (in Km <sup>2</sup> )	381
Table 57:	Crop wise Area in ha (2007-08)	381
Table 58:	Comparison of Area Production and Productivity of fruits in the Himachal Pradesh	382
Table 59:	District wise Bearing & Non bearing Area (Km <sup>2</sup> ) under Fresh fruits, Dry fruits & Vegetables (1988-99)	383
Table 60:	Major Medicinal Herbs Exported From Himachal Pradesh (Quintal)	383

**CHAPTER 6 ANIMAL HUSBANDRY & LIVESTOCK****386**

Table 1:	Livestock Development (1972-2007) Himachal Pradesh	386
Table 2:	District-wise Livestock (1982-2003), Himachal Pradesh	386
Table 3:	Comparison of population of Livestock in Himachal Pradesh (1992-2007)	387
Table 4:	District wise Hospital & Dispensaries, H.P	388
Table 5:	Tehsil/ Sub-Tehsil wise number of livestock and poultry in district Bilaspur	388
Table 6:	Number of livestock and poultry in district Chamba	389
Table 7:	Number of livestock and poultry in district Kangra	390
Table 8:	Number of milk chilling plant in district Kangra	390
Table 9:	Number of livestock and poultry in district Kinnaur	390
Table 10:	Number of livestock and poultry in district Kullu	391
Table 11:	Statement showing the livestock and institutions in Lahaul & Spiti district as on 31.3.1999	391
Table 12:	Number of live stock and poultry in district Mandi	392
Table 13:	Number of Institutions and Production of milk products in 1998-99	392
Table 14:	Number of Livestock and poultry in Shimla District	393
Table 15:	Number of Institutions in Shimla District	393
Table 16:	Number of livestock and poultry in district Sirmaur	394
Table 17:	Number of Livestock and Poultry in District Una	395
Table 18:	Livestock (1972-1997), Himachal Pradesh	395
Table 19:	Comparison of Livestock in India and Himachal Pradesh, 1992	396
Table 20:	Composition of Livestock, 1972 and 1997	396
Table 21:	District-wise Concentration of Livestock, 1982-1997	396
Table 22:	District-wise Livestock Combination, 1997, Himachal Pradesh	397
Table 23:	Animal Produce (1987-2002)	400
Table 24:	District-wise Annual Milk Production 2000-2001 and 2001-02	401
Table 25:	District-wise Annual Wool Production 2000-2001 and 2001-02	401
Table 26:	Meat Production by Districts, 2001-02 (in tonnes)	401
Table 27:	Egg Production by Districts, 2001-02 (in Million)	402
Table 28:	Livestock Productivity in Himachal Pradesh	402
Table 29:	Milk Production and Per Capita Availability	403
Table 30:	Development in the livestock population, production and their health programmes for year 1997 to 2007, H.P	403
Table 31:	Estimated optimum and surplus livestock population in H.P., 1992	416
Table 32:	Tehsil wise information of the population of livestock for the year 2003	420
Table 33a:	District-Wise Number of Various Veterinary Institutions under Animal Husbandry Department in H.P. (as on 01.06.2010)	422
Table 33b:	District-Wise Number of Various Veterinary Institutions under Animal Husbandry Department in H.P. as on 01.06.2010	423
Table 34:	Trends in Milk Production, 1987-2009, Himachal Pradesh	424
Table 35:	District-wise Annual Milk Production (2000 to 2008)	424
Table 36:	Wool Production (1987-2009), Himachal Pradesh	424
Table 37:	District-wise Annual Wool Production (2000-2001 and 2001-02)	425
Table 38:	Meat Production, (1987-2009) Himachal Pradesh	425
Table 39:	Himachal Pradesh: District-wise Annual Meat Production 2001-02 (in tonnes)	425
Table 40:	Egg Production (1987-2009), Himachal Pradesh	426
Table 41:	Himachal Pradesh Districtwise Annual Egg Production 2000-08	426
Table 42:	Production of Milk Based Industry	426
Table 43:	Detail of sanctioned posts of various categories in the Animal Husbandry Department	427

## List of Figures

<b>CHAPTER 1 FORESTS &amp; WILDLIFE</b>	<b>18</b>
Figure 1: Forest cover map of Himachal Pradesh	18
Figure 2: National parks & sanctuaries of Himachal Pradesh	29
Figure 3: Map showing 10 kms area around National Parks and Sanctuaries in Himachal Pradesh	65
Figure 4: Institutional mechanisms within the sector to address identified environment issues	81
<b>CHAPTER 2 WETLANDS</b>	<b>119</b>
Figure 1: Type-wise wetland distribution in Himachal Pradesh	121
Figure 2: Wetlands Sites of Himachal Pradesh	122
Figure 3: Organogram of Forest Department, Himachal Pradesh	153
Figure 4: Organogram of Department of Environment, Science & Technology, Himachal Pradesh	153
Figure 5: Organogram of H.P. State Council for Science, Technology & Environment	154
<b>CHAPTER 3 FISHERIES</b>	<b>160</b>
Figure 1: Organisational Chart of Fisheries Department	213
<b>CHAPTER 4 AGRICULTURE</b>	<b>229</b>
Figure 1: Different Agro-Climatic Zones of Himachal Pradesh	230
Figure 2: Organization Structur	303
Figure 3: Organisational Chart of HP Agriculture Marketing Board	304
<b>CHAPTER 5 HORTICULTURE</b>	<b>313</b>
Figure 1: Zones in Himachal Pradesh	315
Figure 2: Apple growing belt	315
Figure 3: Trends in fruit production in relation to area	335
Figure 4: Organisational Chart Department of Horticulture	377
<b>CHAPTER 6 ANIMAL HUSBANDRY &amp; LIVESTOCK</b>	<b>386</b>
Figure 1: Organisational Chart of Animal Husbandry Department	419
Figure 2: Organisational Chart of H.P.State Wool Procurement and Marketing Federation Ltd.	420



## Introduction

The key objectives of the Environment Master Plan are to enable the State of Himachal Pradesh to:

1. Simultaneously address issues of ecological and environment restoration and bring convergence along with the development activities taking place in the state;
2. Engage and ensure close coordination with all the concerned development departments, both at the state and Government of India level;
3. Decide future financing of investments for development in a sustainable manner, and
4. Develop suitable institutional arrangements in order to implement the Government of Himachal Pradesh's policies and strategies.

Seven tasks have been undertaken for preparation of EMP. The major tasks to achieve these objectives are as follows:

- Task 1:** Establish Baseline conditions
- Task 2:** Conduct a Spatial Vulnerability Assessment and Formulate Planning Principles
- Task 3:** Develop Public Consultation and Communication Strategy for the Department of Environment
- Task 4:** Develop Sectoral Guidelines.
- Task 5:** Develop an institutional mechanism for implementation of the EMP
- Task 6:** Establish need for training and capacity enhancement
- Task-7:** Develop monitoring and Evaluation Protocols

### **Task 1: Establish Baseline conditions.**

Sectoral baseline reports have been prepared covering 18 subsectors of 3 sectors namely Infrastructure (9), Natural Resources Management (5) and Services (4). These baseline reports have helped in identification of issues relating to ecological and environment and social aspects of each sector.

### **Sectors covered under EMP for Himachal Pradesh**

Infrastructure	Natural Resource Management (NRM)	Services
Roads, highways, rural roads and Transport	Agriculture	Education, and Vocational training
Hydropower (generation transmission, and distribution)	Horticulture	IT and Telecom
Tourism, Ecotourism + Art, Architecture and cultural heritage	Animal Husbandry Livestock	Livelihoods
Industry	Forests, Wildlife and Wetlands	Waste disposal.
Mining and Geology	Fisheries	
Irrigation and Public Health		
Health		
Market Infrastructure (including horticulture and agriculture)		
Rural and Urban Planning		

The objective of this task is to establish the “scenario, identify critical thrust areas, issues and corrective measures for all the sectors/activities. As per the Scope of Services, Methodology and Tasks given in the agreement, baseline reports of NRM sector have been prepared as described below.

### **Methodology for carrying out baseline data collection involves the following:**

1. Deployment and utility of a combination of primary and secondary data was done.
2. Combination of in-house and outsourced inputs were derived and appropriately identified, expertise was drawn from the Department of Environment, Science and



Technology and other sectoral departments/ agencies. Secondary data and information were sourced from sectoral and development agencies.

3. Appropriate questionnaires for data collection were developed, administered, data collected and collated.

The data on baseline report for three sectors and subsectors have been collected from concerned line departments of Government of Himachal Pradesh, research and development agencies, academic institutions in Himachal Pradesh, Census of India 2001 and 2011 (as available and applicable for the sectors considered for preparation of EMP), concerned sectoral development plans including Five Year

Plans (including 2007- 2012), State and district level agriculture plans, State of Forest report, Biodiversity Strategy and Action Plan, State of Environment Reports, Statistical Abstracts, Economic Reviews of concerned sector. Baseline data on social and environment policies, Acts, Rules, notifications of Central Government and State Government have been drawn from authoritative texts as given in concerned Gazette notifications. Primary data have been collected through structured questionnaires for eliciting updated data from line departments and collated.

The common **parameter for Scoping Baseline** for NRM sector is given below:

<b>I</b>	<b>Common Parameter for Scoping Baseline</b>
i	Resource inventory of existing assets of the sector
ii	Pattern of Planning and Development in Sector
iii	Technology/Schemes Adopted In Sector Along With Any Change In Technology
iv	Stakeholder Involvement In Environment Preservation and Restoration
v	Critical Environment Issues/Hotspots Associated With Sector
vi	Environmental Initiatives Taken By Sector to Address Critical Environmental Issues
vii	Environment Related Studies Carried Out In The Sector
viii	Environment Monitoring (Key Parameters Such As Air And Water Pollution) Carried Out For Activities Related To The Sector
ix	Institutional Mechanisms Within the Sector to Address Identified Environment Issues
x	Data / documentation pertaining to addressing demographic issues in the context of the sectors, such as population changes; requirements of populations and changing lifestyles, migratory populations including tourists, transhumants; trans it labour population; pressures felt by communities due to degraded environment conditions.
<b>II</b>	<b>Information on Human Resource Management Issues (Which May Have Relevance to Environment Management) in the Sector Such As: Maowerpp Vocational Training, Awareness Levels Etc</b>
<b>III</b>	<b>Regulatory Analysis to Identify Any Regulations That Have Environment Implications (Negative Or Positive), and Compliance with the same</b>
<b>IV</b>	<b>In addition to the above listed common parameters, those specific to NRM sectors, covering flora, fauna, aquatic species are as follows:</b>
	<b>I. inventory of habitats and existing species</b>
	<b>ii. inventory of endangered species</b>
	<b>iii. inventory of exotic species</b>
	<b>iv. inventory of migratory species and scope for introducing new species based on climate/(agro-climatic) stability</b>
	<b>v. information on biodiversity losses</b>

Baseline reports of subsectors of NRM have been prepared namely Agriculture, Horticulture, Animal Husbandry and Livestock,

Forests, Wildlife and Wetlands and Fisheries as per common parameters for scoping baseline for NRM sector.

# CHAPTER 1 FOREST & WILDLIFE

## 1.1 Resource inventory of the existing assets of the sector

As per the State Development Report of Himachal Pradesh (HP), is considered as predominantly mountainous State. Consequently, its climate is more congenial to forests. It comprises four forest zones namely, sub-tropical, sub-temperate, wet-temperate and dry-temperate.

The flora and fauna of varied natural ecosystems constitute the forest wealth of the State. The varieties of forests range from soft-wood conifers to hard-wood deciduous flowering plants. Off the 45,000 species of plants found in the country as many as 3,295

are reported to be present in the State of Himachal Pradesh.

According to India State of Forest Report, 2009, Himachal Pradesh has a geographical area of 55,673 km<sup>2</sup>. The altitude of the State varies from 350 m to 6,975 m above the mean sea level. The State has three distinct regions viz the Shiwaliks with altitude upto 1500 m, middle Himalayan region between 1500 m to 3000 m and the Himadris higher than 3000 m. About one third of the State is predominantly under snow glaciers and cold deserts where the growth of trees is minimal due to harsh climatic conditions. The annual rainfall is about 1800 mm and the temperature varies from sub zero to 35°C. The distribution of forest cover of the State is shown in Figure 1.



Source: India State of Forest Report, 2009

**Figure 1: Forest cover map of Himachal Pradesh**

**Recorded Forest Area:** As per India State of forest Report, 2009, the recorded forest area of the State is 37,033 km<sup>2</sup>. Reserved forests constitute 5.13%, protected forests 89.27%, and

unclassified forests 5.60% of the total forest area. About two third of the State's geographical area is under recorded forests. But a substantial part of this is not conducive for tree growth, being

under permanent snow, glaciers and cold deserts.

**Protected Areas:** Himachal Pradesh has two National Parks and 33 Wildlife Sanctuaries covering an area of 0.76 million ha which constitutes 13.65% of the State's geographical area. The Great Himalayan National Park is famous for snow leopard.

**Joint Forest Management:** Started in 1993, the Joint Forest Management endeavor in the State has about 11% of the forest area under its jurisdiction. There are 1,690 JFM committees managing 0.42 million ha of forest area as on March 2005. About 265,000 families are

involved in JFM, of which 36,000 families belong to Scheduled Tribes.

(Source: MoEF, 2005).

In terms of forest canopy density classes, the State has 3,224 km<sup>2</sup> of very dense forests, 6,383 km<sup>2</sup> of open forests.

Comparison of the current forest cover [satellite data of Oct 2006 – Jan 2007] with the previous assessment [satellite data of Oct – Dec 2004] shows a gain of 2 km<sup>2</sup> of forest cover. The change matrix, given in Table 1, reveals that there has been a decrease of 3 km<sup>2</sup> in the moderately dense forests and an increase of 5 km<sup>2</sup> in open forests.

**Table 1: Forest Cover Change Matrix**

2005 Assessment (Data of Oct. – Dec. 2004)	2007 (Data of Oct 2006 – Jan 2007)					Total of 2005
	VDF	MDF	OF	Scrub	NF	
Very Dense Forest	3,224	0	0	0	0	3,224
Moderately Dense Forest	0	6,377	2	0	4	6,383
Open Forest	0	4	5,051	1	5	5,061
Scrub	0	0		327	0	327
Non-Forest	0	0	21	0	40,657	40,678
Total of 2007	3,224	6,381	5,074	328	40,666	55,673
Net Change	0	-2	13	1	-12	

Source: India State of Forest Report, 2011

The Table 2 shows forest area according to classification from 2006 to 2007.

**Table 2: Forest Classification- 2006-07**

Category	Area ( in km <sup>2</sup> )	Percentage to Total
<b>CLASSIFICATION BY</b>		
<b>A - LEGAL STATUS</b>		
Reserved Forests	1898	5.1
Demarcated Protected Forests	11841	31.9
Un-demarcated Protected Forests	21219	57.3
Un-Classed Forests	977	2.7
Other forests managed by Forest Department	369	1.0
Not managed by Forest Department	729	2.0
Total	37033	100.0
<b>B - OWNER SHIP</b>		
State Owned Forests	35934	97.0
Cantonment & Municipal Forests	24	0.1
Private Individual Forests	1075	2.9
Total	37033	100.0
<b>C - CROP COMPOSITION</b>		
Coniferous	9026	24.4

Category	Area ( in km <sup>2</sup> )	Percentage to Total
Broad Leaved/Scrub	7382	19.9
Waste, Blank, Pasture & Snow Bound Areas	20625	55.7
Total	37033	100.0
<b>D - MANAGEMENT STATUS</b>		
Area covered under Working Plans	24909	67.3
Area not covered under Working Plans		
including Alpine pastures & parts of UPFs	12124	32.7
Total	37033	100.0
<b>E - DENSITY DISTRIBUTION OF FORESTS</b>		
- Forest Area Legally Defined	37033	100.0
- Very Dense Forests (crown density > 70%)	3224	8.7
- Moderately Dense Forests (crown density 40%-<)	6383	17.2
- Open Forests (crown density 10% -<40%)	5061	13.7
- Forest blanks with crown density < 10%	5989	16.2
- Un-culturable barren land (alpine pasture, snow area etc.)	16376	44.2

Source: Forest Report, Himachal Pradesh, 2010

District wise forest resources are summarized in Table 3. Species wise area, growing stocks and yield of important species is summarized in Table 4. Table 5 describes forest produce and their value from 2001 to 2007. Table 6

describes sources of forest revenue. Table 7 describes the inventory of forest produce from 1991 to 2000. Table 8 describes inventory of different species, which are being raised under different schemes in the State.

**Table 3: Forest Resources in Himachal Pradesh**

<b>A- FOREST AREA AND POPULATION (2006-07)</b>					
Name of District	Geographical area by professional survey (km <sup>2</sup> )	Forest area (km <sup>2</sup> )	% of Forest area to Geographical area in the District	% of Forest Area in the District	Population As per 2001 Census
Bilaspur	1167	428	36.7	1.1	340885
Chamba	6522	5030	77.5	13.7	460887
Hamirpur	1118	219	19.6	0.6	412700
Kangra	5739	2842	49.5	7.7	1339030
Kinnaur	6401	5093	79.6	13.8	78334
Kullu	5503	4952	89.9	13.4	381571
Lahaul-Spiti	13841	10133	73.2	27.3	33224
Mandi	3950	1860	47.1	5.0	901344
Shimla	5131	3418	66.6	9.2	722502
Sirmour	2825	1843	65.2	5.0	458593
Solan	1936	728	37.6	1.9	500557
Una	1540	487	31.6	1.3	448273
<b>Total</b>	<b>55673</b>	<b>37033</b>	<b>66.5</b>	<b>100.0</b>	<b>6077900</b>

Source: Forest Report, Himachal Pradesh, 2009

**Table 4: Species-wise area, Growing stock and Yield of important species - 2006-07**

Name of Species	Forest Area (km <sup>2</sup> )	Growing Stock ('000 m <sup>3</sup> )	Annual Yield ('00 m <sup>3</sup> )
Deodar	811	16517	1736
Kail	809	13365	1320
Chil	1436	12481	981
Fir/Spruce	1343	39364	2430
Sal	183	4852	280
Ban Oak	540	5949	156

Name of Species	Forest Area (km <sup>2</sup> )	Growing Stock ('000 m <sup>3</sup> )	Annual Yield ('00 m <sup>3</sup> )
Mohru Oak	35	201	N.P
Kharsu	246	1717	21
Mapple	N.A	298	12
Walnut	N.A	126	2
Bird-Cherry	N.A	15	N.P
B.L. Species	258	5217	30
<b>Total :</b>	<b>5661</b>	<b>100102</b>	<b>6968</b>

Source: Himachal Forest Statistics, 2010

**Table 5: Outturn of Forest Produce and their contribution to Forest Revenue**

Sr. No.	Name of Produce	Quantity					Estimated Value				
		2001-02	2002-03	2003-04	2005-06	2006-07	2001-02	2002-03	2003-04	2005-06	2006-07
1	Timber (m <sup>3</sup> )	371,599	367,330	334,085	414,105	236,265	14,698.07	14,615.12	13,967.5	64,554.85	39,522.51
	Firewood (tonnes)	6,891	4,953	6,631	4,690	4,010	209.71	147.59	211.36	186.92	156.43
2	Charcoal (tonnes)	103	433	362	110	165	5.82	24.46	20.45	9.44	10.61
3	Resin (tonnes)	7,354	5,495	8,254	8,508	8,591	495.59	556.59	476.82	641.77	753.47
4	Bamboos	-	-	253	1,889	555	4.38	8.46	11.29	10.90	15.49
5	Bhabbar	351	428	925	397	614	0.78	0.5	1.16	1.50	1.49
6	grass (tonnes)										
7	Grazing / Fodder (tonnes)	-	-	-	-	-	6.51	4.12	8.77	9.83	8.18
8	Medical herbs (tonnes)	2,491	1,795	1,366	1,744	1,244	718.07	1,057.06	448.62	423.80	494.25
9	Other	-	-	-	-	-	65.13	1.81	34.03	99.06	32.22
10	Minor Products (tonnes)										
	Khair	815	1,651	1,421	1,841	1,526	11.87	24.05	20.69	88.36	73.25
	<b>Total</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>16,439.76</b>	<b>15,200.69</b>	<b>66,026.43</b>	<b>41,067.90</b>

Source: State Environment Report, Himachal Pradesh (Published in 2009).

**Table 6: Sources of Forest Revenue**

Name of Produce	Revenue collected ('000 `)		
	2007-08	2008-09	2009-10
1. Timber and other Forest Produce removed from forests by Govt. Agency	3851	(-)22289	1776
2. Sale of timber and other forest produce removed from forests by consumer/purchaser	448010	239893	307635
3. Drift and Waif wood	-	256	109
4. Sale of timber and other forest produce removed from forests other than HPSFC	67274	223554	192265
5. Minor Forest Produce including Medicinal Plants	3064	705	10461
6. Grazing and Grass Cutting	1076	1103	1204
7. Miscellaneous Products	972793	100804	207671
8. Revenue from forests not managed by Government.	241	1	1
<b>Total :</b>	<b>1496309</b>	<b>554027</b>	<b>721122</b>

Source: Forest Report, Himachal Pradesh, 2010

**Table 7: Forest Produce of Himachal Pradesh from 1991- 2000**

Year & Forest Produce Agencies	1991-92			1995-1996			1998-1999			1999-2000		
	Timber (M <sup>3</sup> )	Firewood (Qtl.)	Charcoal (Qtls.)	Timber (M <sup>3</sup> )	Firewood (Qtl.)	Charcoal (Qtls.)	Timber (M <sup>3</sup> )	Firewood (Qtl.)	Charcoal (Qtls.)	Timber (M <sup>3</sup> )	Firewood (Qtl.)	Charcoal (Qtls.)
Government Extraction	2521	49	176	907	27	605	824	12	96	1779	11	66
Forest Corporation	227699	1346	295	325220	834	364	244842	281	8	206750	506	8
Right Holders	113735	152	-	96274	6	-	100310	118	-	96572	313	-
Free Grants	7693	91	350	2981	350	-	9316	-	-	7181	122	-
Other Agencies	4731	490	-	402	5	-	161	-	-	149	121	-
<b>Total</b>	<b>356379</b>	<b>2128</b>	<b>821</b>	<b>425784</b>	<b>1222</b>	<b>969</b>	<b>355453</b>	<b>411</b>	<b>104</b>	<b>312431</b>	<b>1073</b>	<b>74</b>
Year & Forest Produce Agencies	2000-01			2001-02			2002-03			2003-04		
	Timber (M <sup>3</sup> )	Firewood (Qtl.)	Charcoal (Qtls.)	Timber (M <sup>3</sup> )	Firewood (Qtl.)	Charcoal (Qtls.)	Timber (M <sup>3</sup> )	Firewood (Qtl.)	Charcoal (Qtls.)	Timber (M <sup>3</sup> )	Firewood (Qtl.)	Charcoal (Qtls.)
Government Extraction	1230	5	60	255	-	89	274	1133	159	385	59	226
Forest Corporation	243153	19	-	275140	3749	-	287319	3369	236	233361	4514	109
Right Holders	87835	127	-	87182	594	14	69841	277	35	90026	676	-
Free Grants	9429	-	-	9022	-	-	8107	-	-	10211	219	-
Other Agencies	119	2545	-	-	2548	-	1789	174	3	102	1163	27
<b>Total</b>	<b>341766</b>	<b>2696</b>	<b>60</b>	<b>341599</b>	<b>6891</b>	<b>103</b>	<b>367330</b>	<b>4953</b>	<b>433</b>	<b>334085</b>	<b>6631</b>	<b>362</b>

Source: State Environment Report, Himachal Pradesh (Published in 2009).

**Table 8: Plantations of different species are being raised in Himachal Pradesh under various schemes**

Plantation Period Name of Species	1951-52 to 1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-2000	2000-01	2001-02	2002-03	2003-04	Total Plantation up to 31-03-04	%age
	Deodar	79,078	3,154	3,360	3,918	3,322	3,926	4,253	6,218	3,631	1,993	1,802	2,614	117,269
Kail	8,934	328	354	613	351	235	250	210	168	262	218	143	12,066	1.30
Fir/Spruce	13,635	761	412	445	382	265	461	289	151	214	162	228	17,405	1.87
Chir	218,344	8,088	9,813	8,025	6,647	5,129	5,059	4,394	3,871	2,854	1,904	1,330	275,458	29.66
O. Coniferous	113	-	-	-	-	-	-	-	-	-	-	-	113	0.01
Walnut	3,399	13	31	38	7	11	113	63	88	45	38	69	3,915	0.42
Willow	5,785	486	837	585	392	339	365	331	204	205	196	198	9,923	1.07
Mapple	100	-	-	-	-	-	-	-	-	-	-	-	100	0.01
Khair	122,850	4,697	4,941	3,770	3,350	4,175	3,962	3,769	3,728	3,141	2,299	1,734	162,416	17.49
Shisham	7,712	296	533	971	865	1,159	1,024	1,264	1,592	1,280	745	513	17,954	1.93
Bamboo	2,129	91	85	361	85	309	170	293	702	815	437	464	5,941	0.64
Mulberry	1,378	-	-	-	-	-	-	-	-	-	-	-	1,378	0.15
Popular	9,185	485	578	619	455	552	856	722	344	256	208	209	14,469	1.56
Robinia	27,380	2,526	2,334	2,226	2,140	2,291	2,171	1,770	1,206	960	997	631	46,632	5.02
Leucenea	-	-	-	-	-	-	-	-	1,058	780	408	420	2,666	0.28
O. BL, Spps.	153,742	6,880	7,408	8,658	7,995	8,860	11,112	10,123	8,179	7,630	5,703	4,861	241,151	25.96
<b>Total</b>	<b>653,764</b>												<b>928,856</b>	<b>100.00</b>

Source: State Environment Report, Himachal Pradesh (Published in 2009)

On the basis of ground truthing by the officials of FSI and the information gathered from the State Forest Department, the main reason for an increase in the forest cover in Kangra District is the conversion of scrub to open forest whereas the reason for decrease in forest

cover in the districts of Sirmaur and Solan is due to the construction of roads and small hydro- electric projects. District wise forest cover in different canopy density classes and scrub along with the changes compared to the 2005 assessment is given in Table 9.

**Table 9: District-wise forest cover in 2007**

District	Geographical Area	Very Dense Forest (VDF)	Mod. Dense Forest (MDF)	Open Forest (OF)	Total	% of G.A.	Change*	Scrub
Bilaspur	1,167	24	171	167	362	31.02	0	0
Chamba	6,522	853	773	811	2,437	37.35	1	38
Hamirpur	1,118	39	91	114	244	21.82	-1	0
Kangra	5,739	310	1,221	533	2,064	35.96	2	11
Kinnaur	6,401	82	262	256	600	9.37	-2	70
Kullu	5,503	586	785	588	1,959	35.60	1	23
Lahaul-Spiti	13,841	15	32	147	194	1.40	1	31
Mandi	3,950	373	735	567	1,675	42.41	2	29
Shimla	5,131	739	1,037	610	2,386	46.50	2	32
Sirmaur	2,825	130	568	687	1,385	49.03	2	56
Solan	1,936	55	404	391	850	43.90	1	38
Una	1,540	18	302	203	523	33.46	2	0
<b>Total</b>	<b>55,673</b>	<b>3,224</b>	<b>6,381</b>	<b>5,074</b>	<b>14,679</b>	<b>26.37</b>	<b>11</b>	<b>328</b>

Source: India State of Forest Report, 2011

**Table 10: Altitude zone wise forest cover**

Altitude Zone	VDF	MDF	OF	Total
0-500m	13	424	311	748
500-1000m	237	1,594	1,148	2,979
1000-2000m	569	1,479	1,470	3,518
2000-3000m	1,860	1,950	1,124	4,934
>3000m	545	936	1008	2,489
<b>Total</b>	<b>3,224</b>	<b>6,383</b>	<b>5,061</b>	<b>14,668</b>

(Based on SRTM Digital Elevation Model)

**Forest Cover in different Forest Types:** The State has 35 different forest types as per Champion & Seth's classification system (1968) belonging to the 8 type groups viz Tropical Moist Deciduous, Tropical Dry Deciduous, Subtropical Pine, Himalayan Moist Temperate, Himalayan Dry Temperate, Sub Alpine Forests, Moist Alpine Scrub and Dry Alpine Scrub.

**Tree Cover:** Tree cover of the State has been estimated including tree outside forest (TOF) sample data of inventory collected over a period of six years i.e. 2002-08. The estimated tree cover in the State is 638 km<sup>2</sup> which is

1.15% of the geographical area of the State. The forest and tree cover of the State is presented in Table 11.

**Table 11: Forest & Tree Cover**

Category	Area	% of Geographical area
Tree Cover	638	1.15
Forest Cover	14,668	26.35
Forest & Tree Cover	15,306	27.50

Source: India State of Forest Report, 2009

## Status of Forest in Himachal Pradesh

The forests have been classified into reserved, protected, un-classed and recorded forest as per legal classification and forest area and growing stock of important tree species.

**Reserved forests (RFs):** Reserved forests are most important to conservation or scientific management, and have been properly demarcated and notified under provisions of the Indian Forest Act (1927). These forests benefit from the highest degree of State control and the exercise of its proprietary rights. Usually, local villagers do not have any rights in the reserved forests.

**Protected forests (PFs):** Protected forests are similar to reserve forests but the State a lower degree of control and proprietary rights. Local villagers can exercise some rights, unless specifically prohibited by notifications.

**Table 12: Status of Recorded Forest Area in Himachal Pradesh**

Forest Type	Area (Km <sup>2</sup> )	Percentage
Reserved Forests	1896	5.12
Demarcated	11387	30.75
Protected Forests		
Un-demarcated	21656	58.48
Protected Forests		
Un-classed Forests	976	2.63
Others (managed by Forest Department)	370	1.00
Not managed by Forest Department.	748	2.02
<b>Total</b>	<b>37033</b>	<b>100.00</b>

Source: State of Environment Report, Himachal Pradesh (Released in 2009)

### Forest Types of Himachal Pradesh:

Himachal has a diverse and rich flora as a result of the extremely varied physio-climate in its four agro-ecological zones. Differences in elevation lead to eco-zones with different vegetative cover, land use, and land capabilities. The vegetation of the State varies from tropical

**Un-classed forests (UFs):** All publicly-owned forests other than reserved forests and protected forests are categorized as un-classed forests. The State Government exercises the least degree of control over such forests, and they are usually in a state of severe degradation. There is a gradual process to bring un-classed forests into the category of reserved and protected forests.

### Recorded forests and Stocks of Important Trees:

Within the administrative/ legal classification of recorded forests framework, some areas are earmarked for specific preservation of wildlife, flora, and natural ecosystems. This has been achieved by creating 2 national parks (under The Wildlife Protection Act, 1972) and 33 Wildlife sanctuaries in HP. Table 12 and Table 13 describe the status of recorded forest and growing stocks of important species.

**Table 13: Forests Area/ Growing Stock of important tree species**

Name of species	Forests Area (Km <sup>2</sup> )	Growing Stock (000 M <sup>3</sup> )
Deodar	811	16129
Kail	809	15074
Chil	1436	12648
Fir/spruce	1343	46357
Sal	183	2,563
BanOak	540	7988
Mohru Oak	35	893
Kharsu	246	5880
Maple	N.A	778
Horse Chestnut	N.A	513
Walnut	N.A	331
Bird Cherry	N.A	256
Others	258	2315
<b>Total</b>	<b>5661</b>	<b>111725</b>

Source: State Environment Report, Himachal Pradesh (Released in 2009)

forests in the lower hills to alpine pastures in the high mountains. It has a rich and diversified flora because of the wide variety of soils, altitude and climatic conditions. The altitudinal pattern of vegetation in Himachal Pradesh parallels the latitudinal patterns of vegetation found globally. Hence, the forest types seen in the higher



altitudes of the State are more akin to those found in temperate latitudes.

The forests of Himachal Pradesh are rich in vascular flora, which forms the conspicuous vegetation cover. Out of a total 45,000 species of plants found in the country, as many as 3,295 species (7.32%) are reportedly found in the State. More than 95% of species are endemic to Himachal and characteristic of the Western Himalayan flora, while about 5% (150 species) are exotic introduced over the last 150 years. Among the rare plants is the living fossil

tree Ginkgo biloba, a native of China, of which two plants have been found in Manali and Kalpa.

The forests can be classified on ecological basis broadly into coniferous forests and broad-leaved forests as laid down by Champion and Seth. The distribution of species follows altitudinal stratification, apart from area with microclimatic changes resulting from aspect, exposure, and local changes in rock and soil. The types of forest with dominant tree species occurring in Himachal Pradesh are given in Table 14.

**Table 14: Forest types with dominant tree species occurring in Himachal Pradesh**

Forest types	Area (Km <sup>2</sup> )	Important tree species
Tropical Dry Deciduous	2,140	<i>Shorea robusta</i> , <i>Acacia catechu</i> , <i>Anogeissus latifolia</i> , <i>Boswellia serrata</i> , <i>Lannea coromandelica</i> , <i>Aegle marmelos</i> , <i>Mallotus philipinensis</i> , etc.
Tropical Thorn	43	<i>Prosopis spicigera</i> , <i>Salvadora species.</i> , <i>Acacia species.</i> , <i>Azadirachta indica</i> , etc.
Sub Tropical Pine	3,853	<i>Pinus roxburghii</i> , <i>Cedrus deodara</i> , <i>Pinus wallichiana</i> , <i>Quercus incana</i> , <i>Lyonia ovalifolia</i> , <i>Pyrus pasbia</i> , <i>Crataegus crenulata</i> , <i>Rhododendron arboreum</i>
Sub Tropical Dry Evergreen	470	<i>Olea cuspidata</i> , <i>Pinus roxburghii</i> etc.
Himalayan Moist Temperate	4,064	<i>Quercus incana</i> , <i>Cedrus deodara</i> , <i>Pinus wallichiana</i> , <i>Pinus roxburghii</i> , <i>Rhododendron arboreum</i> , <i>Lyonia ovalifolia</i> , <i>Litsia umbrosa</i> , <i>Quercus dilatata</i> , <i>Q. semicarpifolia</i> , <i>Picea smithiana</i> , <i>Abies pindrow</i> etc.
Sub Alpine and Alpine	2,512	<i>Abies spectabilis</i> , <i>Pinus wallichiana</i> , <i>Picea smithiana</i> , <i>Rhododendron campanulatum</i> , <i>Taxus baccata</i> , etc.

Source: State Environment Report, Himachal Pradesh (Released in 2009)

### Agro-ecological Zones and Vegetation

**Types:** The State of Himachal Pradesh has been divided into four agro-ecological zones based on altitudes, which are associated with different forest types each having trees, shrubs and herbs species.

- I) Sub-tropical zone, comprising low hills up to 1000 m.
  - ii) Sub-tropical zone, covering mid- hills between 1000m-1500 m
  - iii) Temperate wet zone representing high hills between 1500m - 3000 m.
  - iv) Temperate dry zone representing high hills above 3000 m (Alpine pasture zone)
- I) Sub-tropical, low hills zone; up to 1000 m: This zone is mainly dominated by tropical mixed deciduous forest and

thorn scrub in the foothills and fallow lands. The main native tree species found are: *Acacia catechu*, *Emblia officinalis*, *Dalbergia sissoo*, *Terminalia chebula*, *Cassia fistula*, *Anogeissus latifolia*, *Zizphus jujuba*. The most common shrubs found are *Euphorbia royaleana*, *Adbatoda vasica*, *Vitex negundo* and *Woodfordia fruticosa*.

- ii) Sub-tropical, mid hills zone; 1000-1500 m: The sub tropical mid hill zone is characterized by the presence of Group 9 -subtropical pine forests also known as Upper Himalayan Pine forests. It bears almost a pure crop of *Pinus roxburghii*. The other species found in mixture are, *Quercus incana*, *Lannea* sp., *Lyonia ovalifolia*, *Rhododendron arboreum*, *Indigofera* sp., *Myrsine* sp., *Rubus* sp.

etc. Several sub- types of *Pinus roxburghii* dominated forests which can also be recognized in this zone are given below:

- a) *Pinus-Carissa*, *Terminalia chebula* and *Lannea*.
- b) *Pinus-Carissa -Indigofera* with abundant pine regeneration.
- c) *Pinus-Quercus* with *Myrsine* and *Berberis*.
- d) *Pinus-Acacia catechu* with *Mallolotus* and *Lannea*.
- e) *Pinus-Wendilandia* with *Dodonaea* and *Carissa*.
- f) *Pinus-Carissa* with *Flacourtia*.

**Himalayan scrub:** These areas are characterized by dry and shallow soil with intensive influence of biotic factors. The species of trees found here are *Diospyros melanoxyton*, *Embelica officinalis*, *Carrissa* sp., *Dodonaea viscosa*, *Acacia catechu*, *Anogeissus* sp., *Lannea* sp., *Cassia fistula*, etc.

**Euphorbia scrub:** This vegetation is dominated by *Euphorbia royleana* with a mixture of palms under, controlled by edaphic factors and rocky ridges, steep slopes and very shallow soils.

**Dry evergreen bush:** The vegetation consists of *Olea cuspidata* with *Punica granatum*. Such vegetation is met with in plain alluvial beds in the valley.

- iii) Temperate wet high hills zone; between 1500-3000 m: Group 12, Himalayan moist temperate forests constitute major forest types in Himachal Pradesh and is dominant in temperate wet zone. The sub-types of group 12 forests are:

- 12/c 1 Lower Western Himalayan temperate forests
- 12/c 1a Ban oak forest (*Quercus incana*)
- 12/c 1b Moru oak forest (*Q. dilatata*) DS1 Oak scrub
- 12/c 1c Moist Deodar forest (*Cedrus deodara*)
- 12/c 1d Western mixed coniferous forest (*Picea smithiana*, *Pinus wallichiana* & *Abies pindrow*)
- 12/c 1e Moist temperate deciduous forest
- 12/c 1f Low level blue pine forests (*Pinus wallichiana*)
- DS1 Oak scrub
- Ds2 Himalayan temperate secondary scrub.
- 12/C2 Upper West Himalayan temperate forest
- 12/c 2a Kharsu oak forest (*Quercus semicarpifolia*)
- 12/c 2b West Himalayan upper oak/fir forest
- 12/c 2c Moist temperate secondary scrub.

The main coniferous tree species met with are *Pinus wallichiana*, *Cedrus deodara*, *Picea smithiana*, *Abies pindrow* and main broad-leaved trees found are three Oaks' species namely, *Quercus incana*, *Q. semecarpifolia*, *Q. dilatata* along with *Aesculus indica*, *Acer caesium*, *Prunus padus*, *Populus cilata*, *Corylus colurna*, *Ulmus wallichiana*, *Juglans regia*, *Pyrus lanata*, *Betula alnoides*, *Fraxinus* sp., *Carpinus* sp. In this zone, typical of Western Himalayan forests, the three common oaks provide a simple and convenient basis for sub-division into altitude zones each with its typical coniferous counterpart as shown below in Table 15.

**Table 15: Western Himalayan oaks**

Altitude	Broad-leaved	Coniferous
3,000 m	Sub-alpine Birch- Rhododendron	<i>Abies spectabilis</i>
2,500 m	<i>Quercus semecarpifolia</i>	<i>Abies pindrow</i>
2,250 m	<i>Quercus dilatata</i>	<i>Abies pindrow</i> , <i>Picea smithiana</i>
2,000 m	<i>Quercus leucotricophora</i>	<i>Cedrus deodara</i> , <i>Pinus wallichiana</i>
1,500 m	(Sub-tropical tree species)	<i>Pinus roxburghii</i>

Source: State Environment Report, Himachal Pradesh (Published in 2009)

iv) Temperate dry high hills zone; above 3000 m: The main grass species found in sub-alpine pastures are *Agropyron longeristatum*, *A. semicostatum*, *Brachypodium sylvaticum*, *Bromus asper*, *B. japonicus*, *Dactylus* sp., *Danthonia* sp., *Festuca* sp., *Milium effusum*, *Oryzopsis*, *Pbleum*, *Poa* sp.). Alpine pastures (meadows) are composed mostly of mesophytic herbs with very little grass such as *Primula*, *Anemone*, *Fritillaria*, *Iris*, *Gentiana* sp. and at higher altitudes of stony desert with herbs such as *Sedum crassipes*, *Primula minutissima*, *Saxifraga imbricata*, *Potentilla fruticosa*, *Draba gracillima*, *Kobresia dubtei* etc. Dwarf shrub species of *Juniperus wallichiana*, *J. communis* and *Caragana* sp. is predominantly found in this zone. Alpine scrub, which adjoins the dry temperate forests, may take their place under heavy pressure of grazing and has been described as Alpine steppe.

thus the size of the area classified as forest has changed in recent years in the State. Until the mid eighties, forests were conceived in terms of tree production, and only the cultivable area was measured (21,215 km<sup>2</sup>, or 38.1% of the total geographical area). Since the introduction of the new forest policy, forests have been considered more as an ecosystem, and the definition of forest area has extended to include areas of rocky precipices, alpine snow, and meadows which, although devoid of actual tree cover, are nonetheless an integral part of the larger forest eco-system. The legal forest area is now calculated to be 37,033 km<sup>2</sup>, or 66.52% of the total geographical area of the State of which 14353 km<sup>2</sup> (25.78 % of State geographical area) is under forest cover and 12366 km<sup>2</sup> is culturable non- forest area. About 65% of the forest area is found at altitudes above 1,800 m. The breakup of protected areas and biogeographical zone is described in Table 16. The district wise list of national parks and wildlife sanctuaries is given in Table 17.

### The Extent of Forest and Pasture Areas:

The perception of what constitutes a forest and

**Table 16: Protected Areas in Himachal Pradesh**

Sr. No.	Protected Areas	Area (km <sup>2</sup> )	Biogeographical Zones
1	Great Himalayan NP	754.40	Himalaya
2	Pin Valley NP	675.00	Trans-Himalaya
3	Bandi WLS	41.32	Himalaya
4	Chail WLS	108.54	Himalaya
5	Churdhar WLS	56.15	Himalaya
6	Daranghati WLS	167.00	Himalaya
7	Darlaghat WLS	140.00	Himalaya
8	Dhauladhar WLS	943.98	Semi-arid
9	Gangul Saihbehi WLS	108.85	Himalaya
10	Govind Sagar WLS	100.34	Semi-arid
11	Kais WLS	14.19	Himalaya
12	Kalatop-Khajjiar WLS	61.00	Himalaya
13	Kanawar WLS	54.00	Himalaya
14	Khokhan WLS	14.05	Himalaya
15	Kibber WLS	1400.50	Trans-Himalaya
16	Kugti WLS	378.86	Himalaya
17	Lippa Asrang WLS	30.89	Himalaya
18	Majanthal WLS	40.00	Himalaya
19	Manali WLS	31.80	Himalaya
20	Naina Devi WLS	123.00	Semi-arid
21	Nargu WLS	278.37	Himalaya
22	Pong Lake WLS	307.29	Semi-arid
23	Renuka Lake WLS	4.02	Semi-arid

Sr. No.	Protected Areas	Area (km <sup>2</sup> )	Biogeographical Zones
24	Rupi Bhaba WLS	269.00	Himalaya
25	Sainj WLS	90.00	Himalaya
26	Sangla (Raksham Chitkul) WLS	650.00	Himalaya
27	Sechu Tuan Nala WLS	102.95	Himalaya
28	Shikari Devi WLS	72.00	Himalaya
29	Shilli WLS	2.13	Himalaya
30	Shimla Water Catchment WLS	10.25	Himalaya
31	Simbalbara WLS	19.03	Semi-arid
32	Talra WLS	26.00	Himalaya
33	Tirthan WLS	61.12	Himalaya
34	Tundah WLS	64.22	Himalaya

Source: Indian Institute of Remote Sensing, Department of Space, Government of India, Dehradun, August, 2002.

Biodiversity profile of Himachal Pradesh is given below.

- Area under Protected Area Network: 7002 km
- National Parks (2): 1440 km<sup>2</sup>
- Wildlife Sanctuaries (32): 5562 km<sup>2</sup>
- Recorded taxa of higher plants: >3500
- Recorded species of mammals: 77
- Recorded species of birds: 463
- Recorded species of reptiles: 44
- Recorded species of fish: 80
- Recorded species of aquatic fauna: 436

Protected Important Wild Species are given below.

#### a) Birds

1. Shikra (*Accipiter* spp.), 2. Black Necked Crane (*Grus nigricollis*), 3. Black Partridge (*Francolinus* sp.), 4. Cheer Pheasant (*Carteus wallichii*), 5. Spotted Owlet (*Athene blewettii*) 6. Hawks Eagle (*Spizaetus nipalensis*) 7. Grey Horn Bill (*Tockus birostris*), 8. Geese (*Anser* spp.), 9. Kaleej Pheasant (*Lophura leucomelana*), 10. Lammergeier (*Gypaeatus barbatus*), 11. Large Whistling Teal (*Dendrocygna bicolor*), 12. Monal Pheasant (*Lophophorous impejanus*), 13. Mountain Quail (*Ophrysia superciliosa*), 14. Ospreys (*Pandion haliaetus*), 15. Peacock Pheasant (*Polyplectron bicalcaratum*), 16. Pea Fowl (*Pavo cristatus*), 17. Siberian White Crane (*Grus leucogeranus*), 18. Tibetan Snow Cock (*Tetraogallus tibetanus*), 19. Western Tragopan Pheasant (*Tragopan melanocephalus*) and 20. White Spoon Bill (*Platalea leucorodia*).

#### b) Mammals

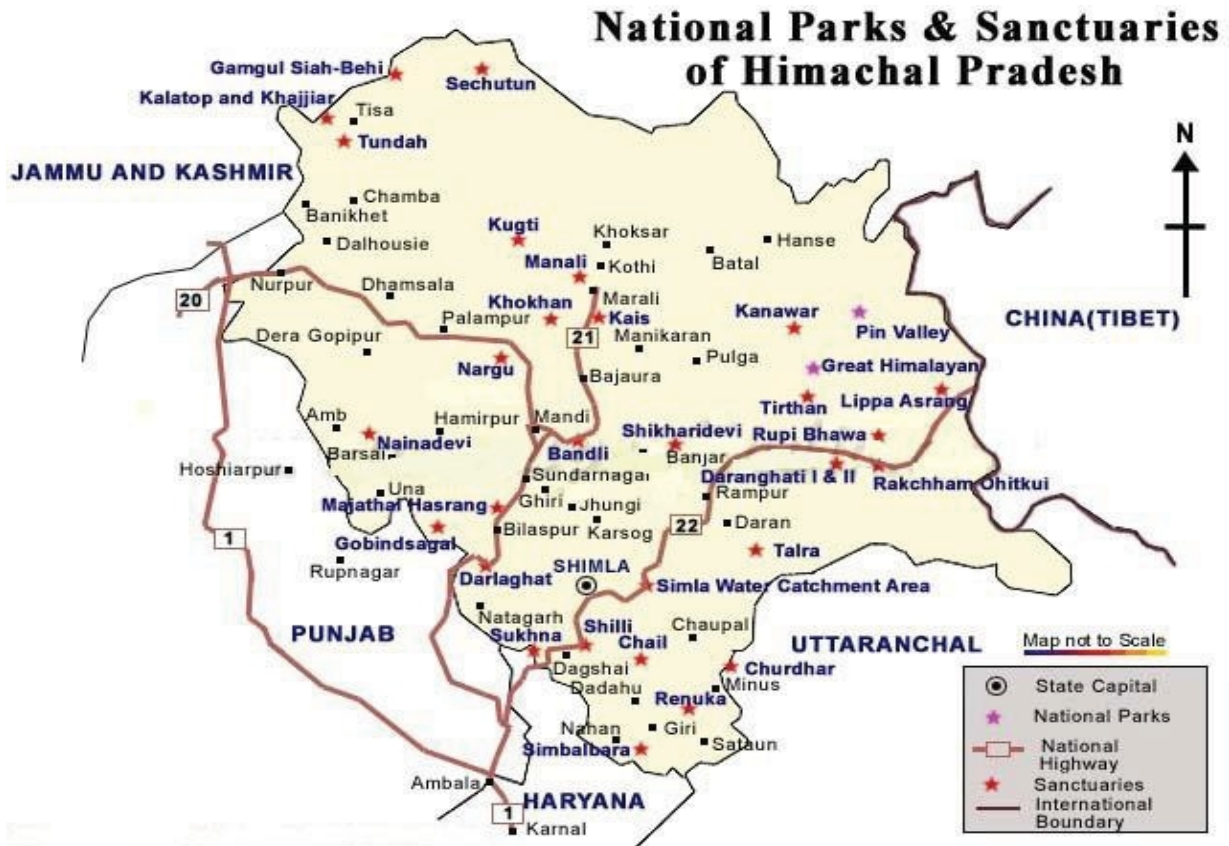
1. Bharal (*Ovis nabura*), 2. Caracal (*Felis caracal*), 3. Clawless Otter (*Aonyx cinerea viverriana*), 4. Fishing Cat (*Felis* sp.), 5. Himalayan Brown Bear (*Ursus arctos*), 6. Himalyan Tahr (*Hemitragus jemlabicus*), 7. Himalayan Ibex (*Capra ibex*), 8. Indian Wolf (*Canis lupus palliper*), 9. Kashmiri stag (*Cervus elaphus hanglu*), 10. Leopard Cat (*Felis bengalensis*), 11. Leopard or Panther (*Panthera pardus*), 12. Lynx (*Felis lynx isabellinus*), 13. Markhor (*Capra falconeri*), 14. Musk Deer (*Moschus moschiferus*), 15. Nyan or Great Tibetan Seep (*Ovis ammon hodgsonii*), 16. Pangolin (*Manis crassicaudata*), 17. Serow (*Capricornis sumatraensis*), 18. Snow Leopard (*Panthera uncia*), 19. Tibetan Fox (*Vulpes ferrilata*), 20. Tibetan Wild Ass (*Equus hemionus*), 21. Tiger (*Panthera tigris*), 22. Tibetan Wolf (*Canis lupus chonco*) and 23. Wild Yak (*Bos grunniens*).

**c) Reptiles**

1. Barred Oval or Yellow Monitor Lizard (*Varanus flavescens*)
2. Crocodiles (*Crocodylus porosus* and *Crocodylus palustris*)
3. Terrapin (*Batagur baska*)

**List of Vermin**

1. Common Crow, 2. Fruit Bat, 3. Mice and 4. Rat



**Figure 2: National parks & sanctuaries of Himachal Pradesh.**

**Table 17: District wise List of National Parks and Wildlife Sanctuaries**

Sr. No.	District (with Geographical Area in sq. km)	Sanctuary/ National Park	Area (Km <sup>2</sup> )	Total area within the district (In Sq. Km)
1	Bilaspur	Govind Sagar (WLS)	100	223
2	(1167)	Shri Nainadevi (WLS)	123	
3	Chamba	Sach-Tuan Nala (WLS)	103	724
4	(6522)	Gangul-Siyabehi (WLS)	109	
5		Tundah (WLS)	64	
6		Kugti (WLS)	379	
7		Kalatoop-Khajjiar (WLS)	69	
8	Kangra	Pongdam Lake (WLS)	307	1251

Sr. No.	District (with Geographical Area in sq. km)	Sanctuary/ National Park	Area (Km <sup>2</sup> )	Total area within the district (In Sq. Km)
9	(5739)	Dhauladhar (WLS)	944	
10	Kinnaur (6401)	Rakchham-Chhitkul (WLS)	304	838
11		Lipa Asrang (WLS)	31	
12		Rupi-Bhaba (WLS)	503	
13		Sainj (WLS)	90	272
14	Kullu (5503)	Tirthan (WLS)	61	
15		Kias (WLS)	14	
16		Khokhan (WLS)	14	
17		Kanawar (WLS)	61	
18		Manali (WLS)	32	
19		Lahaul & Spiti (13841)	Kibber (WLS)	1400
20	Mandi (3950)	Bandli (WLS)	41	391
21		Nargu (WLS)	278	
22		Shikari Devi (WLS)	72	
23	Shimla (5131)	Daranghati I & II (WLS)	167	217
24		Talra (WLS)	40	
25		Water Supply Catchment (WLS)	10	
26	Sirmour (2825)	Churdhar (WLS)	66	89
27		Simbalbara (WLS)	19	
28		Renuka (WLS)	4	
29	Solan (1936)	Chail (WLS)	109	157
30		Shilli (WLS)	2	
31		Majathal (WLS)	40	
32		Darlaghat (WLS)	6	
		Total Area for Wildlife Sanctuary	5562	5562
33	Kullu (5503)	Great Himalayn National Park	765	1440
34	Lahaul & Spiti (13841)	Pin Valley Ntional Park	675	
		Total Area for National Parks	1440	
<b>Total Area Of Protected Area Network</b>			<b>7002</b>	<b>7002</b>

In addition to the above listed common parameters, those specific to NRM sectors,

covering flora, fauna and aquatic species are given in Tables 18, 19, 20.

**Table 18: Critically Endangered (CR)**

Sr. No	Botanical Name	Common / Local Name
1.	<i>Aconitum heterophyllum</i>	Atis
2.	<i>Arnebia benthami</i>	Ratanjot
3.	<i>Arnebia euchroma</i>	Ratanjot
4.	<i>Atropa acuminata</i> (Syn. <i>Atropa belladonna</i> )	Jhakra
5.	<i>Dactylorhiza batagirea</i> (Syn. <i>Orchis latifolia</i> )	Salam panja
6.	<i>Malaxis muscifera</i>	Jeevak/ Rishabhik
7.	<i>Genstiana kurroo</i>	Kutki
8.	<i>Lilium polyphyllum</i>	Ksheer kakoli
9.	<i>Rauwolfia serpentina</i>	Sarpagandha
10.	<i>Saussurea gossypiphora</i>	Ghooghi
11.	<i>Saussurea obvallata</i>	Brahma kamal
12.	<i>Swertia chirayita</i> (Syn. <i>S. chirata</i> )	Chirayata

**Table 19: Endangered (EN)**

Sr. No	Botanical Name	Common/Local Name
1.	<i>Aconitum deinorrbizum</i>	Mohra
2.	<i>Angelica glauca</i>	Chora
3.	<i>Betula utilis</i>	Bhojpatra/Bhoj
4.	<i>Datisca cannabina</i>	
5.	<i>Dioscorea deltoidea</i>	Shingli mingli
6.	<i>Ephedra Gerardiana</i>	Somlata
7.	<i>Fritillaria roylei</i>	Ksheer kakoli
8.	<i>Habenaria intermedia</i>	Riddhi
9.	<i>Hyoscyamus niger</i>	Khurasani ajwain
10.	<i>Juniperus polycarpus</i> (J. <i>macrospora</i> )	Jau. Hauber
11.	<i>Jurinea dolomiaea</i> (J. <i>macrocephala</i> )	Dhoop
12.	<i>Meconopsis aculeata</i>	Patishan rooli
13.	<i>Nardostachys grandiflora</i> (N. <i>jatamansi</i> )	Balchharh
14.	<i>Paris polyphylla</i>	Meethi bach. Dudh bach
15.	<i>Picrorhiza kurroo</i>	Karu, Kutki
16.	<i>Podophyllum hexandrum</i> (P. <i>emodi</i> )	Bankakri
17.	<i>Polygonatum cirrbifolium</i>	Salam mishri, Maha meda
18.	<i>Rheum emodi</i> (R. <i>australe</i> )	Revandchini
19.	<i>Rheum moorcroftianum</i>	Revandchini
20.	<i>Taxus wallichiana</i> (T. <i>baccata</i> )	Talishpatra
21.	<i>Zanthoxylum armatum</i> (Z. <i>alatum</i> )	Tirmur

**Table 20: Vulnerable (VU)**

Sr. No	Botanical Name	Common/Local Name
1.	<i>Aconitum violaceum</i>	Mithi patish, Mitha telia
2.	<i>Allium stracheyi</i>	Jambu, Faran
3.	<i>Bergenia stracheyi</i>	Pashanbhed
4.	<i>Bunium persicum</i> (Carum <i>bulbocastanum</i> )	Kala Zira, Shia zira
5.	<i>Cinnamomum tamala</i>	Tejpatta
6.	<i>Colchicum luteum</i>	Suranjan kadvi
7.	<i>Didymocarpus pedicillata</i>	Pathar laung, Patharphori
8.	<i>Embelia tsjeriam-cottam</i>	Vibidang
9.	<i>Eremostachys superba</i>	Gaju mulla
10.	<i>Ferula jaeskeana</i>	Kindal
11.	<i>Gloriosa superba</i>	Kalihari
12.	<i>Heracleum lanatum</i>	
13.	<i>Hippobac rhamnoides</i>	Sea buckthorn, Charma
14.	<i>Hypericum perforatum</i>	Basant, Khoontir
15.	<i>Hyssopus officinalis</i>	
16.	<i>Litsea glutinosa</i> (L. <i>chinensis</i> )	Maida lakari
17.	<i>Physoclaena praealta</i>	Bajar bhang

Sr. No	Botanical Name	Common/Local Name
18.	<i>Polygonatum multiflorum</i>	Salam mishri
19.	<i>Polygonatum verticilatum</i>	Salam mishri
20.	<i>Rheum speciforme</i>	Revandchini, Chukri
21.	<i>Rheum webbianum</i>	Revandchini
22.	<i>Rhodiola heterodonta</i>	
23.	<i>Rhododendron anthopogon</i>	Talispatra
24.	<i>Rhododendron campanulatum</i>	Kashmiri patta
25.	<i>Rhododendron lepidotum</i>	Kashmiri patta
26.	<i>Roylea cinerea</i> (R. <i>calycina</i> )	Karvi
27.	<i>Valeriana jatamansi</i> (V. <i>wallichii</i> )	Mushkbala, Tagarpanth

## Decline in Floral & Faunal Wealth

District wise status of Forest and Wildlife in Himachal Pradesh: District wise status of forest and wildlife in the State is described below.

**Bilaspur:** The forests of the district are neither very rich nor extensive, as they lie in the sub-tropical zone. Topographically forested area lie in the inner Shiwaliks and outer Himalayas. The Chil and Bamboo forests are found mainly on the Shiwaliks formation. Scrub forests situated on the Shiwaliks formation are superior than scrub forest growing on other formations such as Karol series where *Carissa spinarum* is predominant. Chil forests are mainly restricted to the northern and eastern slopes, while southern and western slopes are occupied by scrub forest. According to the annual report of the State Forest Department, the total area under forests is 428 km<sup>2</sup> which constitutes 36.7% of the total geographical area of the district (1999).

Forests have been classified as reserve, un-demarcated, protected and demarcated forest. Excluding Bahadurpur forest, which contains Ban and Deodar, the remaining forests may be divided into three classes:- (1) Chil forests, (2) Scrub Jungle and (3) Bamboo forests. The Chil forests are found at an elevation of 610 to 1,524 metres on the north and north-east slopes of the main ridges. Scrub jungles contain a valuable species of which the most important are Sheesham and Tun. These occur at low elevations generally in or near cultivated lands and on the banks of the Sutlej. The bamboo -

forests are found at an elevation of 366 to 914 metres. Mostly these forests cover a large portion of the northern slope of Naina Devi Dhar. There are two main varieties of bamboo-the small, khinj and the large-bans. A third species called 'nal' bans is extensively cultivated by the Zamindars, a few clumps being found near most of the villages.

The principal marketable forest products are chil timber, bamboo, resin, bhabar grass and katha. Bhabar grass is found in Naina Devi Dhar and used for making ropes, rafting timber and thatching. Originally, timber used to be floated down the Sutlej and its tributaries, Gambhar and Seer Khads but it has been stopped now due to construction of dams and is currently transported by road network.

**Flora:** The district is rich in flora. The details of common trees, shrubs and climbers found in the forests of Bilaspur are as follows : (a) Trees: Chhal (*Anogeissus latifolia*), Khair (*Acacia catechu*), Kulam (*Stephegyne parrifolia*), Bil (*Aegle marmelos*), Keor (*Holarrhena antidysenterca*), Semal (*Bombax malabaricum*) Jaman (*Eugenia jambolana*), Barnah (*Limonia acidissima*), Chamtalor (*Ehretia laevis*), Ber (*Zizyphus jujuba*), Amb (*Mangifera indica*), Alis (*Cassia fistula*), Ratela (*Wendlandia exortam*) Amla (*Phyllanthus emblica*), Pilkhan (*Ficus rumphii*), Bar (*Ficus bengalensis*), Goela (*Casearia tomentosa*), Gaj (*Bauhinia retusa*), Balodhar (*Sapium insigne*), Dakanan (*Diospyros cordifolia*), Ruer (*Acacia leucophloea*), Kikar (*Acacia arabica*) and pipal (*Ficus religiosa*).



**Bush-wood:** Garna (*Carissa spinarum*), Mendu (*Dodonaea viscosa*), Dhamin (*Woodfordia floribunda*), Bassooti (*Adhatoda vasica*), Gandhela (*Murraya koenigii*), Koori (*Nyctanthes arbortristis*), Kamal (*Mallotus philippinensis*) Chhoin (*Euphorbia royleana*), Ber (*Zizyphus nummularia*), and Pardesi Buti (*Lantana camara*).

**Grasses:** Bagar (*Ischaemum angustifolium*), Ghor bagar (*Eriopogon comosum*), Khabbal (*Cynodon dactylon*), Dhaulu (*Chrysopogon*

*montanus*), Sardula (*Heteropogon contortus*), Palman (*Bothriochloa intermedia*), Alunji (*Themeda anathera*), Khawi (*Cymbopogon martinii*) and Lanbanu (*Aristida depressa*).

The common fruit trees are pears, jamun, ber, banana, papaya, mango and shahtoot. Kikar is commonly met within village common lands with shallow and rocky soils. Bamboo thrives at lower elevations. Some Citrus species are also cultivated. Table 21 shows forest area according to the classification from 1990-91 to 1999-2000.

**Table 21: Forest Area According to Classification (ha)**

Year	Forest under the control of Forest Department					Forest not under the control of Forest Department	Total (Col.6&7)
	Reserved forest	Protected forest	Un-classified forest	Other forest	Total		
1	2	3	4	5	6	7	8
2000-01	89.60	16250.07	19998.24	1604.17	33942.08	4614.00	38556.08
2001-02	89.60	16266.07	15998.24	1604.17	33958.08	4614.00	38572.08
2002-03	89.60	16266.07	15998.24	1604.17	33958.08	4614.00	38572.08
2003-04	89.60	16287.50	15998.24	1604.17	33979.51	4614.00	38593.51
2004-05	89.60	15816.07	16448.24	1604.17	33958.08	4614.00	38572.08
2005-06	89.60	15816.07	16448.24	1604.17	33958.08	4614.00	38572.08
2006-07	89.60	15816.07	16448.24	1604.17	33958.08	4614.00	38572.08
2007-08	89.60	15816.07	16448.24	1604.17	33958.08	4614.00	38572.08
2008-09	89.60	15816.07	16448.24	1604.17	33958.08	4614.00	38572.08
2009-10	89.60	15816.07	16448.24	1604.17	33958.08	4614.00	38572.08
2010-11	89.60	15816.07	16448.24	1604.17	33958.08	4614.00	38572.08

Source: District Statistical Abstract, Bilaspur-2011.

Table 22 showing the output and value of major and minor forest products in the district during the year 1999-2000 is 75.64 m<sup>3</sup> of the

building timber valued at `1.35 thousands according to the District Statistical Abstract-Bilaspur 2002.

**Table 22: Output and Value of Major Forest Products**

Year	Timber		Fuel	
	Quantity ('000 Cub. Mtrs.)	Value ('000 `)	Quantity ('000 Cub. Mtrs)	Value ('000 `)
1	2	3	4	5
1990-91	-	-	-	-
1991-92	N.A.	N.A.	N.A.	N.A.
1992-93	0.03	0.06	3.21	28.69
1993-94	0.03	0.25	77.10	51.00
1994-95	N.A.	N.A.	N.A.	N.A.
1995-96	2.14	928.63	-	-
1996-97	3.85	2,260.10	-	-
1997-98	1,412.21	993.58	-	-
1998-99	48.60	0.03	-	-

Year	Timber		Fuel	
	Quantity (’000 Cub. Mtrs.)	Value (’000 `)	Quantity (’000 Cub. Mtrs)	Value (’000 `)
1999-2000	75.64	1.35	-	-

Source: District Statistical Abstract, Bilaspur-2002.

Based on the forests of the district, ‘Rosin’ & Turpentine factory has been set at Bilaspur.

The year wise production is shown in Table 23 below.

**Table 23: Production of Rosin, Turpentine and Cement**

Year	Rosin (Quintals)	Turpentine (’ 000 Litres )
1	2	3
1990-91	33,869	9,31,169
1991-92	N.A.	N.A.
1992-93	N.A.	N.A.
1993-94	59,880	16,03,489
1994-95	57,090	16,19,627
1995-96	58,470	16,47,894
1996-97	52,920	14,84,380
1997-98	56,386	15,55,290
1998-99	57,780	15,80,953
1999-2000	65,376	18,13,107

Source: District Statistical Abstract, 2000

**Fauna:** The district is fairly rich in wildlife. Some of the wildlife in the district include Leopard or panther, Striped Hyena (Jhirak or Lakar Bagha), Jackal (Gidhar, Shial), Small fox or hill fox (Lomri), Indian Wild Boar (Suar), Goral, Himalayan Langur, Rhesus monkey or common Bandar, Common jungle cat (Jungli billi), Common Grey mongoose (Newal, Neyol), Long tailed mongoose, Indian muntja ghural.

Leopards are a constant menace to the cattle, goats and sheep. Wild pigs are numerous and destructive. Monkeys and wild cats are common. Among other carnivorous animals, jackals, fox and the mongoose are common. Goral and barking deer are found through out the district. Other common animals are porcupine, Himalayan Langur, rats and mice.

**Birds:** There is a variety of birds in the district. Apart from pheasant, chikor and peacocks there are rare and aquatic birds like ducks and geese which would come from far off places to

make their homes in Gobindsagar. Partridge, pigeons, green parrots and quails are also found here.

**Reptiles:** Snakes are fairly common of Bilaspur district, in the valley and along the river and khads. The better known snakes are the Cobra, spotted Agama, Indian Chameleon, Common Krait, harmless Krait, rat snake, water snakes and other common grass snakes. Of the lizards, the geckos & common house gecko are found. Common Indian crocodile (magar) is also found in the Sutlej.

**Afforestation:** All possible efforts have been made in order to increase substantially the forest/tree cover in the region. It is through massive afforestation and social forestry programmes the green leave lopping has been curbed in order to preserve the forest wealth. Various new types of plants have been introduced such as Leucaene, Drek, Eucalyptus, poplar; Shehtoot-etc. A Special programme has been launched in the district under the National Social Forestry Project. Its main features are:

1. Agro Forestry
2. Tree tenure for poor and landless
3. Community plantations
4. Departmental plantations

**Farm Forestry programme:** The programme envisages extensive plantations on the public waste land, school compounds, private farm land etc. Schemes have been launched whereby rural folks are encouraged to plant more trees and protect the existing growth in order to enable them to meet the bonafide requirement of fodder, fuel and small timber. Landless farmers who desire to raise plantations are being provided with Government land to raise plants and tree-patta for the plants is also given. Fencing material and plants are supplied to them by the department.

The following steps have been taken for popularising the farm forestry and other type of forestries:

1. Public meetings are conducted in villages emphasising the importance of forestry and its impact on the environment etc.
2. Visual aids are used.
3. Seedlings of various fuel, fodder, small timber, species are distributed at nominal costs.
4. Fuel saving devices like Dhauladhar Chulhas and pressure cookers are distributed at subsidised rates amongst the farmers.
5. Training camps for the progressive farmers of the area are also organised.

**Chamba:** More than 70% of the total area of the district has been classified as forest area. But actual forest cover in the district is spread over 2,436 km<sup>2</sup> in the district constituting 37.35% of the total geographical area of the district. Of this total forest cover, 853 km<sup>2</sup> is under very dense forests, 773 km<sup>2</sup> under moderate dense forest and 810 sq. kms. is open forests. Table 24 shows the area under different types of forest cover during 1998-99 in the district.

**Table 24: Forest cover during 1998-99**

Sr. No.	Type of Forests	Area in Hectares
1	Reserve forests	32,798
2	Protected forests	326,948
3	Unclassified forests	99,256
4	Other	1,253
<b>Total</b>		<b>460,255</b>

Source: District Statistical Abstract, Chamba - 2000

The forests play a vital role in shaping the climatic conditions of an area. Besides, these also influence the economic and social life of the people to a great extent. The forests provide valuable timber, medicinal herbs and raw materials for industries and also provide employment and play a vital role in conserving the soil and ensure timely rains. According to the State Forests Report of 2009, much gap is

observed between the forest area and forest cover in the district. The district has much scope for bringing more area under the forest cover due to the availability of forest land. Timber is an important product of Chamba forests and value of timber extracted from the forests during 1998-99 amounted to `64.67 lacs as reflected in Table 25 given below.

**Table 25: Value of forests products-1998-99**

Sr. No.	Item	Quantity (cubic metres)	Value in `
1	Timber	40,796.98	6,466,657
2	Fuel	2,101.85	159,404

Source: District Statistical Abstract, Chamba, 2000

These forests lie in the Shiwalik and Himalayas at a height between 1,066 to 3,657 metres above mean sea level. The composition and condition of the forest considerably varies with the altitude. The forests of the district can broadly be classified into the following categories:

**Himalayas Sub-Tropical Blue Pine Forests:**

These are found at an elevation of 1,066 to 1,524 metres. Chil is mostly found on grassy slopes. Among other trees *Pyrus pashia* (Kainth), *Pistacia integerrima* (Kakeran), *Albizia stipulata* (Siris), *Olea cuspidata* (kao), *Quercus incana* (ban), *Grewia oppositifolia* (dhamman) and *Cedrela toona* (toon) are worth mentioning.

**Ban Oak Forests:** These serve as chief source of winter fodder and excellent fuel and remarkable wood for agricultural implementations. Ban occupies an important position in the agricultural economy of the district. These forests are found at an elevation of 1,524 to 2,438 metres above the mean sea level. The main species is Ban Oak. These forests represent the remains of climax vegetation that has been replaced through the ages, largely as a result of felling, with coniferous forest mainly of Deodar and Kail.

**Deodar Forests:** This type occurs at the same altitude as ban, oak. The main species found in these are the Oak, *Litsea umbrosa* (Chirindi), *Celtis australis* (Khark), *Cedrela serrata* (dauri), *Populus ciliata* (Chaloon), *Carpinus fagiana* (charkri), *Ulmus villosa* (maral), *Cornus macrophylla* (haleau) and other species.

**Western Mixed Coniferous Forests:** These forests are found at an elevation of 2,438 to 3,048 metres above mean sea level. The spruce and silver fir attain large dimensions and the growing stock per hectare is considerably high. Deodar is generally seen scattered, singly or in groups along the crests of spurs and ridges associated with the firs and frequently forming

considerable bits of deciduous forests in depressions and nalas are the *Aesculus indica* (goon), *Juglans regia* (kear), *Acer* sp. (mandar), *Celtis australis* (kharak), *Prunus padus* (Jammu), *Ulmus wallichiana* (maral), *Fraxinus floribunda* (tunnu) and *Morus serrata* (karun).

**Kharsu Oak Forests:** These are mixed coniferous forests of spruce and silver fir & bits of kharsu oak with their characteristic brown tinged foliage festooned with mosses.

**Lower Blue Pine Forests:** These forests are represented by the blue pine forests of the dry eastern zone. Here kail grows in remarkable pure and even aged formations. On eastern and north eastern slopes, the kail extends right upto 3,657 metres elevation, although above 3,048 metres, it is generally stunted and deformed.

**Moist Alpine Scrub or Grasslands:** Extensive tracts of alpine pastures are stretched above forest limits to the line of perpetual snow. Great variety of medicinal herbs and flowers are found in them. Dhup (*Jurinea macrocephala*), Mohri (*Aconitum vapellus*), patis (*Aconitum heterophyllum*), Kaur (*Picronbiza kurroa*) and Kuth (*Saussurea lappa*) are some of well known valuable plants. Banafsha (*Viola odorata*), Bankakaru (*Podophyllum midi*), mushkbala (*Valeriana wallichii*) and thuth (*Salvia moorcroftiana*) are also found in abundance in the deodar and fir zone.

Because of the quick dwindling of the forest wealth, the State Government has adopted various measures to increase the forest wealth for the rejuvenation of forest area. Social Forestry Programme has been effectively implemented in the district with the component of Agro-Forestry such as Farm forestry and private waste land planting, community plantation and departmental plantation for rehabilitation of degraded forests. Steps are being taken for popularising the farm forest and other type of forestry.

**Flora:** Table 26 describes various species of plants and forest trees which are generally found in Chamba District.

**Table 26: Plant species found in Chamba**

Botanical Name	Local Name	Botanical Name	Local Name
(a) Trees		<i>Carpinus faginea</i>	Chakri
<i>Abies webbiana</i>	Rai	<i>Carpinus viminea</i>	Chakri
<i>Acer caesium</i>	Mandar	<i>Cedrela serrata</i>	Dauri
<i>Acer caudatum</i>	Mandar	<i>Cedrela toona</i>	Toon
<i>Acer pictum</i>	Mandar	<i>Cedrus deodara</i>	Diyar
<i>Acer villosum</i>	Mandar	<i>Celtis australis</i>	Khark
<i>Aesculus indica</i>	Goon	<i>Cornus macrophylla</i>	Haleu
<i>Albizia lebbkeck</i>	Siris	<i>Corylus colurna</i>	Thangi
<i>Albizia odoratissima</i>	Kali Siris	<i>Cupressus torulosa</i>	Devi Diyar
<i>Alnus nepalensis</i>	Piak	<i>Dalbergia sissoo</i>	Tali
<i>Alnus nitida</i>	Piak	<i>Ehretia serrata</i>	Punna
<i>Bauhinia variegata</i>	Kral	<i>Euonymus fimbriatus</i>	Tritu
<i>Betula alnoides</i>	Bhuj	<i>Ficus glomerata</i>	Phagoora
<i>Betula utilis</i>	Bhuj	<i>Ficus nemoralis</i>	Phagoora
<i>Bombax malabaricum</i>	Simbal	<i>Ficus palmata</i>	Phagoora
<i>Buxus sempervirens</i>	Shamshad	<i>Ficus religiosa</i>	Pipal
<i>Fraxinus floribunda</i>	Sunnu	<i>Colebrookia oppositifolia</i>	Dharoos
<i>Grewia oppositifolia</i>	Dhamman	<i>Coriaria nepalensis</i>	Richh-ka-Ancha
<i>Grewia vestita</i>	Dhamman	<i>Cornus capitata</i>	Halen
<i>Juglans regia</i>	Khor	<i>Cotoneaster bacillaris</i>	Renus
<i>Litsea umbrosa</i>	Chirindi	<i>Cotoneaster microphylla</i>	Renus
<i>Macbilus odoratissima</i>	Bhadrol	<i>Cotoneaster vulgaris</i>	Renus
<i>Macbilus dutbiei</i>	Bhadrol	<i>Daphne cannabina</i>	Niggi
<i>Melia azedarach</i>	Darek	<i>Daphne oleoides</i>	Niggi
<i>Morus alba</i>	Karun	<i>Desmodium tiliacifolium</i>	Pre
<i>Morus serrata</i>	Karun	<i>Deutzia corymbosa</i>	Batti
<i>Olea suspidata</i>	Kau	<i>Dodonaea viscosa</i>	Mhendru
<i>Picea morinda</i>	Tos	<i>Girardiana heterophylla</i>	Ain
<i>Pieris ovalifolia</i>	Ailan	<i>Hex dipyrena</i>	Kanderu
<i>Pinus gerardiana</i>	Neoz	<i>Indigofera gerardiana</i>	Kathi
<i>Pinus longifolia</i>	Chir	<i>Rosa moschata</i>	Ban gulab
<i>Pistacia integerrima</i>	Makreran	<i>Vitis latifolia</i>	Panibel
<i>Populus ciliata</i>	Chalaoon	<i>Indigofera hirsuta</i>	Kathi
<i>Prunus armeniaca</i>	Sari	<i>Indigofera pulchella</i>	Kathi
<i>Prunus communis</i>	Aloocha	<i>Jasminum humile</i>	Chambeli Wild
<i>Prunus padus</i>	Jammu	<i>Jasminum officinale</i>	Chambeli Wild
<i>Prunus persica</i>	Aru	<i>Juniperus communis</i>	Bither
<i>Pyrus baccata</i>	Lewar	<i>Juniperus recurva</i>	Bither
<i>Pyrus communis</i>	Nakh	<i>Lonicera angustifolia</i>	Kantias
<i>Pyrus lanata</i>	Amlok	<i>Lonicera quinquelocularis</i>	Bakhru
<i>Pyrus malus</i>	Seo	<i>Myrsine africana</i>	Chota Mehndru
<i>Quercus dilatata</i>	Moru	<i>Otostegia limbata</i>	Boo
<i>Quercus incana</i>	Ban	<i>Parrotia jacquemontiana</i>	Kilar
<i>Quercus semecarpifolia</i>	Kreu	<i>Plectranthus rugosus</i>	Kuthal
<i>Rhododendron arboreum</i>	Cheo	<i>Prinsepia utilis</i>	Kangora
<i>Rhus punjabensis</i>	Tittri	<i>Rhododendron campanulatum</i>	Sarngar
<i>Rhus semialata</i>	Arkhar	<i>Rhus cotinus</i>	Tung
<i>Salix alba</i>	Badda Majnu	<i>Ribes spp.</i>	Rajae
<i>Salix babylonica</i>	Badda Majnu	<i>Rosa macrophylla</i>	Karer, Bangulab
<i>Salix wallichiana</i>	Badda Majnu	<i>Rubus fabrifuga</i>	Kantias

Botanical Name	Local Name	Botanical Name	Local Name
<i>Sapindus mukorossi</i>	Ritha	<i>Rubus biflorus</i>	Akhre
<i>Taxus baccata</i>	Barmi	<i>Rubus lasiocarpus</i>	Akhre
<i>Symplocos crataegoides</i>	Lodhar	<i>Rubus niveus</i>	Akhre
<i>Ulmus wallichiana</i>	Maral	<i>Rubus paniculatus</i>	Akhre
<i>Ziziphus oxyphylla</i>	Ber	<i>Sageretia theezans</i>	Kankalu
		<i>Sarcococca pruniformis</i>	Dium
(b) (Shrubs)		<i>Spriaca lindleyana</i>	Kande
<i>Adbatoda vasica</i>	Basuti	<i>Staphyleae midi</i>	Chitra, Nagdaun
<i>Artemisia vulgaris</i>	Charmar	<i>Syringa emodi</i>	Chara
<i>Berberis aristata</i>	Kemal	<i>Viburnum continifolium</i>	Talanj
<i>Berberis lycium</i>	Kemal	<i>Viburnum foetens</i>	Talanj
<i>Berberis nepalensis</i>	Kemal	<i>Vitex negundo</i>	Banna
<i>Berberis vulgaris</i>	Kemal	<i>Xanthoxylum alatum</i>	Timber
<i>Cannabis sativa</i>	Bhang		
<i>Cocculus laurifolius</i>	Nag daun	(c) (Climbers)	
<i>Clematis montana</i>	Garol	<i>Bauhinia vablii</i>	Taur
<i>Clematis buchananian</i>	Garol		
<i>Hedera helix</i>	Kural		

**Fauna:** The district is rich in animals and birds many of which are rare. Table 27

describes the species of fauna found in the district.

**Table 27: Species of fauna found in Chamba**

1	Rhesus monkey or common bander	14	Common Indian porcupine
2	Brown bear	15	India wild bear
3	Himalayan black bear	16	Bharal or blue sheep
4	Yellow bellied weasel	17	Himalayan ibex
5	Strip backed weasel	18	Musk deer
6	Snow leopard	19	Ghoral
7	Leopard or panther	20	Indian muntjac
8	Leopard cat	21	Serow
9	Common jungle cat	22	Jackal
10	Lynx	23	Common otter
11	Caracal	24	Small or claw less otter
12	Striped hyena	25	Upland hare
13	Common fox or bill fox	26	Barking deer

Among the mammals, barking deer (Kakar), ghoral and leopard are found in the lower areas in addition to other animals like fox or porcupine. At higher elevations black and red bears are common. Musk deer is also found.

**Birds:** A large number of bird species are found in the district as the altitude, climate and the vegetation exhibit large variations.

Different types of pheasants viz., the horned pheasant (locally known as phulgar) the koklass and of the most part of the district both the

black and the gray khakhorla are found at different elevations. The chakor is quite widespread in the district and both the black and the gray partridges are also quite common. Wood partridge is found in deodar and oak forests between altitude of 2,000 metres and 2,500 metres. Peacock and jungle fowl are also found. Besides these game birds, some other birds found in the district include:

The *Himalayan Tree Pie*, The *Himalayan Nut cracker*, The *Indian Grey Tit*, *Simla black Tit*, *Laughing Thrush*, *White Throated Laughing*

*Thrush, Rufous Babbler, Spotted Babbler, White Necked Bulbul, Dark Gray Bush Chat, Ruby Throat, Spotted Forktail, White Capped Redstart, Plumbeous Redstart, Whistling Thrush, Orange Minivet, Tickellies Willow Warbler, Goldfinch, Greenfinch, Cinnamon Tree Sparrow, Common Swallow, Blue Headed Bee-eater, Trogon, Alpine Swift, Forest eagle Owl, White Bellied Snow Pigeon, White Crested Kaleej, Painted bush Quail, Chukor, Wagtails and Fly Catcher.*

**Reptiles:** Poisonous snakes are not common except in the part adjacent to Kangra. The Cobra is rare but Karait is now uncommon and vipers are also sometimes found. Non-poisonous snakes and grass snakes are quite common. Rock lizards are found everywhere.

### Wildlife Sanctuary

1. **Kalatop Khajjiar Sanctuary:** This small sanctuary lies in the catchment of the Ravi

#### Fauna: Mammals

Bear, Himalayan Black	Marten, Himalayan Yellowthroated
Cat Leopard	Deer, Barking
Goral	Squirrel, Common Giant Flying
Serow	Jackal
Langur, Common	Leopard

Source: Census (2001)

#### Bird

Common Name	Scientific Name
Blackbird	<i>Turdus merula</i>

2. **Sacha Tuan Nala Sanctuary:** It is a very high altitude sanctuary with significant population of Ibex, Musk deer, and Pheasants. Snow leopards have also been reported from here.

#### Fauna: Mammals

Bear, Brown	Markhor
Bear, Himalayan Black	Cat, Jungle
Mouse-hare, Himalayan	Deer, Musk
Goral	Serow
Ibex	Sheep, Blue
Langur, Common	Thar, Himalayan
Leopard, Snow	

Source: Census (2001)

River, and contains patches of good coniferous and Oak forests. A lovely bowl-shaped meadow at Khajjiar, with a lake and a 'floating' island, it is a popular tourist spot. There is a 'golden' domed temple at the edge of this meadow, dedicated to the deity 'Khajinag', from whom the area derives its name. Flora & Fauna found in the sanctuary are given below.

**Flora:** The vegetation consists of mature mixed Blue Pine and Deodar forest, with some Green Oak and *Rhododendron*. Undergrowth in the forest is well developed, dense in places and with a good cover of grass in November. Forest cover is 1962.84 ha, out of which Ban Oak Forest 12/C1 (a) covering 120 ha, Moist Deodar Forest 12/C1 (c) covering 1047.24 ha., and Western Mixed Coniferous Forest 12/C1 (d) covering 795.60 ha, interspersed with these are some Alpine Pastures 15/C3. List of fauna and birds found in the district are given below.

**Flora:** Forest type include Lower Western Himalayan Temperate Forest 12/C1, Moist Alpine Scrub *Jurinea macrocephala*, and *Ephedra gerardiana*. List of fauna is given below.

## Bird

Common name	Scientific Name
Accentor, Alpine <i>Source: Census (2001)</i>	<i>Prunella collaris</i>

**3. The Kugti Sanctuary:** This sanctuary is rich in high-altitude Himalayan wildlife, and is one of the last homes of Himalayan tahr in Himachal Pradesh. It is also well-known as a source of many medicinal plants. Abundant water resources, many originating from glaciers and a diverse topography add to the attraction of the area. To the west, it is connected with Tundah Sanctuary by a forest corridor. There is an annual pilgrimage by thousands of people to the Mani Mahesh Temple located inside the sanctuary.

12/C1 (c) spread over 5,800 ha., Western Mixed Coniferous Forest 12/C1(d) over 6,028 ha., and Alpine Pastures 15/C3.

The herbs *Gentiana kurroo* (Karu) and *Jurinea macrocephala* (Dhup) are believed to be locally threatened due to over-extraction. Plantation work over 133 hectares has been carried out from 1979 to 1984. Kail and Deodar were planted for commercial timber; other species planted are Poplar, Robinia, Walnut, Fir, and Spruce. Of these, Poplar and Robinia are introduced. There is a forest department nursery at Kugti. List of fauna & birds found inside the sanctuary are given below.

**Flora:** Forest types include Moist Deodar Forest

## Fauna Mammals

Bear, Himalayan Black	Ibex
Bear, Brown	Langur, Common
Cat, Leopard	Leopard
Deer, Musk	Marten, Himalayan Yellowthroated
Fox, Indian/Red	Serow
Goral	Tahr, Himalayan

*Source: Census (2001)*

## Birds

Common Name	Scientific Name
Babbler, Jungle	<i>Turdoides striatus</i>
Babbler, Redbilled	<i>Stachyris pyrrhops</i>
Barbet, Crimsonthroated	<i>Megalaima rubricapilla</i>
Barbet, Great Hill	<i>Megalaima virens</i>
Bee-eater, Green	<i>Merops orientalis</i>
Bul-Bul, Black	<i>Hypsipetes madagascariensis</i>
Bul-Bul, Redvented	<i>Pycnonotus cafer</i>
Bul-Bul, White cheeked	<i>Pycnonotus leucogenys</i>
Bunting, Crested	<i>Melophus lathami</i>

*Source: Census (2001)*

**4. The Tundah Sanctuary:** This is a high altitude sanctuary with good, though disturbed, habitat for Himalayan tahr, Ibex and pheasants. The area also supports a small population of Musk deer. It is

connected to Kugti Sanctuary by a forest corridor to the east.

**Flora:** Forest type include Moist Deodar Forest 12/ C1 (c), Western Mixed Coniferous Forest



12/C1(d), Moist Temperate Deciduous Forest 12/C1(e), and Alpine Pastures 15/C3.ala (Dhup) are believed to be locally threatened due to over-extraction. Plantation work over 133 hectares has been carried out from 1979 to 1984. Kail and Deodar were planted for

## Fauna

### Mammals

Bear, Himalayan Black	Ibex
Bear, Brown	Langur, Common
Cat, Leopard	Leopard
Deer, Musk	Weasel, Himalayan
Fox, Indian/Red	Serow
Goral	Tahr, Himalayan
Macaque, Rhesus	Marmot, Longtailed
Cat, Jungle,Marten	Mouse-hare, Himalayan
Shrew, Grey	Deer, Barking
Vole, Royle's	Weasel, Himalayan
Wolf	Rat, Indian Bush
Langur, Common	Vole, Royle's
Squirrel, Common Giant	Jackal
Flying	

Source: Census (2001)

### Birds

Common Name	Scientific Name
Babbler, Jungle	<i>Turdoides striatus</i>
Babbler, Redbilled	<i>Stachyris pyrrhops</i>
Barbet, Crimsonthroated	<i>Megalaima rubricapilla</i>
Barbet, Great Hill	<i>Megalaima virens</i>
Bee-eater, Green	<i>Merops orientalis</i>
Bul-Bul, Black	<i>Hypsipetes madagascariensis</i>
Bul-Bul, Redvented	<i>Pycnonotus cafer</i>
Bul-Bul,White cheeked	<i>Pycnonotus leucogenys</i>
Bunting, Crested	<i>Melophus lathami</i>

### Fauna Mammals

Bear, Himalayan Black	Ibex
Bear, Brown	Langur, Common
Cat, Leopard	Leopard
Deer, Musk	Weasel, Himalayan
Fox, Indian/Red	Serow
Goral	Tahr, Himalayan
Macaque, Rhesus	Marmot, Longtailed
Cat, Jungle,Marten	Mouse-hare, Himalayan
Shrew, Grey	Deer, Barking
Vole, Royle's	Weasel, Himalayan
Shrew, Grey	Deer, Barking
Shrew, Grey	Deer, Barking
Squirrel, Common Giant	Jackal
Flying	

Source: Census (2001)

commercial timber; other species planted are Poplar, Robinia, Walnut, Fir, and Spruce. Of these, Poplar and Robinia are introduced. There is a forest department nursery at Kugti. List of fauna & birds found inside the sanctuary are given below.

## Birds

Common Name	Scientific Name
Babbler, Jungle	<i>Turdoides striatus</i>
Babbler, Redbilled	<i>Stachyris pyrrhops</i>
Barbet, Crimsonthroated	<i>Megalaima rubricapilla</i>
Barbet, Great Hill	<i>Megalaima virens</i>
Bee-eater, Green	<i>Merops orientalis</i>
Bul-Bul, Black	<i>Hypsipetes madagascariensis</i>
Bul-Bul, Redvented	<i>Pycnonotus cafer</i>
Bul-Bul,White cheeked	<i>Pycnonotus leucogenys</i>
Bunting, Crested	<i>Melophus lathami</i>
Bunting, Greyheaded	<i>Emberiza fucata</i>
Buzzard, Honey	<i>Pernis ptilorhyncus</i>
Buzzard-eagle, White- eyed	<i>Buteo teesa</i>
Chat, Blue	<i>Eritacus brunneus</i>

Source: Census (2001)

- The Gangul Sanctuary:** It is a high-altitude sanctuary harbouring small population of Musk deer, Himalayan tahr, and pheasants. This is the only sanctuary in Himachal Pradesh which has reported the presence of Kashmir stag, though none have been observed in the last few years. The sanctuary is under severe human pressure and is heavily grazed. Its northern boundary adjoins the State of Jammu and Kashmir.

**Flora:** Forest type include Moist Deodar Forest 12/C1 (c), Western Mixed Coniferous Forest 12/C1 (d), and Alpine Pastures 15/C3. List of fauna & birds found inside the sanctuary are given below.

Bear, Himalayan Black	Ibex
Bear, Brown	Langur, Common
Cat, Leopard	Leopard
Deer, Musk	Weasel, Himalayan
Fox, Indian/Red	Serow
Goral	Tahr, Himalayan
Macaque, Rhesus	Marmot, Longtailed
Cat, Jungle,Marten	Mouse-hare, Himalayan
Shrew, Grey	Deer, Barking
Vole, Royle's	Weasel, Himalayan
Shrew, Grey	Deer, Barking
Shrew, Grey	Deer, Barking
Squirrel, Common	Jackal
Giant Flying	

A systematic list of Birds with their altitudinal distribution observed in the District Chamba is given below in Table 28.

**Table 28: List of Birds**

Species and Common Name	Distributional range of birds observed in the district (Altitude in Meters)
<i>Milvus migrans</i> (Boddaert) Pariah Kite	800-1150
<i>Accipiter badius</i> (Gmelin) Indian Shikra	850-1550
<i>Gyps himalayensis</i> (Hume) Himalayan Griffon vulture	1100-2500
<i>Gyps bengalensis</i> (Gmelin) Whitebacked Vulture	1100-2500
<i>Neophron percnopterus</i> (Linnaeus) Egyptian or Scavenger Vulture	900-1300
<i>Falco tinnunculus</i> (Linnaeus) European Kestrel +	1500-2400
<i>Arborophila torqueola</i> (Valenciennes) Simla Hill partridge*	1500-2700
<i>Vanellus indicus</i> (Boddaert) redwattted Lapwing	800-1200
<i>Treron sphenura</i> (Vigors) wedgetailed Green Pigeon	1000-1500
<i>Columba leuconota</i> (Vigors) West Himalayan Snow Pigeon	3500-4000
<i>Columba livia</i> (Gmelin) Blue Rock Pigeon	800-1500
<i>Streptopelia orientalis</i> (Latham) Western Turtle-Dove+	2000-3300
<i>Streptopelia decaocta</i> (Frisvaldszky) Indian ring Dove	800-1500
<i>Psittacula krameri</i> (Scopoli) Northern Roseringed Parakeet	900-1500
<i>Psittacula cyanocephala</i> (Linnaeus) Northern Blossomheaded Parakeet	800-1500
<i>Psittacula himalayana</i> (Lesson) Himalayan Slatyheaded Parakeet*	1500-2500
<i>Eudynamis scolopacea</i> (Linnaeus) Indian Koel	1100-1500
<i>Apus melba</i> (Linnaeus) Alpine Swift	1000-2000
<i>Halcyon smyrnensis</i> (Linnaeus) Indian Whitebreasted Kingfisher	1100-1600
<i>Merops orientalis</i> (Latham) Indian small Green Bee-eater	1100-1600
<i>Megalaima asiatica</i> (Latham) Bluethroated Barbet	900-1500
<i>Megalaima virens</i> (Boddaert) Himalayan Great Barbet*	1450-2400
<i>Picus squamatus</i> (Vigors) Himalayan Scalybellited Green Woodpecker*	1200-2200
<i>Picus canus</i> (Gmelin) Indian Blacknaped Green Woodpecker*	1200-2200
<i>Hirundo rustica</i> (Linnaeus) Western swallow	1000-2200
<i>Lanius schach</i> (Linnaeus) Rufousbacked shrike	1300-2250
<i>Oriolus oriolus</i> (Linnaeus) indian Golden Oriole	1200-1700
<i>Dicrurus adsimilis</i> (Bechstein) North India Black Drongo	800-1400
<i>Sturnus pagodarum</i> (Gmelin) Brahminy Myna	800-1500
<i>Acridotheres tristis</i> (Linnaeus) Indian Myna	800-1700
<i>Acridotheres fuscus</i> (Wagler) Northern Jungle Myna	1000-1500
<i>Cissa flavirostris</i> (Blyth) Western Yellowbilled Blue Magpie*	1500-2200
<i>Pica pica</i> (Linnaeus) Kashmir or White rumped Magpie*	1500-2300
<i>Dendrocitta vagavunda</i> (Latham)North WesternTree Pie*	1400-1800
<i>Dendrocitta formosae</i> (Swinhoe) West Himalayan Tree pie*	1000-1700
<i>Nucifraga caryocatactes</i> (Linnaeus) Larger SpottedNutcracker*	1500-2000
<i>Corvus splendens</i> (Vieillot) Indian House Crow	1200-1500
<i>Corvus macrorhynchos</i> (Wagler) Himalayan Jungle Crow	1000-3000
<i>Pericrocotus flammeus</i> (Forster) North India Scarlet Minivet	1100-1500
<i>Pericrocotus ethologus</i> Bangs & Phillips West Himalayan Longtailed Minivet+	1100-1500
<i>Pericrocotus cinnamomus</i> (Linnaeus) Sind small Minivet	1100-1400
<i>Pycnonotus leucogenys</i> (Gray) Whitecheeked Bulbul*	800-2200

Species and Common Name	Distributional range of birds observed in the district (Altitude in Meters)
<i>Pycnonotus cafer</i> (Linnaeus) Punjab Redvented Bulbul	1000-1500
<i>Hypsipetes madagascariensis</i> (P.L.S.Muller) Himalayan Black Bulbul*	1000-3200
<i>Garrulax lineatus</i> (Vigors) Simla Streaked Laughing Thrush*	1500-2000
<i>Leiothrix lutea</i> (Scopoli) Western Redbilled Leiothrix*	1400-1800
<i>Muscicapa sibirica</i> (Gmelin) Kashmir Sooty Flycatttcher	1600-2200
West Himalayan Longtailed Minivet +	1100-1500

\* Resident Bird of Himalaya (subject to winter-summer vertical/altitudinal movement)

+ Summer (breeding) visitor (March to September) to Himalaya.

**Hamirpur:** As per State Forest Report of 1999, forest area in the district is about 219 km<sup>2</sup> which constitutes 19.6% of the total geographical area of the district. According to a revised forest survey done by H.G.Champion and S.K. Seth, the forests in this district have been classified in the following types:

- i) **Shiwalik Chil Pine Forests:**The chil is the dominant species and occurs in the zone ranging from 600 metres to 1,100 metres height. It generally forms pure forest on the western and south-western slopes of the Jakh Dhar and in the Chabutra Dhar, the proportion of Chil is reduced and scrub of miscellaneous broad leaved species cover the ground. The majority of forests in Hamirpur district consist of Chil forests. But these forests are very prone to fire causing much damage to their density.
- ii) **Northern Dry Mixed Deciduous Forests:** Khair is the predominant species. However, besides it, other broad leaved species are also found. The altitudinal range is from 400 metres to 850 metres. The various species of plants and forest trees, which are found in the district, are Kikar, Amla, Neem, Karal, Taur, Bil, Kasmal, Khair, Ber, Chil etc. With the increase in human population there is pressure on the forests for timber, firewood and fodder for cattle. Commercial exploitation of the forest is

being done through Himachal Pradesh State Forest Corporation. Besides, fodder yielding trees were introduced and the increasing requirement for fire wood and timber is being compensated by planting chil in Government and private waste land. New Social Forestry Project, known as Social Forestry Umbrella Project, was taken up in the district from the year 1984-85. Under the project, private, community, Government waste land and forest land are to be planted to bring more area under forest cover. Besides, plants are being distributed amongst the people at subsidized rates for the plantation on farm land so that fuel, fodder and timber could be supplied to the people. During the year 1999-2000, the area under different types of forest cover in the district was 9,558.28 hectares under protected forests, 6083.84 ha under unprotected forests under and 6,214.12 hectares in other type of forests under the management of forest department.

**Fauna:** The species of animals commonly found in the district are, namely, leopard (bagher), hare, wild boar (jangli suar), jackal, barking deer (kakkar), monkey and sambhar. The commonly found birds are chakor, crow, red jungle fowl (jangli murga), black partridge (kala titar), grey partridge (safed titar) and wood pecker. Table 29 shows the value of forest products during the year 1999-2000.

**Table 29: Forest Product and Revenue**

Sr. No.	Forests product	Production in cubic meters	Value (in `)
1	Folder	N.A.	15,000.00
2	Grass	N.A.	156,000.00
3	Timber	3,991	11,490,000.00
4	Fuel	450	208,000.00

Source: District Statistical Abstract, Hamirpur-2001

Forests in the district are an important source of fodder, fuel, wood and timber. In addition to this, forest based activities provided employment to 5,605 persons during 1999-2000.

**Kangra:** The forest area in Kangra district was 2,062 km<sup>2</sup> as per State Forest Report of 2009

The forests of Kangra district have a great variety of vegetation due to variations in altitude, geological formations and climatic factors. The forests are situated for the most part on the northern slopes of the hill ranges and contain much useful timber. The vegetation varies from the tropical bamboo which clothes the lower hills to alpine vegetation, oak, pine and rhododendron of higher ranges. In between two extremities occur distinctive vegetation zones of chil, ban-oak, mixed coniferous (kail, spruce, fir) and Kharsu oak forests. The forests of Kangra can be classified into seven main groups.

- (I) **Miscellaneous scrub forests:** These forests are mainly found between 600 metres and 1,200 metres elevation and are composed mainly of trees/scrubs of Khair, Kachnar, Siris, Kakrain, Thingan bil etc. The under-growth consists of garna, mander, basuti, gandla etc. The forests are generally open, degraded and are getting crowded due to over grazing and excessive exercise of various rights.
- (ii) **Chil forests:** The chil forests occur between elevations of 800 metres to 1,700 metres. The best growth is however, between 1,200 meters to 1,700 metres.
- (iii) **Ban-oak forests:** These forests occur at elevation from 1,600 metres to 2,300

which constitutes almost half of total geographical area of the district. Of this total forest cover 310 km<sup>2</sup> is under very dense forests and 1221 km<sup>2</sup> is moderate dense forests while 531 km<sup>2</sup> is open forests which forms 35.93% of the total area of the district.

metres. There are, however, a few exceptions like the oak forests of Dhalun near Yol cantonment, Shahpur, Manjgran and Khaniara where these forests have gone down to about 800 metres elevation.

- (iv) **Deodar forests:** Deodar forests are only found in Dharam Kot forests near Mcleodganj town and are exclusively of artificial origin.
- (v) **Mixed coniferous (Kail, spruce and Fir):** These forests are only patchy between 2,100 metres to 3,000 metres elevation. Kail forests are practically absent. Towards the upper most extremities Kharsu oak is found intimately mixed with fir and spruce. The common associates are walnuts, horse chestnut, acer species, ulmus species etc.
- (vi) **Kharsu Oak forests:** These forests are found between the altitudinal zone of 2,300 metres to 3,800 metres, the upper most limit of tree growth. This Oak generally occurs as a pure crop, while spruce and fir are found scattered individually or in small groups of sites suitable for these species.
- (vii) **Alpine Scrub and Alpine Pastures:** This type extends in this region above 3,800 metres elevation and is represented by extensive alpine meadows with a few scattered patches of evergreen branchy scrub of *Juniperus recurva* and

*Rhododendron*; the meadows are mostly composed of perennial herbs and grasses.

Kangra forests have a large number of aromatic and medicinal plants which can be utilized for pharmaceutical and Ayurvedic medicines like dhoop, Karu/Kour, brahmi, kuth/khuth, bankakri etc. Social Farm Forestry Programme has carried on extensive plantations on public waste lands, schools compounds and private farm land. Table 30 shows the area of forest cover in the district.

**Table 30: Forest Area under control of Forest Department, during year 1999-2000**

1	Reserve forest	7,601 Hectares
2	Protected forest	54,951 Hectares
3	Unclassified forest	164,434 Hectares
4	Other forest	57,197 Hectares
	<b>Total</b>	<b>284,183 Hectares</b>

Source: Statistical abstract of Kangra-2000.

**Fauna:** The district is rich in animals and birds which includes some of the rare species. The animals and birds found in the district include Ghoral, Kakar, Kastura, Aimu, Ibex, Blue Mountain Sheep, Thar, Black Bear, Brown Bear, Leopard, Snow Leopard, Wild Boar, Spotted Deer or Chital, Sambar, Porcupine, Flying Squirrel and Himalayan Pine Martin. Animals like Jackal, Monkey, Langoor, Fox etc. are also found within this area.

**Birds:** Monal Pheasant, Snow Cock, Western Horned Tragopan, Peacock, Ring Dove, Spotted dove, Shikra, Parrot, Tawny eagle, Green Pigeon, Pigeon, Gritton Vulture, Nut Cracker, Pies, Wood Pecker, Crow, Himalayan Fly Catcher etc. are found in the district.

**Kinnaur:** The district has both demarcated & undemarcated forest areas. The demarcated protected forest area is spread over 23,686 hectares, where as un-demarcated protected forest area is spread over 353,533 hectares. During the year 1998-99, 5,022 cubic metres of timber wood, 70 cubic metres of firewood and medicinal herbs, the value of which amounts to

₹127,550/- had been received as forest produce from the district.

Kinnauris are primarily agro-pastoral people and their land utilization and management practices are crude and primitive. Large scale felling of forest tracts within and out side reserved and demarcated forests took place in an unrestricted manner for house construction, for the extension of cultivation and for finding grazing grounds for the ever increasing cattle. These felling combined with fires, loppings and over grazing resulted in the destruction of large area of forests and pasture lands. To overcome this problem, the forests' department has closed certain areas in Nichar and Poo for grazing throughout the year.

The forest types can be classified into three main divisions in Kinnaur district:

- (i) The moist zone forests are found on the left side of the Sutlej valley with northern exposure up to Nichar. They comprise the Tranda range of forests. From the river side at 3,500 feet to alpine pasture at 12,000 feet on the right base consists of grasslands and higher up are the forest belts. Along the side stream, the forests are well developed and *Pinus longifolia*, *Pinus wallichiana*, *Cedrus deodara*, *Picea smithiana*, *Abies pindrow*, *Pinus gerardiana* form a broad belt of forests along with sides of the Sutlej valley and the side streams between the cliffs of the gorge below and alpino pastures. On the lower slopes up to 5,000 feet, Chir pines occur in pure form and higher up give way to *Quercus incana* and *Rhodeodron arboreum*. On shelter ravine bank between 5,000 to 12,000 feet, *Cedrus deodara* and *Pinus wallichiana* form intervening forests, higher up from 7,000 to 10,000 feet *Picea smithiana* with a mixture of broad leaf species are predominant.
- (ii) The dry zone is spread in the middle of Kinnaur where the Deodar reaches its optimum development and forms large areas of pure forests. It extends from Nichar to Chini and is also found in Sangla

valley. At the lowest levels, pine trees are found while in the higher tracts blue pine, spruce and silver fir trees are found. Neoza pines (Chilgoja) which produce edible nuts grow in this zone and are the only forest of Neoza in India barring the Peer Panjal range.

- (iii) The arid Zone includes the parts adjoining to Tibetan border where the deodar develops well only on cool aspects and comparatively at higher elevations than elsewhere. In this zone, the forest consists of rose dog and dwarf bushes and vast, barren, desolate and rocky areas are devoid of tree cover.
- (iv) The forests have been termed as “Green Gold” and there is heavy pressure on forests due to the requirement of fuel wood during the long and harsh winters and requirements of timber by the right holders for the construction of houses. The forests of Kinnaur are valuable timber forests and source of considerable revenue.

**Wildlife Sanctuary:** The tract of Kinnaur district due to great variation in its elevation, climate and topography represents varied fauna and flora. For the reason of their ecological, faunal, floral and geographical importance, three wildlife sanctuaries have been created in this district, which are:

- i) Rakchham – Chitkul Sanctuary
- ii) Lippa – Asrang Sanctuary
- iii) Rupi – Bhabha Sanctuary

The main objective behind the creation of these sanctuaries is protection, propagation and development of wildlife and its environment.

The other two wildlife sanctuaries of Kinnaur namely Lippa-Asrang and Rupi-Baspa are situated in the north-eastern part of this district. The Lippa-Asrang is in the upper catchment of Taiti Stream, which is an important tributary of Sutlej River.

**Flora:** Table 31 describes various species of the plants and forest trees which are generally found in the Kinnaur district:

**Table 31: Species of plants & forest trees found in Kinnaur**

Sr. No.	Botanical Name	Local name
1	<i>Berberis aristta</i>	Komal
2	<i>Berberis lyceum</i>	Kashnala
3	<i>Berberis petiolaris</i>	Karundu
4	<i>Betula utilis</i>	Bhojpatra
5	<i>Capparis spinosa</i>	Bussar
6	<i>Cedrus deodara</i>	Deodar
7	<i>Clematis buchananiana</i>	
8	<i>Clematis connata</i>	
9	<i>Clematis graveolens</i>	Bailen Climbars
10	<i>Clematis grata</i>	
11	<i>Clematis Montana</i>	
12	<i>Clematis orientalis</i>	
13	<i>Cotoneaster bacillaris</i>	Reesh
14	<i>Cobryrus colurna</i>	Sheloi
15	<i>Daphne oleoides</i>	Agru
16	<i>Elsholtzia poeystachya</i>	Pag
17	<i>Fraaxinus xanthoxyloides</i>	Thun
18	<i>Hex dipyrone</i>	Kaderu
19	<i>Indigofera gerardiana</i>	Kathi
20	<i>Juglans regia</i>	Akharot
21	<i>Myraino Africana</i>	Chitring
22	<i>Phetontbus rugosus</i>	Pag
23	<i>Pinus excelsa</i>	Kail
24	<i>Pinus gerardiana</i>	Neoza
25	<i>Pinus longifolia</i>	Chir
26	<i>Pistacia integerrima</i>	Kakzosan
27	<i>Prinsepia utilis</i>	Bhekunil
28	<i>Prunus armeniaca</i>	Chuli
29	<i>Prunus padus</i>	Jamu
30	<i>Prunus persica</i>	Baimi, Aau
31	<i>Prunus puddum</i>	Phaja
32	<i>Pyrus communis</i>	Nashpati
33	<i>Pyrus malus</i>	Seo
34	<i>Pyrus pashia</i>	Kainth
35	<i>Rhus punjabensis</i>	Tittri (Harku)
36	<i>Rhus succedanea</i>	Sish
37	<i>Rumex hastatus</i>	Shrub
38	<i>Rumex nepalensis</i>	Shrub
39	<i>Spiraea eindbeana</i>	Kusht
40	<i>Syringa emodi</i>	Shapar

**Fauna:** Table 32 describes are the species of fauna found in the district:

**Table 32: Faunal species found in Kinnaur**

1	Bharal	20	Himalayan ibex
2	Brown bear (Lal	21	Indian Muntjac

	Bhalu or snow bear		migrating (jungle Bakri)
3	Hill fox (Lomri)	22	Jackal (Gidhar, Shial)
4	Common jungle cat	23	Larg brown flying squirrel
5	Porcupine	24	Leopard cat (Chita Billi)
6	Common European bat	25	Leopard or Panther (Tendwa)
7	Common Musk shrew must at (Chachundar)	26	Long eared rat
8	Common otter (Udbilao)	27	Musk deer
9	Common rat	28	Red lynx or caracal (Sinaghush)
10	Common Indian rat	29	Rhesus Monkey
11	Common House mouse	30	Serow
12	Dark brown bat	31	Small Tibetan grey fox
13	Flying fox	32	Small grey fox
14	Ghoral	33	Snow leopard
15	Great Himalayan leaf nosed bat	34	Upland hare
16	Himalayan langur	35	White nosed weasel
17	Himalayan black bear (Bhalu, Richh)	36	Yellow bellied weasel
18	Himalayan tahr	37	Himalayan Wolf or (Chanku)
19	Himalayan palm civet	38	House hare

Mammals that are found in this area include brown bear, musk deer, Tibetan antelope and ibex. The wild cat, leopard cat, civet cat, jackal and hill fox are also commonly found.

**Birds:** Pheasants, monals, hawks, eagles, dove, pigeons, snow cock, tragopan, koklash and chakor are commonly found in the area. Raven and the common Indian crows are plentiful.

**Reptiles:** Snakes of various kinds are found here. Common reptiles are the spotted agama, Indian chameleon, common krait and the other harmless creatures. Frogs are found at some places. Amongst the lizards, monitor lizard, common house gecko and garden lizard are found occasionally.

**Fish:** Among the prominent species of fish found in the stream and rivers in the district, are *Salmo fario* and *Oreinus sinuatus*. The indigenous fish fauna is uniformly distributed in the water of the district. The exotic fish species brown trout (*Salmo fario*) was introduced in Baspa River in 1926. In 1961-62 State Fisheries department had established a Trout Farm at Sangla for incubating the trout eggs, which were brought from Barot fish Farm in Mandi District.

**Afforestation:** The denuded rugged and tree less brown and barren tract of Poo in the district calls for immediate afforestation. To begin with, during 1982- 83 suitable areas were identified and enclosed where water was available and command area was proposed to be created. The plantation of fast growing species of poplar (*Populus ciliata*), willow (*Salix alba*, *Salix fragilis*) wild almond, wild apricot, *Robinia* sp. was undertaken to meet the objectives of the Desert Development programme. Later on, the plantation of other species including the coniferous types was undertaken as it was felt that coniferous species such as juniper and chilgoza are more adaptable to the local conditions as compared to poplar and willow.

**Kullu:** The forests of Kullu district are rich in various kinds of medicinal herbs like Karu, Dhoop, Muswala and Kakar Singi. Mushrooms are also available in plenty and extracted in large quantity. Deodar attains considerable dimensions in the upper Beas and Parvati valleys. All the higher ranges have dense forests while in the valleys as one descends lower, the growth of forests is less. Deodar, Kail, Cheel, Walnut, Horse chestnut and oak are better classes of trees found in abundance in the forests. Rae, Tosh and Ardar which stand beautiful from artistic point of view are also available in plenty.

The Kullu forests considerably resemble those in the adjacent parts of Kangra and Mandi. Cheel and Pine are found best in quartzite rock and are available in the Parvati and Tirthan valleys. Wild olive and mulberry are found on

lower levels. Extensive forests of common Himalayan oak are found largely in the Hurla valley above 2,400 metres elevation. Spruce and silver fir forests also exist. The oak, spruce and silver fir trees attain a height of about 61 metres. Hazel, Hornbeam, Yew and Bird Cherry are also found. Birch, Moru, Ban and Rhododendron are found alongwith willows, Ash, Wild, Apple and Juniper. Tree growth is replaced by Alpine pastures ascending to the limit of vegetation and snow line. These grazing grounds are used for

grazing sheep and goats during the summer and also by the ponies where the slope is not too steep. During winter when these uplands are snow covered, the forest work ceases till return of spring. There are many shrubs and plants which provide food, medicines and dyes. Wild strawberry, raspberry and barberry are also found. Table 33 shows the area of forest coverage in the district based on the assessment (2009) of the Forest Department of the State:

**Table 33: Forest cover in kullu district (km<sup>2</sup>)**

Geographical Area (km <sup>2</sup> )	Forest cover (km <sup>2</sup> )			Total (km <sup>2</sup> )
	Dense forests	Mod. dense forest	Open forests	
5,503	586	789	583	1958

Source: Forest Report of the State-2009.

Percentage of forest cover comes to 35.9% of the total geographical area of the district while the proportion of both dense and open forests to total forest area is 39.0% according to the Forest Department.

**Flora:** Table 34 describes various species of the plants and forest trees which are generally found in Kullu district:

**Table 34: Species of plants & trees found in Kullu**

Sr. No.	Botanical Name	Local Name
1	<i>Cedrela serrata</i>	Duri or Dari
2	<i>Aesculus indica</i>	Gun or Khaner
3	<i>Acer caesium</i>	Mandar
4	<i>Pistacia integerrima</i>	Kakrain or Kakar
5	<i>Rbus cotinus</i>	Tung
6	<i>Rbus wallichii</i>	Rikhal, Arkhal
7	<i>Dalbergia sissoo</i>	Tali or Shih and Shishu
8	<i>Pyrus pashia</i>	Kainth or Shegal
9	<i>Pyrus lanata</i>	Pala
10	<i>Prunus padus</i>	Paja
11	<i>Prunus armeniaca</i>	Shari
12	<i>Prunus persica</i>	Aru, Malaru
13	<i>Contoneaster bacillaris</i>	Reunsh
14	<i>Prinsepia utilis</i>	Bhekhal
15	<i>Rubus ellipticus</i>	Anchu, Achla
16	<i>Rubus paniculatus</i>	Thisri
17	<i>Pieris ovalifolia</i>	Ailan or Arban
18	<i>Rhododendron campanulatum</i>	Shargar, Kashmiri Pata

**Fauna:** Brown and black bear, the spotted and white leopard, musk deer, wild cat, flying squirrel, hyena, wild pig, jackal, fox and marten are found in the district. The climatic conditions

Sr. No.	Botanical Name	Local Name
19	<i>Fraxinus floribunda</i>	Angu
20	<i>Buxus sempervirens</i>	Shamshad
21	<i>Ulmus villosa</i>	Maran
22	<i>Morus indica</i>	Chun, Chimo
23	<i>Ficus roburghii</i>	Trembala or Trimul
24	<i>Ficus palmata</i>	Phagra
25	<i>Populus ciliata</i>	Phalsh
26	<i>Alnus nepalensis</i>	Koi or Kosh
27	<i>Quereus semecarpifolia</i>	Kreu or Kharshu
28	<i>Taxus baccata</i>	Phatish or Rakhhal
29	<i>Cedrus deodara</i>	Kelon or Kelo
30	<i>Abies webbiana</i>	Tos
31	<i>Picea morinda</i>	Rai
32	<i>Cupressus torulosa</i>	Dedididar

prevailing in the district are most favourable for game birds. Hill pheasant and monal are found in the higher ranges. The white crested pheasant, koklas and the cheer, red jungle fowl,



black and wood partridge, chukor are very common in lower hills. Snipe, wood cock and teal are also found. In winter the snow pheasant and snow partridge are also found along with the wild duck and geese. Eagles, vultures, kites and hawks inhabit the upper reaches. Due to considerable pressure on the forests and reckless felling of trees, many places have been denuded resulting in the fast disappearance of wild animals and birds.

**Lahaul & Spiti:** The forest area cover in the district is only 193 km<sup>2</sup> out of total geographical area of the district which constitutes only 1.39 per cent of the total area according to the Forest report of the State 2009. The district is situated in the inner Himalayas. Its deep valleys are dry, rugged and barren and there is no scope for afforestation. The greatest problem is conservation of soil and prevention of erosion. There is a poor forest in the district in comparison with the vast area. There are only a few and scanty forests of Kail, deodar and birch owing to difficult climatic conditions and high elevation. The principal tree species in the forest areas are Kail, deodar, pencil cedar, birch, willow, juniper, bird cherry and poplar which are met with in various places in the form of small cluster of trees. Kail, the most valuable tree of Lahaul is found at intervals along the left bank of river Chandra between Koksar to Sissu, upto Tandi along the Chandrabhaga down to Chamba border and little beyond Nainghar in Thiroth nallah. In the Bhaga, it occurs on its left bank in Kardang and Cheling on northern slope. Except in Mooling where there are some big trees, Kail is generally of small size and mostly occurs either in banks of canopied trees or scattered amongst the cliffs where the soil is sufficient for them to grow.

Deodar, the most common tree of Lahaul division is chiefly found in Kothis of Gumrang and Kolong near Jaspa and in the Pattan valley in Kothi jalma on the right bank of river Chandrabhaga. The scattered trees on the small patches are found in the right bank of Bhaga. There are few trees of spruce near Guru

Ghantal monastery, in the Jhalma Nallah and Thiroth Nallah mixed with Kail. Willow is largely cultivated near villages where irrigation is available. Willow trees are much valued by the people and used for fodder and fuel. Lombardy poplars were introduced by the Moravian Mission and are doing very well in Lahaul. The vegetation cover of the entire area of Spiti is very sparse. It falls in Dry Temperate Zone, Alpine Zone and Zone of perpetual snow.

The poplar and willow trees are popular for afforestation in Lahaul & Spiti valleys. The nursery farms are located at Tabo and Pooch in which cuttings of various species are being raised. Community plantation is also being emphasised which is subsidized by the government upto fifty per cent on fencing and plantation.

**Flora:** The flora is of Central Asian or Siberian character and also of dry alpine nature at lower elevation on account of limited amount of rainfall and humidity and extremely cold climate. The growth of trees is very poor and slow. The vegetation can be divided into three altitudinal zones viz. the first extending from 8,000 ft. to 11,500 ft. and containing maximum vegetation, the second zone from 11,500 to 16,000 ft. which carries alpine vegetation and the third zone from 16,000 ft. upwards containing practically no vegetation at all except the grass meadows.

The first zone of vegetation is characterised chiefly by the presence of nearly all the trees that exists in Lahaul Valley viz. *Juniper*, *blue pine*, *birch*, *Hippophae* spp, willows, poplar, *spruce*, *Pyrus species*, *walnut* etc. Other shrubs and herbs of lesser importance are *Crataegus*, *Oxyacantha* (Howthorn) *Viburnum foetens*, *Fraxinus*, *Xanthoxyloides*, *Berberis vulgaris*, *Prunus padus*, *Spiraea kamtschatica* and *Lonicera* spp with *Myricaria elegans* etc. The finest flowering plant in Lahul is *Eremurus spectabilis*, of which the flowering stem is four to six feet in height, and the spike inflorescence varies from two to three feet in length,

*Hemerocallis fulva*, *Iris kumaonensis* and *Anemone* spp., *Potentilla* spp., *Sibbaldia* spp. and *Pedicularis* spp. are also common flowering plants of the spring season. *Gentiana* spp. is common in summer and autumn.

The second zone is devoid of trees and only juniper, birch, andromeda and *Rhododendron* spp. are found as shrubs upto the maximum elevation of 14,000 ft. Frequent good patches of short grass and wild flowers are found here. The *Gentiana* spp (Kam) grows abundantly with *Aconitum* spp (Palish), *Jurinea macrocephala* (dhup), *rhubarbs* and *Polygonum* spp. Yellow and orange coloured *Potentilla* spp with several of the *Saxifraga* spp. and one or two species of *Salix* in an alpine form are also found. Some of the *Prinula* spp. occur in extensive beds recognizable from a great distance. The characteristic plant of the third zone is *Rheum moorcroftianum* which does not occur below this height, otherwise this zone is devoid of any vegetation.

**Fauna:** The most majestic and stately animal in the district is the Ibex or Tangrol with its long beautiful horns. Along the same altitude are to be seen the muskdeers. The other animals found in this region are brown bear, Himalayan fox, snow leopard, snow wolf, bharal, mouse hare, Himalayan blue sheep, snow rabbit etc. The number of these species is declining rapidly due to indiscriminate killings by poachers and therefore stern and stringent measures are being implemented to save them from near extinction.

The most common bird found in the district is the snow cock. The Hill pigeons, sparrows, chakor, green sandpiper and partridges are also visible in the region. Wild ducks are seasonal birds which pass through the district on their way from Central and North Asia to the plains of India during autumn. Snow trout of very good quality is found where side streams join the river or where water lies in pools. Two types of snakes whitish grey and yellowish brown in colour and thought to be poisonous are found

in the Spiti valley. A few lizards are also seen in the valley.

**Mandi:** According to Annual Forests Report at the end of the year 1998-99, the total area under forests was 176,601 hectares. Of these, 145,764 hectares were demarcated reserved forests, 3,773 hectares were undemarcated reserved forests and 27,064 hectares were unclassified forests. Forests are scattered throughout the district on the higher slopes. The important forests are those lying in the Sutlej valley. The main species of deodar occur in large compact blocks. Deodar forests are generally found at an altitude varying from 5,000 to 9,000 feet. This species is at its best in the Damoon forest at an altitude of about 7,000 feet. Chill forests are at an altitude between 950 metres to 2,750 metres. In the lower areas, bamboos and other bush type forests are found in the entire district. Deodar, Chill, Kail, Silver Fir etc. are important species available in the district. The other prominent trees of the region are Simbal, Tuni, Mulberry, Willow, Poplar, Oak, Walnut and Bamboo. During the year 1998- 99, timber valuing `103,773,045 and fuel wood and coal valuing ` 337,140 was extracted from the forests of the district besides which the values of the minor forest products worked out to be `9.82 lacs.

The breakup of forest area as per division is given in Table 35. At the end of the year 1998-99, the total forest area under Jogindarnagar division was 19,867.29 hectares, Mandi 33,097.79 hectares, Suket 41,759.26 hectares, Nachan 38,470.69 hectares and Karsog 43,405.74 hectares covered under the demarcated reserve forest, undemarcated reserve forest and unclassified forests. The forest area covered under different species in the district at the end of year 1998- 99 was 17,550 hectares by deodar, 5,140 hectares by Kail, 11,250 hectares by silver fir, 40,079 hectares by Chil, 14,654 hectares by oak and remaining 29,441 hectares by other species. The State Government has adopted three-dimensional forest farming to rejuvenate the

forests. Statements as given below show the area under forest in hectares, under types of

forests and main forest produce and its value (in lacs) in Mandi district during 1998-99:

**Table 35: Forest area in Hectares**

District and Forest Division	Forest under the control of Forest Department					Not in the control of forest deptt.	Total
	Protected Forest	Demarcated Reserve Forest	Undemarcated Reserve Forest	Un-classified Forest	Other Forest		
Mandi	-	145,764.00	3,773.00	27,064.00	-	-	176,601.00
1 Jogindarnagar	-	18,802.43	1,039.26	25.60	-	-	19,867.29
2 Mandi	-	32,121.81	975.92	-	-	-	33,097.79
3 Suket	-	27,446.26	428.00	13,885.00	-	-	41,759.26
4 Nachan	-	34,254.69	427.00	3,789.00	-	-	38,470.69
5 Karsog	-	33,139.02	902.32	9,304.40	-	-	43,405.74

Source: District Statistical Abstract, Mandi 2000

**Flora:** The vegetation of Mandi district is characteristic of the lower hills of the Western Himalayas and resemble very closely to parts of the Punjab plains. The more prominent trees of the region are the ‘Simbal’, ‘Mango’, ‘Tuni’, several species of Acacia and Albizia, Salambra and two species of Terminalia and Jamun. Associated with these is the larger ‘Taur’ the leaves of which are used extensively as platters. The bamboo is indigenous in this region and the wastelands are covered with thorny shrubs. The chil forest of conifer types occur upto an elevation of 1950 metres when it gives place to the deodar and the blue pines which occur either pure or more usually mixed to an elevation from 1,650 to 2,650 metres. Above these, comes spruce from 2,350 to 2,650 metres and silver fir from 2,650 to 2,950 metres. Each of these zones possesses characteristic oak. At the lower elevation, the ‘Ban’ or white Oak (*Quereus incana*) is found. It is replaced by moura or Holly Oak (*Quereus dilatata*) and green oak (*Quereus glauca*) at 2,350 metres. The flora is entirely temperate in character above 2,350 metres. The walnut, elm, horse chestnut, maple, holly and poplar often accompanied with a dense mass of under growth of hill bamboo, ferns and herbaceous plants are found here. The most common shrubs at the higher elevations are the *Berberis*, *Indigofera* and *Desmodium*. The common fruit trees are banana, ber, jamun, mango, pears and shahtoot. Almond, apple,

apricot, cherry, and peach are being grown in the district as well.

**Fauna:** Black bears are common in the higher valleys while leopards are found through out the district. Barking deer and gorals are frequently found at medium elevations. Pigs are found through out the district at lower parts and musk deer and serao are also found in certain areas. Among the other animals are hill fox, jackal, porcupine, pine marten, langur, rhesus monkeys, flying fox and squirrel; wild cats are common in the different parts of the district. Among the birds, black and grey patridge are commonly found through out the district. There are several kinds of pheasant generally found at medium height of protected lands. The Chakor is found throughout the district. The peacock and jungle fowl, blue rock pigeon and Himalayan wood pigeon are also found in the district. Fly catchers, shrikes, cuckoos, wagtail bulbuls, Warblers etc. are common and ducks and geese are also found in the district. Poisonous snakes do not appear to be common except in the parts adjacent to Kangra district. The Cobra is rare but Karait is not uncommon and Vipers are sometimes found. Non-poisonous species and grass snakes are common. Rock lizards are found every where during the month of hot weather. Besides these animals, birds and reptiles, the district is enriched in stocks of Mahaseer, mountain barbell, *Barilius vagra* and

Barbus stigma and various varieties of fish. The formation of sanctuaries is recognized as a practical method of game animals and birds. In order to protect and to ensure the survival of various species of indigenous fauna, sanctuaries are established in the district. Bandle Wildlife sanctuary, Nargu Winch camp and Shikari Devi Wildlife Sanctuary have been established for various rare Himalayan birds and animals.

Shimla: As per district statistical abstract 2000 (Table 36) there were 3,52,794 hectares of land under forest at the end of the year 1998-99. Of this, 5,346 hectares constituted reserve forest, 342,046 hectares as demarcated forests and 5402 hectares fall in the category of unclassified and other forests. In this region above 1,500 metres from the mean sea level, the soil is generally deep and contains a thin layer of humus or leaf of Ban Oak, Chil, Kail and Deodar. In the lower elevation, scrub forests

are found, while in higher altitudes of district, Chil, Deodar, Kail, Rai, Tosh and 'Bhoj Patar' trees are found. 'Bhoj Patar' trees are mostly found in the Tehsil of Dodra-Kwar in this district. The forest lies between 300 metres to 1,800 metres or more in elevation in this district. In the lower ranges with warmer climate and sharp slopes with deep soil and arable conditions, species of mixed deciduous forest of Scrub and bamboo are found. The main marketable forest products are resin, Chil, Deodar, Kail, fir and spruce timber, alongwith pulpwood, firewood and charcoal. In the year of 1998-99, 134.3 thousands m<sup>3</sup> timber wood was sold by Govt. worth Rupees 7,51,500. In addition, the drugs (medicinal herbs) valuing ` 16,78.900, fodder and grazing products of 25000 and gums and resin of value 9,944 thousands were extracted from the forest areas of the district during 1998-99 as minor forest produces.

**Table 36: Classification of forest with area in hectare**

Year	Reserve forest	Demarcated forest	Unclassified and other forests	Total forest area
1998-99	5,346	3,42,046	5,402	3,52,794

Source: Statistical Abstract Shimla, 2000 District (Page 70-71)

**Flora:** Table 37 describes trees, Shrubs and grasses which are found in the district.

**Table 37: List of trees shrubs & grasses found in Shimla**

Sr. No.	Botanical Name	Local Name
<b>I. Trees</b>		
1	<i>Abies pindrow</i>	Tosh
2	<i>Acacia catechue</i>	Khair
3	<i>Acer caesium</i>	Rikhauclu
4	<i>Acer oblongum</i>	Parong
5	<i>Aegle marmelos</i>	Bul
6	<i>Aesculus india</i>	Khanor
7	<i>Albizia lebecke</i>	Siris
8	<i>Alnus nepalensis</i>	Kunish
9	<i>Anogeissus latifolia</i>	Chal Dahu
10	<i>Azadirachta indica</i>	Neem
11	<i>Bauhinia racemosa</i>	Karyal
12	<i>Bridelia montana</i>	Badhar
13	<i>Butea monosperma</i>	Dhak
14	<i>Carica papaya</i>	Papita

Sr. No.	Botanical Name	Local Name
15	<i>Cassia fistula</i>	Amaltas
16	<i>Castania sativa</i>	Mitha Khaner
17	<i>Cedrela serrata</i>	Darle
18	<i>Cedrela toona</i>	Toon
19	<i>Cedrus deodara</i>	Kelo, Diar
20	<i>Celtis australis</i>	Kharak
21	<i>Citrus aurantifolia</i>	Galgal
22	<i>Citrus aurantium</i>	Sangtia
23	<i>Citrus dccumana</i>	Chaukotra
24	<i>Citrus medica</i>	Nimbu
25	<i>Cordia dichotoma</i>	Lasura
26	<i>Cornus capitala</i>	Khagsha
27	<i>Crataeva religiosa</i>	Barnah
28	<i>Cryptomeria spp</i>	Japani Saru
29	<i>Cupressus spp</i>	Saru
30	<i>Cupressus torulosa</i>	Devidear
31	<i>Dalbergia sissoo</i>	Shisham
32	<i>Elaeodendron spp</i>	Chilru
33	<i>Eriobotrya japonica</i>	Lukatha
34	<i>Eucalyptus globulus</i>	Safeda
35	<i>Euonymus lacernis</i>	Barmeli
36	<i>Ficus glomerata</i>	Shin
37	<i>Ficus palmata</i>	Fegura
38	<i>Ficus religiosa</i>	Pipel

Sr. No.	Botanical Name	Local Name
39	<i>Ficus roxburghii</i>	Tribmal
40	<i>Fraxinus floribunda</i>	Angash
41	<i>Garuga pinnata</i>	Kharpat
42	<i>Grewia elastica</i>	Beul
43	<i>Ilex dipyrena</i>	Kanderu
44	<i>Juglans regia</i>	Akhrot
45	<i>Lyonia ovalifolia</i>	Ailan
46	<i>Mallotus spp</i>	Kamal
47	<i>Mangifera indica</i>	Amb
48	<i>Musa paradisiaca</i>	Kela
49	<i>Myrica nagi</i>	Kaphal
50	<i>Olea glandutifer</i>	Jharinu
51	<i>Picea smithiana</i>	Rai
52	<i>Pinus roxburghii</i>	Chil
53	<i>Pinus wallichiana</i>	Kail
54	<i>Populus ciliata</i>	Safeda,Chalun
55	<i>Prunus armeniaca</i>	Chuli,Khumani
56	<i>Prunus cerasoides</i>	Paja
57	<i>Prunus cerasus</i>	Jaman
58	<i>Prunus communis</i>	Allocha
59	<i>Prunus cornuta</i>	Jaman
60	<i>Prunus persica</i>	Aroo
61	<i>Psidium guajava</i>	Amrud
62	<i>Pyrus communis</i>	Nashpati
63	<i>Quercus dilatata</i>	Mohru
64	<i>Quercus glauca</i>	Bani
65	<i>Quercus incana</i>	Ban
66	<i>Quercus spp</i>	Kharsu
67	<i>Rhododendron spp</i>	Burash,Brass
68	<i>Robinia pseudoacacia</i>	Robinia
69	<i>Salix babylonica</i>	Majnu
70	<i>Salix dephnoides</i>	Benuns
71	<i>Salix elegans</i>	Beuns,Bhashal
72	<i>Bombax malabarica</i>	Semal
73	<i>Sapindus mukorossi</i>	Ritha
74	<i>Sapium insigne</i>	Balojha
75	<i>Sapium sebiferum</i>	Tarcharbi
76	<i>Spondias pinnata</i>	Ambara
77	<i>Syzygium cumini</i>	Jaman
78	<i>Taxus baccata</i>	Thuna
79	<i>Terminalia arjuna</i>	Arjun
80	<i>Terminalia bellirica</i>	Behera
81	<i>Terminalia chebula</i>	Harar

## II. Shrubs

1	<i>Agave americana</i>	Ramban
2	<i>Azadirachta indica</i>	Bassuti
3	<i>Aralia cachemirica</i>	Akhota
4	<i>Artemisia vulgaris</i>	Charmar
5	<i>Berberis aristata</i>	Kashmal
6	<i>Boehmeria spp</i>	Bomol,Khakha
7	<i>Buddleja paniculata</i>	Sandroi
8	<i>Cassia tora</i>	Ailwan
9	<i>Calotropis procera</i>	Ak
10	<i>Cannabis sativa</i>	Bhang
11	<i>Carissa spp</i>	Karunda

Sr. No.	Botanical Name	Local Name
12	<i>Caesalpinia bonduc</i>	Mechka,Relan,
13	<i>Cocculus laurifolius</i>	Pror
14	<i>Colebrookia spp</i>	Dasoindh, Gadoos Oppositifolia
15	<i>Coriaria nepalensis</i>	Gangara
16	<i>Coriaria spp</i>	Chhunchunu
17	<i>Cotoneaster bacillaris</i>	Reuns
18	<i>Cotoneaster spp</i>	Mat-Jhinjira,
19	<i>Cyathula tomentosa</i>	Kothla
20	<i>Desmodium gangeticum</i>	Murt
21	<i>Dodonaea viscosa</i>	Mehndu
22	<i>Euphorbia royleana</i>	Shru, Chhurin
23	<i>Hamiltonia suaveolens</i>	Sidhara
24	<i>Indigofera gerardiana</i>	Kathi
25	<i>Indigofera hebeptala</i>	Kathi
26	<i>Indigofera pulchella</i>	Kathi
27	<i>Indigofera triloliata</i>	Kathi
28	<i>Jasminum humile</i>	Chamrli
29	<i>Jasminum officinale</i>	Chameli
30	<i>Lantanna camara</i>	Phulkari
31	<i>Mabonia nepalensis</i>	Khoru
32	<i>Murraya koenigii</i>	Ghandela
33	<i>Plectranthus rugosus</i>	Chhichhri
34	<i>Pogostemon plectranthoides</i>	Barmara
35	<i>Prinsepia utilis</i>	Bhekhal
36	<i>Ricinus communis</i>	Aran
37	<i>Rose macrophylla</i>	Pahari-Gulab
38	<i>Zanthoxylum alatum</i>	Tirmur

## III. Climbers

1	<i>Abrus precatorius</i>	Raktan, Rati
2	<i>Bauhinia vablii</i>	Tur
3	<i>Cissampelos pareira</i>	Bhatindu
4	<i>Clematis montana</i>	Garol
5	<i>Clematis mutous</i>	Nak Chhikni
6	<i>Cryptolepis buchanani</i>	Dadhali
7	<i>Cuscuta reflexa</i>	Akash Bel Kang
8	<i>Dioscorea pentaphylla</i>	Dragal
9	<i>Ficus scandens</i>	Makhota
10	<i>Hedera nepalensis</i>	Kural
11	<i>Ichnocarpus frutescens</i>	Bakar Bel
12	<i>Pueraria tuberosa</i>	Slood
13	<i>Rosa moschaata</i>	Kuja, Kuin
14	<i>Smilax parvifolia</i>	Ram Datun
15	<i>Vitis trifolia</i>	Pani-Bel,Beli
16	<i>Zehneria umbellata</i>	Ban Kerela

## IV. Bamboos and grasses

1	<i>Aristida depressa</i>	Kumbru, Lambru
2	<i>Arundinaria falcata</i>	Gola
3	<i>Bambusa arundinacea</i>	Maggar
4	<i>Bothriochloa intermedia</i>	Palman
5	<i>Chrysopogon fulvus</i>	Dhau
6	<i>Cymbopogon martinii</i>	Makora, Khawi
7	<i>Cynodon dactylon</i>	Dub

Sr. No.	Botanical Name	Local Name
8	<i>Dendro calamus hamiltonii</i>	Nal
9	<i>Dendrocalamus strictus</i>	Benj
10	<i>Eriantbus munja</i>	Surar, Munj
11	<i>Erophorum comosum</i>	Ghor-Baggar
12	<i>Heteropogon contortus</i>	Sariala, Dangeriash
13	<i>Themeda anathera</i>	Alunjit

**Fauna:** Table 38 describes animals and birds which are found in the forests of the district.

**Sirmaur:** The forests range between scrub, sal and bamboo forests of the low hills to the fir and alpine forests of the higher hills situated at a higher altitude. The area under forests in the district during the year 1999-2000 was 167,799 hectares. Of these, 106,557 hectares was under

**Table 38: List of animals & birds found in Shimla**

Sr. No.	Scientific Name	English Name	Local Name
<b>Animals</b>			
1	<i>Sus scrofa</i>	Indian Wild Boar	Suar
2	<i>Antelope cervicapra</i>	Indian Antelope	Hiran
3	<i>Lepus ruficaudatus</i>	Indian Hare	Khargosh
4	<i>Felis pardus</i>	Panther	Bagh
5	<i>Ursus avetos</i>	Brown Bear	Bhalu
6	<i>Naemorbedus spp.</i>	Goral	Ghurral
7	<i>Muntjac</i>	Barking Deer	Kakar
8	<i>Axis axis</i>	Spotted Deer	Chittal/hiran
9	<i>Cervus unicolor</i>	Sambhar	Sambar
<b>Birds</b>			
1	<i>Coturnix coturnix</i>	Common Quail	Bater
2	<i>Streptopelia decaocto</i>	Indian Spotted Dove	Ghuggi
3	<i>Pavo cristatus</i>	Pea-Fowli	Mor
4	<i>Melanoperadix niger</i>	Black Partridge	Kala Tittar
5	<i>Francolinus pondicerianus</i>	Grey Partridge	Tittar
6	<i>Treron phoenicoptera</i>	Green Pigeon	Harrial
7	<i>Columba rupestris</i>	Blue Hill Pigeon	Kabuttar
8	<i>Gallus bankiva</i>	Red Jangli Fowl	Jangli Murgi
9	<i>Lophura leucomelanos hamiltonii</i>	White-Crested Kalij	Kolsa
10	<i>Alectoris graca</i>	The Chakour	Chakour

reserved forests, 5,658 hectares under protected, 2,046 hectares unclassified and 55,538 hectares fell under categorized as other forests according to the State Forest Report of 1999. Moreover, there is an area of 426 hectares of forest land not under the control of forest department which was occupied by the institutions and households. According to "Forests types of India and Burma" by H.G. Champion, the belt and patches of forests that can be recognized in the tract are Dry Shiwalik Sal, Moist Shiwalik Sal, Moist High Level Alluvial Sal, Sub Tropical Pine (Chir Forests) Khair – Sissu Forests and Ban Oak Forests.

Dry Shiwalik Sal is well distributed and is met with all over the Shiwalik in sand and conglomerate outcrops at an elevation of 1,000 to 2,500 feet. Moist Shiwalik Sal also occurs mainly in Shiwaliks where the soil and moisture conditions are better. This type of forest is found at altitudinal range of 1,000 to 2,500 feet. Moist high level alluvial Sal is found mainly on deep, rich and old soil of the Dun and is well represented by forests like Gorakhpur, Rajban Lamotua, Kukron and Bias. Khair Sissu forests are found along all the big rivers like Yamuna and Giri on new sandy or alluvium soil. Ban Oak forests occur at an elevation of 5,000 to 6,000 feet. There is a wide overlap in shelter

wood places with sal and in spurs with Chir at altitudes ranging from 300 to 5,000 feet. Chir pine forests are found on the Dharati ridge which runs parallel to the Sain Dhar in the south. Chir pine by its nature forms almost pure forests of its own. In shady places, low level Oak, *Cassia fistula*, *Anogeissus latifolia* and other broad leaved species are found, though its universal associates are *Carissa spinarum* and *Adhatoda vasica*. To the south of Chur Dhar, high level forests containing, Oaks, Firs, Yew, birch and blue pine form a belt of about 32 kilometres length and of width varying from 2 to 8 kilometres. They provide some grazing pasture for the buffaloes of the right holders.

Deodar forests mixed with Kail, Oak and Chir pine are found to the south of the alpine forests and to the north of the Giri river. Sain Dhar forests are situated between the Giri river in the

**Table 39: Plants found in Sirmaur district**

**I. Northern dry mixed deciduous forests contain the following type of species:**

1	<i>Anogeissus latifolia</i>	14	Shorea robusta
2	<i>Flacourtia ramontchi</i>	15	Dendrocalamns strictus
3	<i>Terminalia chebula</i>	16	Carissa opaca
4	<i>Syzygium cumin.</i>		Wood fordia floribunda
5	<i>Mallotus philippensis</i>	18	Murraya koenigii
6	<i>Lannea grandis</i>	19	Adhatoda vassica
7	<i>Terminalia tomentosa</i>	20	Colebrookia spp
8	<i>Acacia catechu</i>	21	Enphorbia royleana
9	<i>Limonia acidissima</i>	22	Bauhinia vahilli
10	<i>Dalbergia sissoo</i>	23	Puerariatuberose
11	<i>Cassia fistula</i>	24	Caesalpinia sepiaria
12	<i>Ougeinia dalbergioides</i>	25	Combretum decandrum
13	<i>Aegle marmelos</i>		

Elevation: Upto 1,250 metres

**II. Lower or Shiwaliks Chil pine forests are found upto 100 metres of elevation and comprise the following species of trees:**

north and the Jalal stream in the south. The spur is generally denuded to the valuable forests and is covered with scrub jungle, chir pine being found in small patches. The timbers mostly in demand are Sal, Sain, Chir, Sissu, Tun and Khair. In Dharati ranges and the Cis Giri area, Cheel and Pine forests are of great value for extraction of the resin. The resin extracted from the cheel forests is supplied to the Himachal Resin and Turpentine Factory, Nahan. Other minor forest products are bhabbar grass, gum, hides, horns and munj grass.

**Flora:** The district possesses a variety of vegetation which represents both tropical and temperate species. As the climate of Sirmaur derives its character from different elevations, soils and flora varies with the conditions of the locality in which the various species thrive. Plants found upto the height of 3,400 metres in Sirmaur district are listed in Table 39.

1	<i>Pinus roxburghii</i>	7	Carissa opaca
2	<i>Mauotus philippensis</i>	8	Rubus ellipticus
3	<i>Pyrus pashia</i>	9	Myrsine africana
4	<i>Emblica officinalis</i>	10	Colebrookia oppositifolia
5	<i>Acacia catechu</i>	11	Murraya Koenigii
6	<i>Terminalia tomentosa</i>	12	Adhatoda vasica

Elevation : Upto 100 metres

**III. Upper or Himalayan Chilpine forests**

1	<i>Syzygium cumini</i>	11	Pyrus pashia
2	<i>Lannea grandis</i>	12	Carissa opaca
3	<i>Acer oblongum</i>	13	Rubus niveus
4	<i>Quercus glauca</i>	14	Rhus parviflora
5	<i>Quercus incana</i>	15	Flemingia prostrata
6	<i>Rhododendron arborium</i>	16	Lannea grandis
7	<i>Pieris ovalifolia</i>	17	Bauhinia variegata
8	<i>Myrica nagi</i>	18	Sapium insigne
9	<i>Plectranthus rugosus</i>	19	Euphorbia royleana
10	<i>Meriandra strobilifera</i>		

(Elevation from 1,200 to 2,800 metres)

**IV. Ban Oak forest (*Quercus incana*)**

1	<i>Rhododendron arborium</i>	8	Rubus niveus
2	<i>Pieris ovalifolia</i>	9	Desmodium tiliacifolium
3	<i>Litsea umbrosa</i>	10	Barbris chitria

4	<i>Myrica nagi</i>	11	Prinsepia utilis
5	<i>Myrsine africana</i>	12	Hedera helix
6	<i>Boerhavia albiflora</i>	13	Similax parvifolia
7	<i>Indigofera gerardiana</i>	14	Vitis trifolia

(Elevation : 1,800 metres to 2,300)

**V. Moru oak forest (*Quercus dilatata*)**

1	<i>Pinus smithiana</i>	3	<i>Quercus incana</i>
2	<i>Quercus dilatata</i>	4	<i>Pinus wallichiana</i>

(Elevation : 1,800 to 2,500 metres)

**VI. Moist deodar forest (*Cedrus*)**

1	<i>Quercus incana</i>	8	<i>Rubus niveus</i>
2	<i>Rhododendron arboreum</i>	9	Prinsepia utilis
3	<i>Lonicera angustifolia</i>	10	Hedera helix
4	<i>Viburnum colonifolium</i>	11	Vitis parvifolia
5	<i>Berberis chitria</i>	12	Jasminum officinale
6	<i>Daphne cannabina</i>	13	Clematis montana
7	<i>Indigofera pulchella</i>	14	Rosa moschata

(Elevation : 1,800 to 2,800 metres)

**VII. Western mixed coniferous forests contain following species**

1	<i>Taxus baccata</i>	10	<i>Viola erpensis</i>
2	<i>Quercus semicarpifolia</i>	11	<i>Valeriana hardwickii</i>
3	<i>Quercus incana</i>	12	<i>Geranium wallichianum</i>
4	<i>Quercus dilatata</i>	13	<i>Rubus niveus</i>
5	<i>Viburnum nervosum</i>	14	<i>Ainsliaea aptera</i>
6	<i>Skimmia laurleoa</i>	15	Hedera nepalensis
7	<i>Deutzia corymbosa</i>	16	Vitis spp
8	<i>Arundinaria falcata</i>	17	Jasminum officinale
9	<i>Fragaria vesca</i>		

(Elevation : 2,400 to 3,000 metres)

**VIII. Moist temperate deciduous forest are**

1	<i>Aesculus indica</i>	6	<i>Quercus Semicarpifolia</i>
2	<i>Acer caesium</i>	7	<i>Quercus incana</i>
3	<i>Acer pictum</i>	8	<i>Viburnum foetens</i>
4	<i>Betula alnoides</i>	9	<i>Rubus niveus</i>
5	<i>Juglans regia</i>	10	<i>Spiraea sorbifolia</i>

(Elevation : 1,800 to 2,780 metres)

**IX. Low level blue pipe forests are**

1	<i>Quercus incana</i>	6	<i>Berberis chitria</i>
---	-----------------------	---	-------------------------

2	<i>Quercus dilatata</i>	7	<i>Desmodium tiliifolium</i>
3	<i>Rhododendron arboreum</i>	8	<i>Myrsine africana</i>
4	<i>Berberis lycium</i>	9	Prinsepia utilis
5	<i>Rubus niveus</i>		

(Elevation: Upto 2,400 metres)

**X. Kharsu oak forest (*Quercus semecarpifolia*)**

1	<i>Abies pindrow</i>	7	<i>Sarcococca saligna</i>
2	<i>Picea smithiana</i>	8	<i>Salix vaginata</i>
3	<i>Betula alnoides</i>	9	<i>Geranium Wallichiana</i>
4	<i>Taxus baccata</i>	10	<i>Viola canescens</i>
5	<i>Viburnum foetens</i>	11	<i>Anemone rivularis</i>
6	<i>Cotoneaster bacillaris</i>	12	<i>Skimmia laurleoa</i>

(Elevation : 2,500 to 3,300 metres)

**XI. West Himalayan Upper Oak-fir forest**

1	<i>Abies pindrow</i>	5	<i>Salix elegans</i>
2	<i>Quercus semicarpifolia</i>	6	<i>Skimmia laurleoa</i>
3	<i>Betula alnoides</i>	7	<i>Rumex nepalensis</i>
4	<i>Rhododendron campanulatum</i>	8	<i>Lonicera angustifolia</i>

(Elevation : 2,600 to 3,400 metres)

**XII. Moist alpine scrub**

1	<i>Rhododendron anthopogon</i>	4	<i>Rosa sericea</i>
2	<i>Salix flabellaris</i>	5	<i>Ranunculus diffusus</i>
3	<i>Potentilla argyrophylla</i>	6	<i>Anemone abtusiloba</i>

**XIII. Dry deciduous scrub forest**

1	<i>Lannea grandis</i>	5	<i>Euphorbia royleana</i>
2	<i>Acacia catechu</i>	6	<i>Sapium insigne</i>
3	<i>Aegle marmelos</i>	7	<i>Woodfordia floribunda</i>
4	<i>Carrissa opaca</i>	8	<i>Nyctanthes arbortristis</i>

**XIV. Khair – Sissam forests upto 125 metres**

(a) Botanical names of species

1	<i>Ziziphus jujuba</i>	3	<i>Adhatada vasica</i>
2	<i>Murraya koenigii</i>		

**XV. Himalayan Sub-tropical scrub forests**

1	<i>Sapium insigne</i>	3	<i>Rhus parviflora</i>
2	<i>Enphorbia royleana</i>	4	<i>Carissa opaca</i>

**XVI. Sub-tropical euphorbia scrub forests**

1	<i>Enphorbia royleana</i>
---	---------------------------

**XVII. Oak-scrub forest**



1	<i>Rhododendron arboreum</i>	3	Pyris pasha
2	<i>Pieris ovalifolia</i>		
<b>XVIII. Low level blue pine forests</b>			
1	<i>Quercus incana</i>	5	Desmodium tiliaefolium
2	<i>Rhododendron arboreum</i>	6	Prinsepia utilis
3	<i>Rubus niveus</i>	7	Myrsine africana
4	<i>Berberis lycium</i>	8	Viola sp.
<b>XIX. Dwarf Rhododendron scrub forests</b>			
1	<i>Rhododendron</i> spp.	3	<i>Lonicera</i> spp.
2	<i>Salix</i> spp.		

*Solan: As per 2000 statistical abstract 56,936 hectares of forest land has been reported in the district during the year 1999-2000.*

About 56,599 hectares of forest land was under the control of State Forest Department while 337 hectares of forest land was not under the control of Forest Department. 4,392 hectares of forest land is under reserved forests, 23,697 hectares under protected forests and 12,831 hectares are unclassified forests. An area of 15,679 hectares are covered by other forests like shrubs etc.

Due to wide variations in the altitude, a large variety of fauna is found in the forests of the district, though due to increased poaching and indiscriminate lopping of the forests, there is decrease of the faunal population in the district, and some of the species are almost on the verge of extinction. The musk deer or Kastura is found in the highest altitude of Chur Peak in Pajota, Chursa and Nohra forests. The black bear, which is generally found in the thick forests of deodar, fir and spruce at an elevation of 3,660 metres during summer generally comes down to the valleys at altitude of 1,525 metres during winter. It lives on the roots, corns of oaks, grains, nuts and the bark of the trees and honey. The most commonly found animal is the porcupine, which is found almost in the entire district. This animal mostly feeds on the forest nurseries, walnut plant, chir and deodar. The Himalayan goat (Goral) is found between 900 to 2,700 metres elevation. It is a stocky goat like animal which is found in groups of 4 to 6 grazing on the hill side and in the forests. Barking-deer (Kakar) is found in the chir and ban forests of Sarahan, Rajgarh and Habban range. In the lower portion of Sarahan, Renuka, Jamta and Rajgarh ranges, wild boars are found which generally live on the crop roots, tuber and insects. They cause a considerable damage to the crops. These are generally found in herds

of 2 to 15 or even more. Monkeys and Langoors are quite common in the entire district.

In the Habban, Rajgarh and Sarahan ranges, birds like monal have been sighted. The koklas are found in the deodar and sometime in the fir forests and prefer moist wooded forests with under growth. They are commonly found in the parts of Habban, Rajgarh, Nohra and Sangrah ranges. The black partridge is found upto 1,800 metres elevation and is frequent in the grassy and scrub peaks. The hill partridge is found beyond chir forests mostly in ban and oak forests and occasionally in deodar forests. Chakor is an another species of the pigeon group which is found generally between 1,500 to 3,000 metres elevation in Rajgarh, Sangrah and Shalai ranges.

**Forestry:** The description of forests & main fauna and flora found in three forest divisions of the district are as follows:

(A) **Kunihar Forest Division:** The vegetation found within this division shows a great variation due to wide variations in the altitude. With the soil depth and the available moisture, chil, khair, bamboos and other broad leaved species like chhal, simbal, jhingan etc. are the most important species found within the area. The tropical euphobia scrub forests, shiwalik chil, pine and little ban oak are found in this tract. The vegetation changes, depending on the availability of water and slopes. The undergrowth consists of phul lakri, karounda, ghandela and the top storey consists of kashmal, katni, kainth, tirmira, khair, bel, banarasi, kangu, malkora, dub, daula and lobb.

(B) **Nalagarh Forest Division:** The vegetation found within this division shows variation. Mixed deciduous shrubs, bamboo and chil pine type of forests occur in this division. Natural regeneration of all species is generally deficit because of boitic interferences. The main species under mixed deciduous forests found in the division are chhal (*Anogeissus latifolia*), Jhingan (*Lannea coromandelica*) Simal

(*Bombax ceiba*) Khair (*Acacia*) Toon (*Cedrela toona*), Kachnar (*Bauhinia* spp), Amaltas (*Cassia fistula*) etc. Undergrowth consists of karaunda (*Carissa opaca*) harsingar dhavi (*Woodfordia fruticosa*) ghandhela (*Murraya koenigi*) mehadu (*Dodonaea viscosa*) Basuti (*Adhatoda vasica*) etc. Important grasses are bhabhar (*Ischaemum angustifolium*), makire (*Heteropogon contortus*), dub (*Cynodon dactylon*), aholu (*Chrysiapogon montonus*) etc. Mixed deciduous forests occurs upto 1,000 metre elevation on well drained and loose textured shivalik formation. It closely resembles the foregoing type, except for bamboo which is found in the top canopy. Chil pine forests are the most important forests of the tract occurring between 800 to 1800 metre elevation. Its associates are kainth, ban, oak, kamal, amla, khair and dheru.

(C) **Solan Forest Division:** Chil, khair, bamboos and other broadleaved species like chihal, simbal, jhington etc. are the most important species found within this area. Undergrowth consists of phul lakri, karaunda, ghandela and top storey consists of kashmal, katni, kainth, tirmula, khair, bel, kangu and dub which are the various types of grasses found in this division.

**Fauna:** There is a great variety of wildlife met within the tract of Kuniyar forest division. The main game and wildlife animals found are leopard, goral, Indian wild bear, kakkar, hyena, wild boar, porcupine, dove and squirrels. Leopard is found throughout the division area up to an elevation of about 2500 metres in scrub forests. Ghoral is found above an elevation of 1200 metres in Mangal area too. Various types of birds like chakor, black partridge, kaleshno and jungle fowl are also found in this tract. Besides these, other birds like peacock, parrot, sparrow, pigeon and doves are also found. The animals found in Nalagarh forest division are leopard, goral, Indian wild bear, kakkar, hyena, wild boar, barasingha, porcupine and hare. The different types of birds which are generally found in this division

are chakor, black partridge, kaleshno and jungle fowl. Owing to variations, there occurs a variety of fauna in Solan forest division. Ashni, Ghagar, Kaushalaya and Ghambar rivulets/ streams provide good habitat for the wild animals and birds. There are lots of game animals like black bear, panther, goral, barking deer and wild pig. Non game animals found in this division are lomri, gidar, jungli billi, neqla bandar and common langur. In addition to game animals, certain species of game birds like jungli murga, mor koilea, grey partridge, black partridge, ghughu are found here. Aquatic birds like crane are seen along the banks of streams and rivulets. Certain reptiles like rat snakes, common Indian krait, Himalayan pit viper and Indian cobra are also found in this division.

## Una

The Una Forest Division is bounded in the north by Gular Dhar Chintpurni Ridge, the east by Sola Singhi Dhar, Hamirpur Forest Division and Kutlehar Jagir forest and south and west by the State boundary of Punjab.

In Una district, the plantation of Chil, Khair and Eculyptus have been raised successfully. Table 40 and Table 41 show the area of forest coverage and the value of forest products in the district.

**Table 40: Area under Forest during 1998-99**

Sr. No.	Type of Forests	Area in hectares
1	Reserve forest	4,391
2	Protected forests	4,796
3	Unclassified forests	15,500
4	Other forests	26,860
	<b>Total forests</b>	<b>51,547</b>

Source: District Statistical Abstract-2001

**Table 41: Forest Products and their Value, During Year1998-99**

Sr. No.	Forest Products	Quantity	Value in ` Lacs
1	Timber	575 Cubic Metres	78.75
2	Firewood	995 Cubic Meters	1.81

Sr. No.	Forest Products	Quantity	Value in ` Lacs
3	Khair Wood	55.77 Cubic Metres	10.04
4	Biroza	2,844.95 Quintals	76.81

Source: District Statistical Abstract-2001

**Fauna and Flora:** Many types of forest flora are found in this district, namely, shisham, poplar, mango, banana, lemon, orange and plum. Similarly, there are many kinds of fauna found in the district. The important faunal species that are found here are leopard, wild pig, porcupine, monkey, langoor, stag, neelgai, snail etc.

## 1.2 Patterns of planning and development in the sector

Forests in Himachal Pradesh have a very productive ecological niche. Latitudinally, the State falls in the tropical zone, but its geographical location and good forest cover have enriched it, both biologically and economically. During the immediate post-independence period, planners identified the forests of the State as a source of timber and other products only. This led to large-scale felling and clearing of forest areas. Deforestation, to meet the timber needs of industries set up in the plains and of the flourishing horticulture industry in the State, ultimately created consciousness about the need to protect the forests.

A vast majority of the population of the State is rural and depends mainly for its livelihood either directly on forest products or on those, which are produced by using the resources, conserved or protected by the forests. Unsustainable exploitation of dense forests ultimately led to the gradual loss of the ecological environment suitable for producing different crops, both traditional as well as improved commercial fruit, vegetable and medicinal plants. The damage to the environment and the land is so heavy that certain areas in the mid-hills which 20 years

ago were suitable for growing fruit crops, are no longer able to sustain the fruit plants and the farmers are losing interest in growing these fruit crops. This condition of the forests adversely affects the economy of the hill people.

The forests of Himachal Pradesh are not only of importance for the State, but also have a strong influence on the ecology, climate and bio-resources of the neighbouring States of Punjab, Haryana and Rajasthan. Glaciers flowing from the Tibetan hills (China) and the melting snow feed the rivers originating in the State and provide water to other States. The forest cover of Himachal not only regulates the rainfall in the neighbouring areas but also ensures snowfall in the high mountains. A reduction in the forest cover of the State will prevent the formation of glaciers and snow, resulting in less water in the rivers. The summer heat will easily melt the glaciers and the snow and cause flash floods both in the hills and the plains of the neighbouring States.

The strategy for the Ninth Five Year Plan of Himachal Pradesh stated: "The degraded forest lands, the village common lands and wastelands will be rehabilitated through various State plans / centrally sponsored and externally aided projects/schemes so that a forest cover of 50% by 2000 AD as per policy of the State Government is arrived at". The National Forest Policy, 1988, has also recommended that at least two-third of the total geographical area of Himachal Pradesh should be under forests.

Afforestation work in Himachal Pradesh started from the first Five Year Plan and is continuing till date. Afforestation of over 2,825 km<sup>2</sup> area done prior to the year 1980 is presumed to have been registered in the satellite imageries being used by FSI. Plantations covering 6807 km<sup>2</sup> area has been done in the post 1980 decades, the survival of which is about 60%. The afforestation programmes will continue with enlarged

emphasis on community participation in development and management of forests. Emphasis on utilizing the forest resources for promotion of eco-friendly tourism will be encouraged.

The policy requirement places demand for additional areas to be brought under tree cover, whereas the total culturable area that is available under recorded forests is 20,657 km<sup>2</sup>. There are areas like permanent pastures, which can not support tree cover and grass is the best vegetation that can grow there. In the current scenario, there seems to be no other way except to consider the un-culturable areas forming vital ecosystems and wildlife habitats also as part of forest/tree cover although it is agreed that for carbon sequestration purposes, tree cover is the only lasting answer. The National Forest Policy needs to consider maintaining eco-systems and habitats as well in addition to giving emphasis on tree/forest cover alone.

The strategy for the future has taken the following facts into consideration:

- The area under Moderately Dense (7883 km<sup>2</sup>) requires protection and improvement in density.
- The blank area needs to be afforested.
- The scrub area (389 km<sup>2</sup>) needs to be converted into some useful tree cover.
- The post 1980 plantations (6807 km<sup>2</sup>) were presumed to be fully surviving. But in reality, many of the areas may not be fully surviving requiring re-visit/re-forestation (say about 40% = 2700 km<sup>2</sup>).

The village grazing lands and even the permanent pastures require improvements in terms of soil and moisture conservation and increase in the nutritious and palatable grass. Low altitude pastures are available for Silvi-pastoral activities also. These grazing lands and pastures require frequent re-visiting at

short intervals keeping in view the high grazing pressure.

To achieve the goals set forth in the National/State Policy, the following steps will be considered while implementation of the State Plan.

- The forest working has been nationalized by creating a public sector undertaking, which deals with exploitation and sale of forest produce.
- Green felling in the State is being done only to meet the recorded rights of the local people according to the provision of settlements in force.

Various legal and administrative steps have been taken during the past few years to protect/conservate this national wealth worth about `1,00,000 Crores by checking illicit felling/organized timber smuggling through:

1. Himachal Pradesh Land Preservation Act, 1978 which has been enacted for regulating the felling on private lands.
2. Himachal Pradesh Forest Produce (Regulation of Trade) Act, 1982 which prohibits Sale of restricted/nationalized species by any private owner to any one except the H.P. State Forest Corporation.
3. Himachal Pradesh Specific Corrupt Practices Act, 1984 which deals, firmly against the unscrupulous individuals and officials.
4. The Indian Forest Act (H.P. Second Amendment Act)1991 has been the latest enactment of this Act vide which subsection 52(A) has been added to check smuggling of forest produce.
5. Vide Himachal Pradesh Govt. Notification No. 1-2/71-LSG dated 8.6.1994, DFOs in the State have been empowered under Himachal Pradesh Public Premises & Land (Eviction and Rent Recovery) Act to deal with the problems of encroachment on the forest lands.

6. At present there are two flying squad divisions working in Shimla & Sundernagar. They have been provided with vehicles fitted with mobile wireless sets. In addition, important check posts and field officers along the border areas have also been provided with wireless sets.

In view of tremendous pressure on forests due to extraction of timber, fuel wood and fodder, worth approximately `1020 Crores annually, it is essential to compensate this loss by large scale afforestation and pasture development works. During the 11<sup>th</sup> Plan (2007-12), an area of 38,700 hectares is likely to be afforested under Social and Farm Forestry including Externally Aided Projects and Soil Conservation Schemes.

As per Himachal Pradesh Development report, during the immediate post independence period, planners identified the forests of the State as a source of timber and other forest products only. This led to large scale felling and clearing of forest areas. Forest statistics show a decline in the total forest area from 37,591 km<sup>2</sup> in 1990-91 to 37,033 km<sup>2</sup> in 1995-96 and to 35,427 km, in 2001-02. However, actual forest cover (dense and open forest) showed an increase of about 22% in 2001 from 11780 km<sup>2</sup> in 1990-91 to per SFR 2009. This has been attributed to ban on green felling and inclusion of horticulture trees into the forest cover in the State.

Earlier private contractors carried out harvesting of forests which was auctioned by the Forest Department after demarcation and marking of trees as per prevailing management plans. However, the working by contractors often resulted into illicit felling and damage to unmarked standing trees. Until 1970, when forest coupes were auctioned, timber removal invariably exceeded the annual prescribed yield, which was unsustainable. To overcome this shortcoming, the government of Himachal Pradesh established the Himachal Pradesh State Forest Corporation, which was entrusted with all harvesting operations in the forests. As a

result, since 1975, the annual removal from the forests has always remained below the prescribed yield. Timber measuring 470,000m<sup>3</sup> was extracted annually from the forests of the State during the last five decades of the previous century (1950-2000). The average timber removal was the highest in the decade 1980-90.

There are four districts, Kangra, Kullu, Hamirpur and Shimla, where forest area has declined since 1977. This could be because of the expansion of towns, road network, infrastructural development, housing and tourism. As per 2007 assessment by FSI, (reference SFR 2009), Chamba recorded 5% increase in forest cover. However, Sirmaur and Solan recorded decrease by 2 and 1 % respectively in forest cover since 2005 assessment (revised). The said assessment recorded no change (increase/decrease) in forest cover of other districts.

Ex-situ conservation of wild animals in the State is managed in the Himalayan Nature Park at Kufri, Rescue and Rehabilitation Centre at Tutikandi, Shimla and zoos/pheasantries at Renuka, Riwalsar, Gopalpur and Sarahan Bushahr. There are also some pheasantries and aviaries for the conservation of birds. Conservation breeding of Chir Pheasant and Western Tragopan has been attempted. These centres are located at Chail, Shimla (Raj Bhawan), Sarahan Bushahr and Manali. Efforts to breed musk deer at Kufri and Western Tragopan and other pheasants at Sarahan Bushahr in Shimla district are slow because of paucity of funds and lack of modern technology.

**Plan Schemes:** A number of developmental programmes/schemes were carried out for raising plantations, thereby creating permanent assets and also to arrest soil erosion in the catchments of important river basins. The achievements through forestry and soil conservation schemes under Central sectors are given below in Table 42.

**Table 42: Development Schemes in the Forestry Sector**

Sr. No.	Name of Developmental Schemes	Financial Targets/ Outputs ( ` Lac)	Financial Achievements ( ` Lac)
<b>Forestry Schemes</b>			
<b>State Sector</b>			
1.	Forestry Programme		
	Non-Tribal	9374.75	9257.33
	Tribal	645.44	644.85
2.	Wildlife Conservation		
	Non-Tribal	369.00	369.00
	Tribal	23.64	28.68
3.	Grant in aid		
	Non-Tribal	796.00	796.00
	Tribal	16.00	
	<b>Total State Sector</b>		
<b>Central Sector</b>			
1.	Forestry Programme		
	Non-Tribal	134.41	134.41
	Tribal	-	-
2.	Wildlife Conservation		
	Non-Tribal	274.08	264.06
	Tribal	12.70	12.70
	<b>Total Central Sector</b>	421.19	411.17
	<b>Total Forestry &amp; Wildlife (including Grant-in-Aid)</b>	11633.33	11523.13
<b>Soil Conservation Schemes</b>			
<b>State Sector</b>			
1.	Protective Afforestation Soil Conservation & Demonstration including Suket Fossil Park		
	Non-Tribal	45.44	54.44
	Tribal	56.10	56.10
2.	Micromanagement of Agriculture Supplementation/complementation of State through work plans		
	Non-Tribal	74.59	74.59
	Tribal	-	-
	<b>Total State Sector</b>	176.13	176.13
<b>Central Sector</b>			
1.	Micromanagement of Agriculture Supplementation / complementation of State through work plans		
	Non-Tribal	938.44	938.44
	Tribal	-	-
	<b>Total Central Sector</b>	938.44	938.44
	<b>Grand Total Forestry, Wildlife, Soil Conservation &amp; Grant –in-Aid</b>	12760.59	12637.70

Source: -Annual Administrative Report for the year 2007-08, Forest Department

**Eco zones:** Environment Protection Act (EPA), 1986, chapter 2, section 3 (2):V provides for restriction of areas in which any industries, operations, or processes or class of industries, operations or processes shall not be carried out or shall be carried out subject to certain safeguards. Eco-sensitive Zones have been identified in India as per Environment Protection Act, 1986. However, no Eco-sensitive Zone has been notified in Himachal Pradesh under EPA, 1986 by Ministry of Environment and Forest.

Wildlife Conservation Strategy 2002 adopted by Indian Board for Wildlife, inter alia, envisages declaring land falling within 10 kms of the boundary of National Parks and Sanctuaries as eco-fragile zones. MOEF brought this matter to the attention of State/UT Governments. Guidelines for declaration of Eco-sensitive zone around National Parks and Sanctuaries were issued to the State/UT Governments vide D.O. no. 1-9/2007 WL (pr), dated 11th December 2012 followed by letter dated 31-12-2013, whereby the States/UTs were requested to submit site specific proposals for declaration of eco-sensitive zones around National Parks and Sanctuaries to MoEF by 15th February 2013. In case the State/Union Territory Government fail to submit the proposals within the stipulated period, the activities that have been prohibited as per the guidelines of the Ministry dated 9th February 2011 would stand prohibited within 10 kms of the boundary of National Parks and Sanctuaries.

Nevertheless, the Environment Impact Assessment (EIA) notification, 2006 and subsequent amendments specify list of projects or activities requiring prior environmental clearance and attach general and specific conditions for screening, scoping, public consultation and appraisal of project for consideration of environment clearance. As per EIA notification 2006, the general conditions are "Any project or activity specified in Category 'B' will be treated as Category A, if located in whole or in part within 10 km from the boundary of: (i)

Protected Areas notified under the Wild Life (Protection) Act, 1972, (ii) Critically Polluted areas as notified by the Central Pollution Control Board from time to time, (iii) Notified Eco-sensitive areas, (iv) inter-State boundaries and international boundaries."

EIA notification, 2006 has identified category for project or activity as category A and category B with threshold limits defined for Mining, extraction of natural resources and power generation -for a specified production capacity (Mining of minerals, Offshore and onshore oil and gas exploration, development & production, River Valley projects, Thermal Power Plants), Primary Processing (Coal washeries, Mineral beneficiation), Materials Production (Metallurgical industries-ferrous & non ferrous, Cement plants), Manufacturing/Fabrication (Manmade fibres manufacturing, Distilleries, Integrated paint industry, Pulp & paper industry excluding manufacturing of paper from waste paper and manufacture of paper from ready pulp with out bleaching, Sugar Industry, Induction/arc furnaces/cupola furnaces 5 TPH or more), Service Sectors (Isolated storage & handling of hazardous chemicals), Physical Infrastructure including Environmental Services (Common hazardous waste treatment, storage and disposal facilities, Ports and Harbours, Highways, Aerial ropeways, Common Effluent Treatment Plants (CETPs), Common Municipal Solid Waste Management Facility (CMSWMF) attracts general conditions.

Himachal Pradesh has a Protected Area Network comprising 33 wildlife sanctuaries and 2 national parks spread over 10 districts of the State. This is about 13.65 % of the State's geographical area. Therefore, it can be surmised that 10 kms area around the existing PAs are "eco-sensitive zones" from the perspective of EIA purposes, whether separately identified /declared/notified by Government of Himachal Pradesh/MoEF or not. However, it may be noted that Una and Hamirpur have no PA. Nevertheless, Una's district's tehsils namely Una, Amb and Haroli located in west and south share district

boundaries with Punjab. For the EIA purposes, any proposed category B project located in Una, Amb and Haroli tehsils which falls within 10 kms of the boundary of Punjab will be considered eco-sensitive zone and will be treated as a category A project for consideration of environment clearance. However, in the context of EIA, it may be noted that Hamirpur has no PAs, critically polluted areas, eco-sensitive zone and interstate or international boundaries. Map showing 10 kms area around National Parks and Sanctuaries in Himachal Pradesh are given in **Figure 3** of Baseline conditions of Forests, Wildlife and Wetlands sub sector of Natural Resources Management sector.

In January 2010, Central Pollution Control Board (CPCB), in association with Indian Institute of Technology (IIT), New Delhi, have carried out an environmental assessment of industrial clusters across the country based on Comprehensive Environmental Pollution Index (CEPI) with the aim of identifying polluted industrial clusters and prioritising planning needs for intervention to improve the quality of environment in these industrial clusters and the nation as a whole. The assessment so carried out has been documented in the form of a report entitled, 'Comprehensive Environmental Assessment of Industrial Clusters'. In all, 99 industrial clusters have been assessed. The report has concluded that the industrial clusters/areas having aggregated CEPI scores of 70 and above should be considered as critically polluted; the clusters/areas having CEPI scores between 60-70 should be considered as severely polluted areas (in Himachal Pradesh, Baddi, Kala Amb and Parwanoo fall under this category) and shall be kept under surveillance and pollution control measures should be efficiently implemented; and the critically polluted industrial clusters/areas need further detailed investigations in terms of the extent of damage and formulation of appropriate remedial action plan. The developmental projects from industrial clusters with CEPI score between 60-70 (as listed at serial no. 44 to 75 of the Annexure), which are in the pipeline or have been received for grant of environmental clearance in terms of the

provisions of EIA Notification, 2006 [including projects for stage-I clearance, i.e. scoping (TORs)], will be considered following the procedure outlined in MoEF's earlier circular no.]-11013/18/2009-IA.II (I) dated 25th August, 2009 relating to 'proposals for environment clearance for the projects located in the critically polluted areas as identified by the Central Pollution Control Board'.

In the above said context of eco zones in Himachal Pradesh, it can be surmised that 10 kms area around existing National Parks and Sanctuaries, Critically Polluted areas, inter-State boundaries and international boundaries in the state are of particular significance for identification and assessment of the impacts of development project/activities and mitigation thereof.

In addition, Wildlife Division of MOEF vide F. No. 6-10/2011 WL, dated 19th December, 2012, issued Guidance document for taking up non forestry activities in wildlife habitats. These guidelines prescribe the process of obtaining recommendations of the Standing Committee of NBWL under the Wildlife (Protection) Act 1972 with respect to the areas, for which this process is mandatory under the law, and also in compliance to relevant Hon'ble Supreme Court orders. These guidelines replace the guidelines dated 15.03.2011 issued earlier in this regard, along with all amendments made therein.

The Guidance document covers activities inside Protected Areas (including activities National Parks, Wildlife Sanctuaries, Tiger reserve, Conservation Reserves), Activities in areas other than Protected Areas including Activities within 10 Kms from boundaries of National Parks and Wildlife Sanctuaries, and activities within areas connecting the Tiger Reserves, notified by NTCA for controlling the land use. It specifies procedure to be followed for consideration of proposals by the Standing Committee of National Board for Wildlife and proposals for survey work to be carried out inside national parks and wildlife sanctuaries.



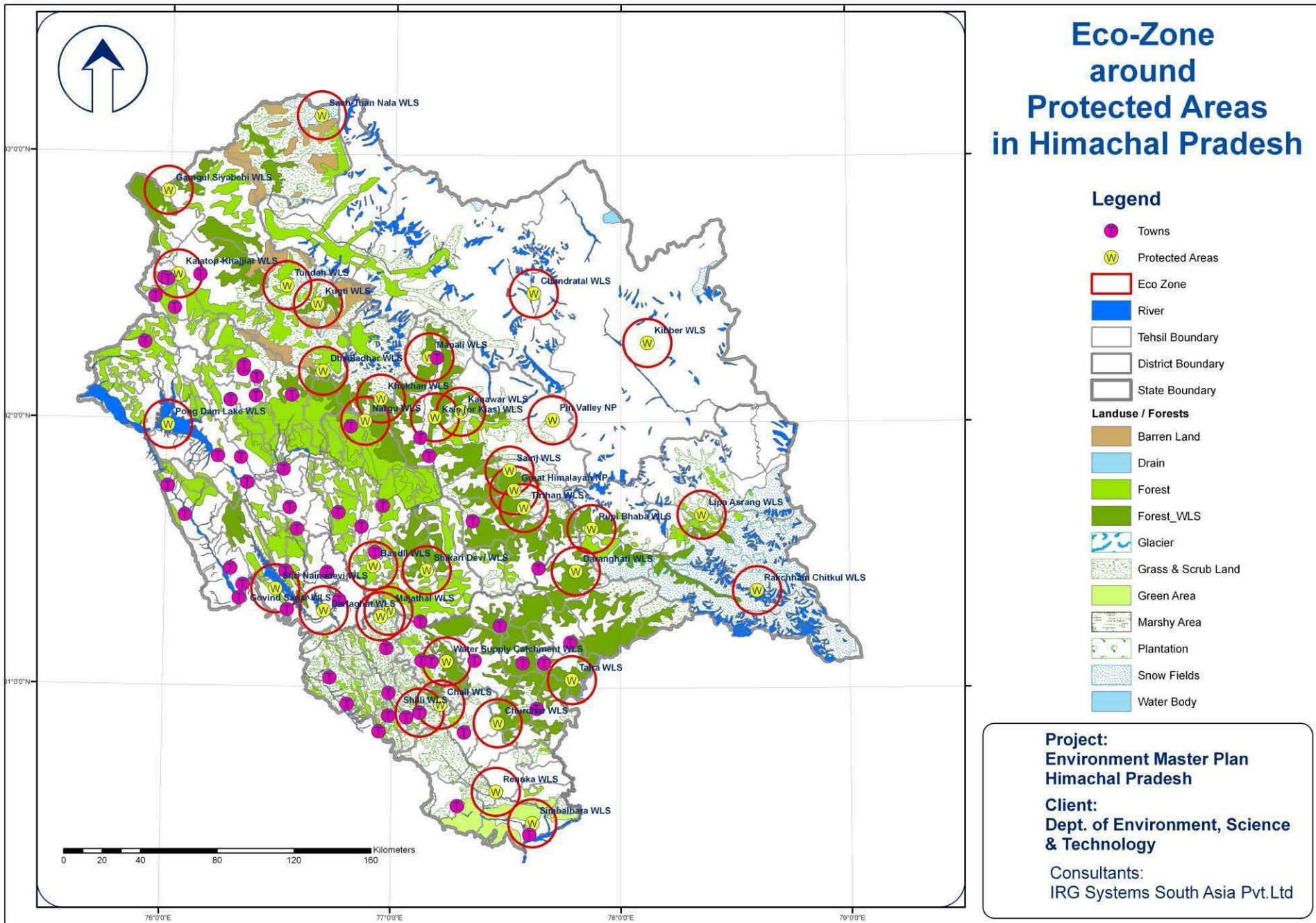


Figure 3: Map showing 10 kms area around National Parks and Sanctuaries in Himachal Pradesh

### 1.3 Technology adopted in the sector along with any changes in technology

Technological interventions in the sector which have been demonstrated in the State are described below.

#### 1. **Three Dimensional Forest Farming:**

Experiments to involve the local people in forest conservation and development began in the right earnest with the introduction of the concept of Three-dimensional Forest Farming (TDFP) in 1976. The TDFP had three objectives, soil conservation, and production of timber and fodder for domestic cattle. With the enunciation of the State Forest Policy in 1980, people's participation in afforestation programmes was highlighted. For synergy, TDFP was later merged with social forestry/farm forestry schemes.

#### 2. **From Forestry to Community Forestry:**

Forestry in Changar project has lost its keystone role as the dominant feature of the Farming Systems and therewith that of local livelihoods. In Changar scenario, where change in local lifestyles is brisk and externally oriented, dependency of local livelihoods substantial, rehabilitation of degraded community and forest lands is not necessarily seen as potential development arena. The track of degradation has led to a situation that local forest users are not able to cope with changing socio-demographic and economic scenarios or new demands on sustainable forest management (e.g. erosion of indigenous know-how, increased workload on women, absence of worker men folk). Current forest management does not tap the multifunctional potential of forests (e.g. conservation, short-term economic benefits, watershed development). Further degradation of natural resources including forests cannot be resisted due to social and economic compulsions and

inequities and, local institutional and governance weaknesses. Therefore, the sustainable development oriented interventions have to be socially just, economically attractive and viable, and ecologically sound. Forests have a paramount role in effecting conservation in degraded areas through enhanced productivity and bio-diversity, and in addressing livelihood needs of the local communities. Therefore, bedrock philosophy of Indo German Changes Eco-Development Project (IGCEDP) since 1994 is based on eco-development. The prime elements of eco-development concept are:

- Participatory planning, implementation and management.
- Development of natural resources
- Development of local expertise
- Functional-linkage oriented supportive institutional mechanisms in the post-project area.

#### **Socio-Technical Management**

- Even on the inhospitable sites, if technical standards are maintained, replacement of dead saplings is not necessary unless it is less than 40%.
- On community lands the initial number of planted trees can be kept 700/ha since the invasion of natural regeneration is spontaneous and compensate for any mortality within two/ three years.
- Early silvi-culture treatments are must to enhance the growth of trees and optimum grass production. These include preventive measures of fire management and suppression of infesting weeds.
- In combination with other monitoring aspects (e.g. surface run-off, water recharging etc.) plantation monitoring is a good tool for impact monitoring on overall watershed treatment.

- A considerable amount of money can be saved by simple protected enclosures and working with natural regeneration.
- In well-established plantations (e.g. higher stocking, dense crowns and bush growth) controlled grazing can be practiced with benefits (e.g. weed suppression) (in Changar Charcha, 2002).

**3. Conservation breeding projects for endangered species:** Following the success of the Western Tragopan breeding programme, Himachal Pradesh wildlife authorities are preparing to undertake similar Conservation Breeding projects for other endangered Himalayan fauna like Monal, and the Chir pheasant. Manali will host the breeding programme for the Monal, found in Deodar and oak forests at over 1800 m. The conservation project for the Chir Pheasant has been planned at the Chail sanctuary.

The State has also taken initiatives in regulating the menace of monkeys in tourist places by establishing 3 Monkey Sterilization Centres. Out of an estimated population of 300,000 monkeys in the State, about 30,000 monkeys have been sterilized and released in the Wilderness.

**4. Restoration of Degraded habitats of Animal Biodiversity:** The Forest Department has embarked upon an extensive programme for restoring degraded habitats of animals through large-scale plantation of different species of trees under various schemes, including social and participatory forestry. There has been a general improvement and restoration of the habitats of wild animal diversity under a World Bank funded project on the restoration of the productive potential of the highly eroded and degraded Shiwalik Hills. The H.P. Shiwalik Watershed Development Society is implementing this project.

## 1.4 Stakeholder involvement in environment preservation and restoration

**National Social Forestry (Umbrella) Project (1985-1993):** National Social Forestry (Umbrella) Project was launched in 1985 with USAID and IDA participation in HP. This project had objective of increasing production of fuel, fodder and timber to provide enhanced income opportunities to the land less and other villagers and to strengthen forestry institutions. In this Umbrella Project, the plantations were to be carried out after consultation with VDCs and preparing Integrated Resource Management Plans (IRMPs). The VDCs were charged with the responsibilities of:

- Assisting in preparation of the Integrated Resource Management Plans (IRMPs)
- Identifying areas for raising fuel, fodder plantation and grassland development.
- Selecting the species to be raised and encouraging the villagers to raise Kisan nurseries.

During the project period, the local people were involved in the various programmes, under the different components of the project. The response of the local people was quite encouraging, and the various VDCs formed under the project worked well towards the protection and development of forests. With the termination of the project in 1993, these committees also stopped working. The main reason for these committees becoming defunct in the absence of project aid appears that the main thrust was given on achievement of targets. Sustenance of the programme, which started during the project period, was not given attention. The thrust was on implementation of the scheme, so the training aspect was not given importance to the level required for the changed working. So, during the project period, the scheme produced very good results, but these could not be sustained after the project got over.

**Sanjhi Van Yojna (Community Action in Forestry) 1998 onwards:** The lessons learnt and experiences gained during the implementation of the earlier projects led to the institutionalization of the PFM process. A regular scheme of the Forest Department, Sanjhi Van Yojana (SVY) was initiated in December 1998 to involve communities in afforestation activities. SVY was modified in August 2001, combining all State plan afforestation schemes such as ‘Apna Van and Apna Dhan’ and ‘Parishram Hamara Van Hamara’.

Under these rules the funds are provided directly to the Village Forest Development Societies (VFDSs) registered under the Societies Registration act, 1860 for carrying out micro-plan activities.

This scheme is being implemented with the following objectives

- Involvement of grass root institutions such as gram panchayats, mahila mandals, yuvak mandals, schools, village development committees (VDCs), NGOs etc.
- Regeneration of degraded forest areas through community involvement.
- Creation of social assets for the benefit of the local communities.
- Creation of employment opportunities in rural areas.

**Integrated Conservation and Development Projects (ICDPs):** The wildlife Wing of H.P. Forest Department has undertaken integrated eco-developmental projects in Wildlife Sanctuaries and National Parks (especially the Great Himalayan National Park). They involve biodiversity conservation linked with local socio- economic development with the active participation of local communities.

In Bilaspur district, following steps have been taken for popularising the farm forestry and other type of forestries:

1. Public meetings are conducted in villages providing emphasis on the importance of forestry and its impact on the environment etc.
2. Visual aids are used.
3. Seedlings of various fuel, fodder, small timber species are distributed at nominal costs.
4. Fuel saving devices like Dhauladhar Chullahas and pressure cookers are distributed at subsidised rates amongst the farmers.
5. Training camps for the progressive farmers of the area are organised.

*Source: District Statistical Handbook 2001*

## **1.5 Critical environment issues /hotspots associated with the sector**

- **Forest degradation:** As per Himachal Pradesh Development report, during the immediate post independence period, planners identified the forests of the State as a source of timber and other forest products only. This led to large scale felling and clearing of forest areas. Forest statistics show a decline in the total forest area from 37,591 sq km in 1990-91 to 37,033 sq km in 1995-96 to 35,427 sq km, reported during 2001-02. This is on account of decrease in protected forest by 1.2% between 1990-2001. However, actual forest cover (dense and open forest) showed an increase of about 22% in 2001 from 11780 sq km in 1990-91 to 26.35% to the current level as per SFR 2009. This has been attributed to ban on green felling and inclusion of horticulture trees into the forest cover in the State.

- Earlier private contractors carried out harvesting of forests which was auctioned by the Forest Department after demarcation and marking of trees as per prevailing management plans. However, the working by contractors often resulted into illicit felling and damage to unmarked standing trees. Until 1970, when forest coupes were auctioned, timber removal invariably exceeded the annual prescribed yield, which was unsustainable. To overcome this shortcoming, the government of Himachal Pradesh established the Himachal Pradesh State Forest Corporation, which was entrusted with all harvesting operations in the forests. As a result, since 1975, the annual removal from the forests has always remained below the prescribed yield. Timber measuring 470,000 m<sup>3</sup> was extracted annually from the forests of the State during the last five decades of the previous century (1950-2000). The average timber removal was the highest in the decade 1980-90.
- **High Population Pressure (Human and livestock) on Forest Resources (Fuel wood extraction):** A large number of villages in the State are located in remote areas and connected by tracks, village paths or by village roads. Moreover, the villages are either adjacent to or enclosed by forests, which are thus deeply integrated with the livelihood of the local people. They depend on the forests for timber, for the construction of houses, firewood, agricultural implements, fodder and a variety of other products and services, including certain medicinal herbs. It has been found that the per capita availability of forests in the State was about 0.23 ha during 1991-2001. However, the population growth in coming decades, exceeded the growth in forest resources. This resulted in unsustainable extraction and use of resources. As per SoE report, district Kinnaur has 0.78 ha as the highest per capita availability of forest while district Hamirpur has 0.06 ha as the lowest per capita availability of forests in 2001. District Kullu and Mandi have a higher number of critical natural habitats which may have significant impact on demography. Other districts include Shimla, Kangra, Una, Hamirpur, Bilaspur, Kinnaur, Solan and Sirmour.
- In Himachal Pradesh about 90.21% of the population is rural and they mostly depend upon fuel wood for their day-to-day energy requirements. The annual fuel wood requirement for sixty lakhs people is about 3.9 million tonnes. The manner in which the fuel wood is obtained is highly damaging. Right holders and the resident population are supposed to collect only dry and fallen wood and twigs, or lop lower branches of permissible tree species. In practice, however, even young poles are hacked and trees are badly lopped. This severely impairs the regeneration and protective capacity of the trees and the development of the forests. Forests that are in the vicinity of habitations are the most affected. The greatest pressure is perhaps on the “Ban-Oak” trees. These are lopped for fuel wood as well as for fodder.
- **Increase in number of Timber Distribution Rights:** New Timber Distribution Policy (TDP, 2010) has come into force to regulate and rationalize the timber distribution practices in the State. (Timber Distribution’ as the policy of distribution of timber to the right holders as per record of rights recorded in the Forest Settlement Reports; and Timber Distribution Rights’ as a right of a right holder having cultivable lands for grant of timber for construction of residential house and cow shed etc. for bonafide domestic use of the right holder, recorded in the Forest Settlement Report of the area concerned). The new policy states that timber distribution rights shall be subject to cooperation and participation of right holders in forest conservancy. In case any

right holder fails to perform his duties for apprehending offenders, extinguishing fire or commits any forest offence as contained in the forest settlement report, his right of timber distribution shall be suspended upto 10 years; and timber distribution right of a right holder shall be suspended upto 10 years if he is found to have misutilized the timber.

- **Unsustainable harvesting of Forest Produce:** Villagers and farmers close to the forests traditionally collect various Non Timber Forest Produce (NTFPs), such as Anardana, Chilgoza, Guchhi and various medicinal and aromatic plants, either free or on payment of some nominal fee. The chilgoza or neoza pine, (*Pinus gerardiana* Wall.), is a compact medium-sized tree. In Himachal Pradesh, it occurs naturally in dry temperate zone, i.e. parts of Kinnaur and Chamba (Pangi) districts covering an area of about 2,060 hectares. It has been estimated that only five percent of seed bearing cones (inaccessible sites) are able to survive the greed of people and become available for natural regeneration. The cones are devoured by a large number of pests, birds, squirrels, rodents and cone borers. Severe lopping practices, browsing by sheep and goats, extraction of torchwood or fuel wood are the major factors detrimental to the regeneration of chilgoza trees. According to an estimate about 14 to 17 tonnes of Chilgoza seeds are collected annually in Kinnaur district. It is thus an important cash crop in the area. It is also facing a threat of extinction and has already been listed as an endangered species. Similar is the case with several other NTFPs, which have been harvested to near-extinction in the wild.
- The H.P. State Forest Department issues permit for the collection of other non-timber products. Medicinal and aromatic plants are of special value. Some of these herbs are found only in Himachal Pradesh and there might be many still undiscovered.

The main concern at present is the unscientific harvesting and excessive and ruthless exploitation of these resources mostly triggered by private pharmaceutical companies. This has resulted in several species of medicinal and aromatic plants either becoming extinct or being listed as endangered species.

- Such produce was worth `12.29 Crores in 1999-2000, of which medicinal herbs alone accounted for 57.43%, that is `7.06 Crores and need to be exploited scientifically using modern management methods. A total of 21,982 quintals were exported outside the State in 1998-99. The main products were musk bala/nihani, pathin, rakkhal dorighas and neoza. The State has introduced Lavender, which yields high value aromatic oil at Salooni in Chamba district along with setting up of an oil extraction unit. A Lavender bush remains productive for 15 years and starts yielding flowers for oil extraction in the second year of its cultivation. The processing of Lavender oil and its consequent use in production of agarbati, dhoop and cosmetic creams could earn additional income, as the current Indian demand for Lavender oil is 40 tonnes annually. Sea buckthorn is another wild plant, of immense medicinal and environmental value that can be grown in abundance in Lahaul & Spiti, Pangi and Kinnaur. As such, some medicinal plants which are not regularly cultivated and are being collected from the wild are becoming scarce and threatened with extinction.
- Livestock population pressure on forest resources (Fodder): According to an estimate, 51.10 lakhs heads of cattle graze in or on the fringes of forests in a year. Almost 90% of the forests of the State, other than areas taken up for regeneration and plantations, are open to grazing. Cultivation of green fodder in agricultural fields is virtually non-existent as are stall-feeding practices. The result is that all forest areas

are openly grazed throughout the year. This continuous grazing diminishes productivity and gives rise to inferior grasses and unpalatable bushes like Lantana and Ageratum species.

- As part of afforestation programme, the State has undertaken plantation activities. Due to lack of fencing and indiscriminate visits of scrub animals in the planned areas, there is large scale damage to the plantation area.
- Forest Encroachment: The incidences of encroachment are mostly reported in the undemarcated protected forests that are without boundary pillars as these adjoin private lands. About 9600 encroachment cases have been reported that involve about 1850 ha of forest area. Previously, cases for eviction of forest encroachments were challenged in the Revenue courts and from 1994 powers for this purpose have been given to DFOs under H P Public Purposes Act. With JFM in place, the recurrence of forest encroachment is expected to decline. For this purpose, the State is making efforts to make JFM more functional through empowerment of local communities.
- Inhibited natural regeneration due to ban on Green felling: The blanket ban on green felling has adversely affected the forests of the State, which is further reinforced by various Supreme Court pronouncements. The complete ban on green felling in the forests imposed by the government is not conducive to the development of forests, because natural regeneration is possible only when an optimum opening in the canopy is made, and the areas are closed to grazing. Therefore, regeneration felling and thinning has to be carried out to induce regeneration and to remove congestion in the crops. Lack of felling leads to the death and decay of mature trees in due course of time with no young growth to replace them. Apart from this, a fall in crown density implies a fall in sustainable yield of the forest products and services including industrial wood and fuel wood as well.
- Diversification in forest plantation: Trees are planted mostly on forest land and on community lands to supplement regeneration efforts in order to increase the forest cover. The various coniferous species tend to become monoculture on account of their silvicultural characteristics particularly on higher elevations. Down the hills and in plains, efforts need to be made to increase the area under species mix. This has to be well planned so that the resultant forest growth is conducive to development of ecosystem services as well as to meet the varying demand of local communities.
- Loss of Forest area from forest fires: Each year thousands of hectares of forest area get affected by forest fire, especially in the “Chil” belt, primarily due to man-made reasons. Fires are very common in the high altitude “Blue Pine” forests during November and early December. This is when the weather is very dry and winter rains are delayed. Forest fire is one of the several causes of forest degradation. Some of the common damages are destruction of regeneration and young poles, the drying up of trees, the retardation of increment, the burning of pine needles and humus. This exposes the soil to wind and rain leading to soil erosion. It also affects the recharging of groundwater and springs. Biodiversity is severely affected both above and below the ground level.
- As per Annual Administration Report on Forestry Activities under Finance and Planning Wing for the year 2009-2010, the total number of reported fire cases was 1906, total area affected was 24849.52 ha and estimated loss of over Rs 255.29 million. The main reason for forest fires has

been attributed to carelessness or accidents by villagers/travelers etc. lighting or fire balloons. Other reasons of forest fire include fire caused by accidents or through carelessness in burning fire lines and fire entering forests by crossing exterior fire tracer.

- Diversion of forest for non forestry purposes: Forest land is often requested for diversion for different development projects of PWD, Road constructions, Hydro electric projects, mining, irrigation, transmission line etc. About 8733.030 ha forest area has been diverted mostly for Hydroelectric projects (44%), followed by TL (25%), PWD roads (4%), Mining (9.5%), roads (2%), Irrigation and RL from 1981 to 31-12-2009.
- The Present situation in the Protected Area Network (PAN) in Himachal Pradesh: HP has a PAN comprising 33 wildlife sanctuaries and 2 national parks spread over 5 Bio-geographical zones in the State. This is about 12.8 % of the State's geographical area. Of the 33 wildlife sanctuaries there are habitations within 24. These inhabited villages are 793 in number with a human population of 116658 (2001 Census) and a livestock of 183891. Most of the inhabitants and their livestock are forest dependent and much of the village economy is linked to access and harvest of NTFPs and grazing in forests surrounding the villages. Over the years, these people have witnessed (and borne the brunt of ) increasing restrictions on their livelihood related activities as also on getting developmental work approved and implemented. Areas without or outside PAs on the other hand, continue to enjoy rights / privileges/ development / better infrastructure and faster economic growth. Therefore, there is a growing anti-PA constituency blocking wildlife conservation.
- Rationalizing the PAN makes a strong case for willing wildlife conservation: Rationalisation of the PAN offers a way out

of this impasse. It simply means re-drawing the boundaries of wildlife sanctuaries and national parks to exclude villages / hamlets along with those forests that are heavily encumbered with people's rights. By doing this, the major grouse of local people in terms of exercise of traditional rights and implementation of development schemes is sorted out. The other laws such as the FCA, 1980 will remain applicable to the excluded areas, but then there will be parity or equality with other rural areas. Secondly, a multitude of unnecessary problems around what is allowed or not allowed within PAs gets circumvented. A crucial difference that rationalization of the PAN will make is that it will lead to capacity enhancement and development of chronically understaffed and moderately trained wildlife department to address wildlife issues and problems. The other and perhaps the last opportunity is that through the process of rationalization, good forest / wildlife tracts can be brought into the PAN and this would greatly enhance the representation of biodiversity within the PAN.

- After formal approval including merger of Sainj & Tirthan Wildlife Sanctuaries in the Great Himalayan National Park, there will be 24 Wildlife sanctuaries, 5 National Parks, 3 Conservation Reserves comprising 8409 sq kms which is more than 15% of the total geographical area of Himachal Pradesh.
- Crop damage by wild animals: In the past wild animals used to feed on wild fruits and other natural food resources and did not interfere with the agricultural crops. However, due to an increase in their population and less of their natural food resources, wild animals have become more aggressive resulting in human and animal confrontation. Monkey Sterilization has been set up in the State to check monkey menace. About 30,000 monkeys have been sterilized and released.



- Stress on wildlife population: Hunting of wild animals is one of the reasons for the decline of wildlife population in some areas. However, the State has taken many conservation initiatives to check poaching and unsustainable extraction of flora and fauna. Conservation breeding of pheasants and sterilization of monkeys are both a conservation measure as well as a rational approach to regulate the growth of certain species. Since 1982, the Government of H.P. has imposed a complete ban on the hunting and killing of wild animals in the State. However, incidents of the illegal hunting of barking deer, goral, wild boar, rabbits, partridges and red jungle fowl by villagers for food are occasionally reported in many areas. Some of the other poached animals include leopard, black and brown bears, musk deer, and monal. The poachers are believed to kill these animals by shooting, trapping or even by poisoning them.
- Loss of naturally occurring vegetation due to spread of alien and invasive species: Trees felled by right holders or removed after they dry up or fall due to vagaries of weather (salvage) have created gaps in the canopy, which has resulted in preponderance of invasive species *Parthenium hysterophorus*, *Ageratum conyzoides*, etc. and a change in the vegetation mix in all types of forests in the State. The resultant growth even though serves the purpose of soil and water conservation, but also effectively eliminates the emergence of tree seedlings and smothers the naturally occurring grasses and herbs in the affected areas.
- The Government of Himachal Pradesh has adopted National Forest Policy, National Conservation Strategy and National Wildlife Action Plan to tackle with various biodiversity related issues. The State Government has also imposed a complete ban on hunting of wild animals and a moratorium on felling of trees in all Protected Areas.
- The Wildlife wing of H.P. Forest Department has undertaken integrated eco-developmental projects in some Wildlife Sanctuaries and National Parks.
- The Forest Department has embarked upon an extensive programme for restoring degraded habitats of wild animals through large-scale plantation of different species of trees under various schemes, including social and participatory forestry.
- The Pong dam wetland is being managed by the Forest Department under centrally assisted Intensive Management Plan for the improvement and creation of suitable habitats, and nesting and roosting sites for several species of birds. The Government of Himachal Pradesh has also undertaken ecological improvement and restoration of Renuka and Riwalsar wetlands for conservation and propagation of their biotic resources.
- The Department of Forest & Wildlife organized a National Conference on Forestry Solutions: Strategies for Mitigation and Adaptation of the Impacts of Climate Change in Western Himalayan Mountain States, at Shimla. These are the outcomes of the conference:-

- 1) There is a need to formulate a separate and distinct forest policy for western Himalayan states in view of their high vulnerability to climatic changes; critical role as watershed states for the northern Indian plains; and unique ecosystems

## **1.6 Environment initiatives taken by the sector to address critical environment issues**

### **1: Initiatives Related to Biodiversity and Forest taken by the State:**

and forested landscapes rich in biodiversity.

- 2) There is an urgent need to establish long-term monitoring plots across representative eco-zones, to gather scientific data on climatic and biological parameters, especially in Riverine, Alpine and Shivalik ecosystems.
- 3) Mapping of climate change driven adaptations in natural resource use and livelihood patterns across the eco-zones.
- 4) Development of a database on Carbon sequestration potential of forest flora in these states.
- 5) Periodic assessment of carbon stock including soil carbon under different ecosystems.
- 6) Effective deployment of new and advanced technologies, such as GIS, remote sensing, climate modeling in natural resource management.
- 7) Urgent need to incentivise community involvement in some mainstream forest department activities including forest protection, afforestation and fire fighting.
- 8) Integrating and extending the concept and practice of Payment for Ecosystem Services (PES) within the states to compensate for foregone land-use and occupation options adversely impacting the environment.
- 9) Conservation of biological diversity should guide afforestation programmes and not carbon sequestration potential alone.
- 10) Re-orienting afforestation programmes to focus on species that help to mitigate man-animal conflict.

11) Revisiting forestry operations to realise full water conservation potential of forests leading to development of 'water sanctuaries'.

12) Gender specific policies are required to help cope with the loss of control over natural resources, technologies and credit to deal with seasonal and episodic weather and natural disasters.

13) Impress Government of India to move beyond Green Bonus to adequately compensate these states for ecosystem services flows.

14) Re-orient developmental interventions for adopting watershed as the unit for planning and fund flows.

15) Re-design the existing tourism policy to produce alternative mountain-specific tourism models focusing on environmental sustainability.

16) Forest departments should be more proactive in influencing policies of other sectors such as Road Construction, Transportation, Power and Industries which impinge on conservation issues.

- The Wildlife wing of H.P. Forest Department has prepared wetland plan for wetland management in the State namely Pong, Khajiar and Renuka.
- Preparation of comprehensive Catchment Area treatment plan for entire Sutlej basin is underway.

## 2 Working Plans

Working Plans are one of the important forestry documents, prescribing treatment for regeneration, management and exploitation of forests keeping in view different growth patterns, status of forests and for meeting

needs of the people. Revision of working plans has been given top priority by the Department of Forest & Wildlife.

Working Plans under preparation/revision: - The working plans of Seraj, Karsog, Palampur, Spiti, Kutlehar and Dharampur-Kamlah (Mini Working Plan under Joginder Nagar Forest Division) are under preparation/revision (6 No.). The PWPR of Shimla (Urban) Division is being prepared by Conservator of Forests, Shimla Circle.

Working Plans under Scrutiny: - The working plans of Dharamshala and Dehra Forest Divisions are under scrutiny by CCF (WP&S)/PCCF.

Working Plans Approved:- The working plans of Bilaspur, Shimla, Theog, Bharmour, Chamba, Churah, Dalhousie, Pangi, Nachan, Kullu-Parbati, Lahaul, Mandi-Joginder Nagar, Una, Kinnaur, Solan, Renukaji, Hamirpur, Kotgarh- Rampur, Outer Seraj (now Luhari), Rorhoo-Jubbal, Chopal, Nahan-Paonta Sahib, Suket, Rajgarh, Nalagath- Kunihar and Nurpur (25 WPs) are approved by the Government of India

### 3. Improvement in tree cover

With a view to meet the ever- increasing demand for timber and to bridge the formidable gap between the existing known resources and demand, three components were framed by the Forest Department to improve the forest cover. The components are as under:-

- Afforestation in blank areas
- Enrichment Planting
- Re-afforestation in Scrub areas

The Component of “Afforestation in blank areas” aims at the areas which did not have tree cover in the recent past. The Component of “Enrichment planting” in degraded areas aims at improving the crown density of the degraded forests (between 10 to 40%) with a view to

enhancing productivity. The component of “Re-afforestation of scrub areas” aims to bring the scrub and weed infected area, under tree cover of improved productivity. An amount of ` 536.97 lakhs was provided during the year 2007-08 for raising plantations over an area of 3737 ha.

### 4. Raising nurseries for departmental plantation and public distribution schemes:

The scheme envisages extensive plantation of industrially important species in compact blocks. The cost of raising of nurseries has been taken out and provided separately under raising of nurseries for Departmental Plantation & Public Distribution Scheme. An amount of Rs 167.67 lakhs was provided for the scheme and Rs 167.67 lakhs was spent on raising nurseries during the year 2007-08.

**5. Pasture Improvement:** Livestock plays an important role in the economy of this State. The conservation & development utilization of fodder resources acquires added importance for feeding the cattle population of the State and also to meet the requirement of the migratory graziers from the adjoining State of Uttarakhand.

**6. Social Forestry Programme:** After the culmination of the Social Forestry (Umbrella Project), the Government of Himachal Pradesh decided to substitute it with another Social Forestry Programme in which afforestation on wasteland and degraded forests lands were undertaken. The “Sanjhi Van Yojna” scheme is being implemented to bridge the gap in employment generation and other activities created, due to the culmination of the Social Forestry Project.

**7. Sanjhi Van Yojna:** Under this scheme, village community lands are planted with active participation of the people. The main objectives of the scheme are as under:

- Involvement of grass root level institution such as gram Panchayats, mahila mandals,

yuvak mandals, schools, village forest development committees, NGOs, etc. in eco restoration.

- Regeneration of degraded forest areas through community involvement.
- Creation of social assets for the benefit of the communities.
- Increasing productivity of the forest areas, by improving nursery stock through adoption of modern nursery techniques.

During the year 2007-08 a sum of ` 71.66 lakhs was provided under this scheme against which ` 71.82 lakhs had been utilized for raising plantations over an area of 216 ha.

**8. Medicinal plant Northern West Himalayas:** Initiatives & achievements of HFRI, Shimla.

**9. Forest Encroachment:** The incidence of encroachment are mostly reported in the undemarcated protected forests that are without boundary pillars as these adjoin private lands. There are about 9600 encroachment cases that involve about 1850 ha of forest area. Previously, cases for eviction of forest encroachments were challenged in the Revenue courts and from 1994 powers for this purpose have been given to DFOs under H P Public Purposes Act. With JFM in place, the

recurrence of forest encroachment is expected to decline. For this purpose, the State is making efforts to make JFM more functional through empowerment of local communities.

As per the record of Forest Department (2005-06), Chil is the single largest species with about 30 % of the area planted by the department. Deodar forms only 12 % of the total area planted during 1950-1951 to 2003-2004 (total plantation up to 31-03-2004). Recently, a large number of broad-leaved species, including walnut, poplar, shisham, etc., were planted under different projects. The community participation in new plantation schemes have been the highlight of the State's initiatives to include broad leaved species to the interests of local people.

### 1.7 Environment monitoring (key parameters) carried out for activities related to the sector

**Forest Cover Monitoring and Reporting:** The environmental monitoring is carried out in the forest sector to assess forest cover and reporting as State of Forest Report and State of Environment Report. An example of this monitoring is given in Table 43 to Table 47.

**Table 43: Forest as Per Crown Density (SFR-FSI-2008) (Area in km<sup>2</sup>)**

Year of Survey	Dense Forests (Crown density > 40%)	Open Forests (Crown density 10% - <40%)	Total Forest Cover	Total Forest Area
1991	8911	2869	11780	37591
1993	9565	2937	12502	35407
1995	9565	2936	12501	35518
1997	9560	2961	12521	36986
1999	9120	3962	13082	37033
2001	10429	3931	14360	37033
2003	8976	5377	14353	37033
2005	8928	5441	14369	37033

Source: Forest Report, Himachal Pradesh, 2008

**Table 44: Changes in Forest Cover of Himachal Pradesh since 1972**

Assessment Year & Data Forest Period Cover	1972 -75	1980 -82	1981 -83	1985 -87	1987 -89	1989 -91	1991 -93	1993 -95	1996 -98	2000	2002
Dense Forest	12,500	6,700	9,908	7,100	8,911	9,565	9,565	9,560	9,120	10,429	8,976
Open Forest	-	-	2,974	6,277	2,869	2,937	2,936	2,961	3,962	3,931	5,377
Total	-	-	12,882	13,377	11,780	12,502	12,501	12,521	13,082	14,360	14,353
Scrub	-	-	2,448	N.A.	1,918	1,845	1,845	1,825	566	566	389
Un-Interp-Reted area	-	-	-	N.A.	18,967	-	-	-	-	-	-
Non-Forest	-	-	40,390	N.A.	23,008	41,326	41,327	41,327	42,025	40,747	40,931
G. Total	-	-	55,720	55,670	55,673	55,673	55,673	55,673	55,673	55,673	55,673

Source: State Environment Report, HP (Published in 2009).

**Table 45: Based on Forest Survey of India, SFRs district wise forest cover change in dense and open**

Assessment Year Forest Cover	SFR 1991	SFR 1993	Change	SFR 1995	Change	SFR 1997	Change	SFR 1999	Change	SFR 2001	Change	SFR 2003	Change
1. District Bilaspur (Geographical Area: 1,167 km <sup>2</sup> )													
Dense Forest	101	49	-52	49	0	59	+10	65	+6	135	+70	105	-30
Open Forest	65	108	+43	108	0	99	-9	170	+71	166	-4	253	+87
Total	166	157	-9	157	0	158	+1	235	+77	301	+66	358	+57
2. District Chamba (Geographical Area: 6,522 km <sup>2</sup> )													
Dense Forest	1,625	1,801	+176	1,767	-34	1,768	+1	1,585	-183	1,652	+67	1,566	-86
Open Forest	392	323	-69	293	-30	293	0	716	+423	690	-26	847	+157
Total	2,017	2,124	+107	2,060	-64	2,061	+1	2,301	+240	2,342	+41	2,413	+71
3. District Hamirpur (Geographical Area: 1,118 km <sup>2</sup> )													
Dense Forest	156	151	-5	151	0	150	-1	93	-57	181	+88	109	-72
Open Forest	60	62	+2	72	+10	73	+1	95	+22	93	-2	133	+40
Total	216	213	-3	223	+10	223	0	188	-35	274	+86	242	-32
4. District Kangra (Geographical Area: 5,739 km <sup>2</sup> )													
Dense Forest	808	1,071	+263	1,071	0	1,071	0	1,338	+267	1,719	+381	1,386	-333
Open Forest	625	684	+59	673	-11	673	0	301	-372	311	+10	481	+170
Total	1,433	1,755	+322	1,744	-11	1,744	0	1,639	-105	2,030	+391	1,867	-163
5. District Kinnaur (Geographical Area: 6,401 km <sup>2</sup> )													
Dense Forest	565	547	-18	547	0	541	-6	436	-105	432	-4	365	-67
Open Forest	68	82	+14	82	0	91	+9	213	+122	215	+2	248	+33
Total	633	629	-4	629	0	632	+3	649	+17	647	-2	613	-34
6. District Kullu (Geographical Area: 5,503 km <sup>2</sup> )													
Dense Forest	1817	1911	+94	1911	0	1907	-4	1631	-276	1749	+118	1412	-337
Open Forest	131	133	+2	133	0	137	+4	343	+206	366	+23	521	+155
Total	1948	2044	+96	2044	0	2044	0	1974	-70	2115	+141	1933	-182
7. District Lahaul & Spiti (Geographical Area: 13,841 km <sup>2</sup> )													
Dense Forest	0	15	+15	49	+34	49	0	34	-15	36	+2	35	-1
Open Forest	17	4	-13	34	+30	34	0	116	+82	118	+2	145	+27
Total	17	19	+2	83	+64	83	0	150	+67	154	+4	180	+26

Assessment Year Forest Cover	SFR 1991	SFR 1993	Change	SFR 1995	Change	SFR 1997	Change	SFR 1999	Change	SFR 2001	Change	SFR 2003	Change
8. District Mandi (Geographical Area: 3,950 km <sup>2</sup> )													
Dense Forest	839	848	+9	848	0	848	0	982	+134	1,112	+130	1,011	-101
Open Forest	462	461	-1	461	0	467	+6	557	+90	544	-13	637	+93
Total	1,301	1,309	+8	1,309	0	1,315	+6	1,539	+224	1,656	+117	1,648	-8
9. District Shimla (Geographical Area: 5,131 km <sup>2</sup> )													
Dense Forest	1,921	2,094	+173	2,094	0	2,084	-10	1,808	-276	1,878	+70	1,781	-97
Open Forest	299	331	+32	331	0	341	+10	582	+241	566	-16	602	+36
Total	2,220	2,425	+205	2,425	0	2,425	0	2,390	-35	2,444	+54	2,383	-61
10. District Sirmaur (Geographical Area: 2,825 km <sup>2</sup> )													
Dense Forest	740	740	0	740	0	736	-4	742	+6	755	+13	687	-68
Open Forest	279	279	0	279	0	288	+9	366	+78	357	-9	692	+335
Total	1,019	1,019	0	1,019	0	1,024	+5	1,108	+84	1,112	+4	1,379	+267
11. District Solan (Geographical Area: 1,936 km <sup>2</sup> )													
Dense Forest	164	164	0	164	0	173	+9	274	+101	459	+185	353	-106
Open Forest	251	254	+3	254	0	249	-5	218	-31	224	+6	466	+242
Total	415	418	+3	418	0	422	+4	492	+70	683	+191	819	+136
12. District Una (Geographical Area: 1,540 km <sup>2</sup> )													
Dense Forest	175	174	-1	174	0	174	0	132	-42	321	+189	166	-155
Open Forest	220	216	-4	216	0	216	0	285	+69	281	-4	352	+71
Total	395	390	-5	390	0	390	0	417	+27	602	+185	518	-84
Himachal Pradesh (Geographical Area: 55,673 km <sup>2</sup> )													
Dense Forest	8,911	9,565	+654	9,565	0	9,560	-5	9,120	-440	10,429	+1,309		
Open Forest	2,869	2,937	+68	2,936	-1	2,961	+25	3,962	+1,001	3,931	-31	5,377	+1,446
Total	11,780	12,502	+722	12,501	-1	12,521	+20	13,082	+561	14,360	+1,278	14,353	

Source: State of Environment Report, Himachal Pradesh

**Table 46: Changes in Growing Stock of commercially important species**

Year Species	1975	1980	1985	1990	1995	2000
Deodar	12,859	12,397	12,716	13,298	14,215	15,219
Kail	13,753	13,396	13,710	12,996	13,616	12,964
Fir/ Spruce	44,220	44,726	39,691	39,026	41,012	38,700
Chir	7,295	8,006	7,982	8,644	10,053	12,080
Sal	3,011	3,011	3,011	2,563	2,563	2,563
Others	18,723	17,949	18,733	20,312	21,052	13,736
Total	99,861	99,485	95,843	96,839	102,511	95,262

Source: State of Environment Report, Himachal Pradesh

**Table 47: NTFPs of Himachal Pradesh from 1995 to 2003 -04 Quantity in Tonnes and Value in '000'**

S. No.	Name of Produce	1995-96		1998-99		1999-2000		2000-2001		2001-2002		2002-03		2003-04	
		Qty.	Value	Qty.	Value	Qty.	Value	Qty.	Value	Qty.	Value	Qty.	Value	Qty.	Value
1.	Resin	8,783	62,644	7,201	53,739	8,725	-	7,357	47,504	7,354	49,559	8,495	55,659	8,254	47,682
2.	Bamboos	-	-	-	-	-	-	-	-	-	438	-	846	-	1,129

S. No.	Name of Produce	1995-96		1998-99		1999-2000		2000-2001		2001-2002		2002-03		2003-04	
		Qty.	Value	Qty.	Value	Qty.	Value	Qty.	Value	Qty.	Value	Qty.	Value	Qty.	Value
3.	Bhabbar grass	536	1988	511	343	671	-	40	20	351	78	428	50	925	116
4.	Fodder/ Grazing	-	908	-	1590	-	-	-	1342	-	651	-	412	-	877
5.	Medicinal herbs														
a.	Dhoop	202.5		69.2		78.0		39.9		39.3		13.5		14.6	
b.	Muskbala/ Nihani	148.7		162.4		93.9		102.3		50.5		71.1		52.7	
c.	Chukri/ Rewarrdchini	83.2		49.1		40.9		46.2		22.8		64.6		46.5	
d.	T/Patters	29.2		15.3		27.4		31.3		8.4		21.8		18.7	
e.	Dorighas	56.1		100.8		142.3		102.7		149.9		78.1		6.0	
f.	Brahmi	50.0		-		6.3		27.5		-		3.5		-	
g.	Kaur/Karu	43.0		12.0		4.6		6.8		4.1		28.1		16.9	
h.	Guchhie	36.3		16.0		10.6		5.0		8.5		15.6		2.8	
i.	Tej Patra	30.8		53.4		45.9		68.0		43.3		10.5		8.0	
j.	Thuth	25.9		10.9		13.6		8.7		18.8		23.3		2.6	
k.	Bankakri	22.4		1.1		0.9		0.3		0.3		1.9		5.3	
l.	Kuth/ Diosorea	26.4	5,59,621	0.1	89,823	14.2	70,579	0.9	66,714	-	71,807	13.5	1,05,706	18.0	44,862
m.	Efdra	12.7		60.2		-		34.9		-		-		-	
n.	Barberries roots	11.1		7.0		-		613.5		1345.2		524.0		717.4	
o.	Birch/ Bhoj Patra	6.5		5.3		15.6		2.0		-		7.2		-	
p.	Banaksha	3.9		0.9		0.5		0.4		-		-		-	
q.	Kakarshingi	2.6		0.4		2.4		1.0		0.4		0.9		6.5	
r.	Chora	1.2		12.3		43.0		5.1		10.4		9.0		0.2	
s.	Baryan	8.0		11.0		3.0		7.7		22.2		2.3		1.5	
t.	Mithi Patties	5.2		14.3		16.9		-		-		-		-	
u.	Bhutkesi	3.2		8.0		5.9		1.2		2.3		6.2		6.6	
v.	Others	646.9		1588.3		835.6		866.5		764.9		901.5		442.2	
6.	Other Produce	-	94	-	113	-	2245				7,700		2,586		4,595
Total		-	1,25,255	-	1,45,608	-	1,22,894		1,25,792		1,30,233		1,65,259		99,261

Source: State of Environment Report, Himachal Pradesh

## 1.8 Institutional Mechanism within the sector to address identified environmental issues

The Department of Forest & Wildlife is the nodal department for carrying out all activities connected with forestry and wildlife in the State of Himachal Pradesh. The department is headed by Principal Chief Conservator of Forests. He/She is assisted by 9 Conservator of Forests (

Territorial) and 3 Conservator of Forests (Wildlife). The Department of Forest & Wildlife has 36 Divisions and 6 Wildlife & 2 National Parks. The officers of the rank of Additional Principal CCF, Chief Conservator of Forests, Conservator of Forests, Divisional Forest Officers, Assistant Conservator of Forests, Range Forest Officers and Deputy Range Officers work in the department at various levels. The existing institutional framework of Department of Forest & Wildlife is shown in

Figure. 3. The responsibilities of the officers are described below.

**1. Addl. Pr.CCF (Finance & Planning)**

He/She is assisted by Chief Conservator of Forests (Forest Protection and Fire Control) and Conservator of Forests (Planning & Finance) and is responsible for all planning and budgeting issues.

**2. Addl. Pr.CCF Admn. & HRD)**

He/She is assisted by Chief Conservator of Forests (Training and Establishment), Chief Conservator of Forests (Monitoring & Evaluation) and Conservator of Forests (MIS & Public Governances) and is responsible for all HRD issues at policy level, matters relating to CEC/Court cases and controlling officer for CCF (Training & Establishment) & CCF (M&E).

**3. Addl. Pr.CCF (CAT & Plantations)**

He/She is assisted by Chief Conservator of Forests (Soil Conservation), Chief Conservator of Forests (Ecotourism & Plantations), Conservator of Forests (CAT Plans), Conservator of Forests (Ecotourism & Plantations) and Director of SLUB and is responsible for all soil & water conservation, land resource management, Controlling officer for Director (State Land use Board) and Eco-tourism Policy, public-private enterprises, Ecotourism website, consultancies, out-sourcing and conferences related to Eco-tourism issues relating to EIA and ES related matters.

**4. Addl. Pr.CCF (Management)**

He/She is assisted by Chief Conservator of Forests (PFM), Chief Conservator of Forests (WP & Settlement), Chief Conservator of Forests (Sale & Audit), Conservator of Forests (Policy & Law) and is responsible for all the co-ordination with various agencies on forest management matters, Policy & rules for PFM, preparation & monitoring of working plan implementation and all working & settlement issues.

**5. Chief Conservator of Forests (FCA & Project)**

He/She is responsible for mining related issues, Land transfer cases matters, and monitoring reports relating to Mid Hill, projects and nodal officer of forest clearances cases, FCA 1980.

**6. Chief Conservator of Forests (Faunal Diversity & PA Network)**

He/She is responsible for Identification, evaluation & management of sites of specific scientific interest (SSSI); qualitative & quantitative survey of protected areas and SSSI; research in protected areas & SSSA; National and State wildlife policies; Wildlife Act and rules/biodiversity act & rules; International conventions and protocols on wildlife, protected areas and SSSI, etc.

**7. Chief Conservator of Forests (Floral Diversity, NTFP & Management)**

He/She is assisted by Conservator of Forest (Research & Silva) and responsible for Conservation and propagation NTFP on governmental and private lands; No timber forest products and all related matters; National and State Medicinal Plant Boards; Co-ordination with outside institutions and research organizations on NTFP and medicinal plants and Invasive alien plant species & their management.

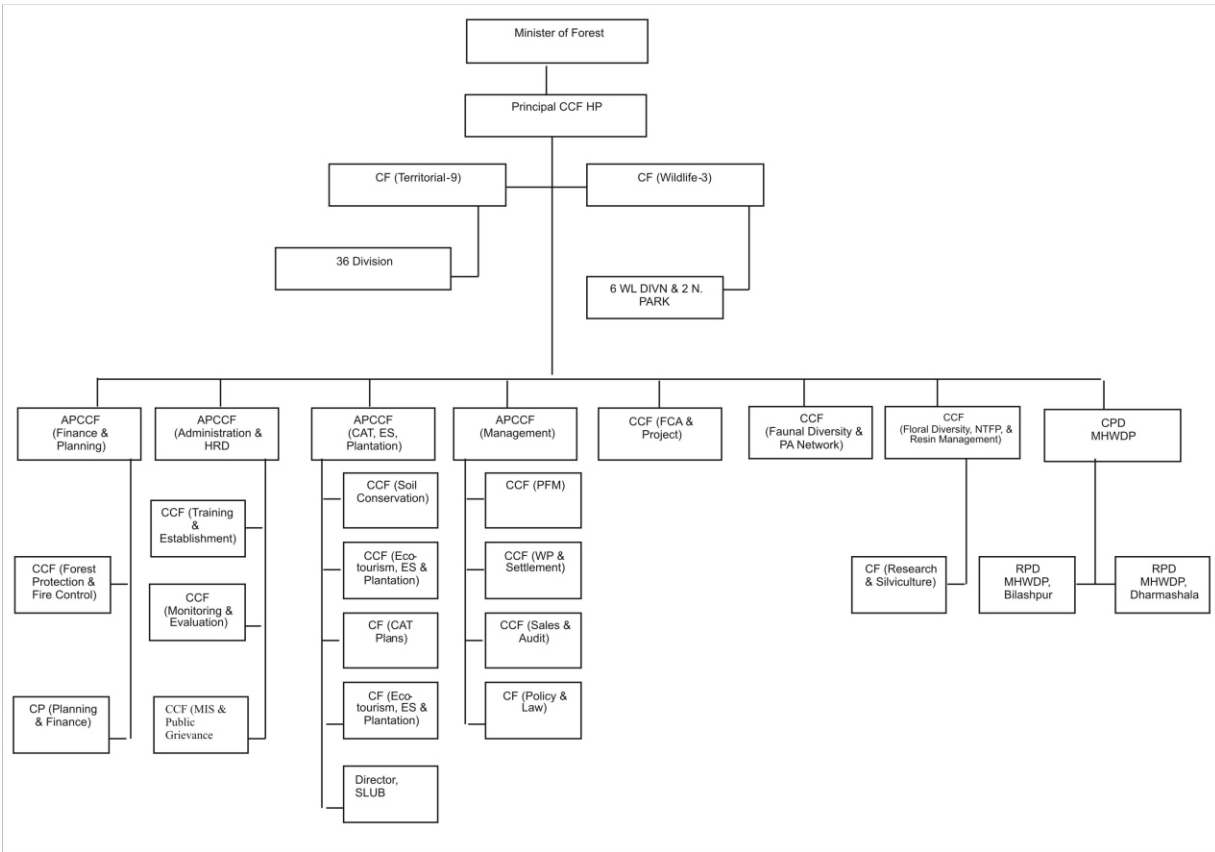
**8. Chief Project Director, Mid Himalayan Watershed Development Project**

He/She is assisted by 2 Regional project director and responsible for proper administration of the affairs and funds of the projects and efficient implementation including management of procurement and disbursement activities, consolidation of annual works programmes and budget, preparation and production of annual progress reports and financial statements and monitoring/evaluation of the project.



In order to address environmental issues identified in concerned sectoral guidelines, a number of interventions are required from line departments. Therefore, based on the above institutional structure, gaps have been identified within the existing institutional framework

which is described in Institutional Mechanism report. Further, institutional responsibilities to implement actions identified and approved by line departments have also been described in Institutional Mechanism Report.



**Figure 4: Institutional mechanisms within the sector to address identified environment issues**

1.9 Data / documentation pertaining to addressing demographic issues in the context of the sectors, such as population changes; requirements of population and changing lifestyles; migratory population including tourists; transhumants; transit labour population; pressures felt by

communities due to degraded environment conditions

High population pressure (human & livestock) on forest resources has been identified as one of the major environmental issue. Increase in timber distribution rights further adds to the existing pressure. Table 48 provides the summary of population, forest area, forest cover and per capita forest area district wise in the State.

Table 48: Forest Area and Population of districts of Himachal Pradesh (Area in km<sup>2</sup>)

District	Geogra-phical Area	Forest Area 2002-03	Population as per 2001 Census	Forest Cover 2003	% age of Forest Cover to Geographical Area	% age of Forest Area to Geographical Area	% age of Total Forest Area in the District	Per Capita Forest Area in ha.
Bilaspur	1,167	428	340,885	358	30.68	36.68	1.16	0.11
Chamba	6,522	5,030	460,887	2,413	37.00	77.12	13.58	0.52
Hamirpur	1,118	219	412,700	242	21.65	19.59	0.59	0.06
Kangra	5,739	2,842	1,339,030	1,867	32.53	49.52	7.67	0.14
Kinnaur	6,401	5,093	78,334	613	9.58	79.57	13.75	0.78
Kullu	5,503	4,952	381,571	1,933	35.13	89.99	13.37	0.51
Lahaul & Spiti	13,841	10,133	33,224	180	1.30	73.21	27.36	0.54
Mandi	3,950	1,860	901,344	1,648	41.72	47.09	5.02	0.18
Shimla	5,131	3,418	722,502	2,383	46.44	66.61	9.23	0.33
Sirmaur	2,825	1,843	458,593	1,379	48.81	65.24	4.98	0.30
Solan	1,936	728	500,557	819	42.30	37.60	1.97	0.16
Una	1,540	487	448,273	518	33.64	31.62	1.32	0.12
Total	55,673	37,033	6,077,900	14,353	25.78	66.52	100.00	0.24

Source: State Environment Report, Himachal Pradesh

**1.10 Information on human resource management issues (which may have relevance to environment management) in the sector such as: manpower, vocational training, awareness levels etc.**

The Forest Department is the nodal department for carrying out all activities connected with forestry and wildlife in the State of Himachal Pradesh. Organization structure of the department is described in section 1.8.

The existing status of Human resource management in forest department of Himachal Pradesh is described in Tables 49, 50, 51 and 52.

**Table 49: Cadre Position of the IFS, HPFS and other Officers**

Sr. No.	Name of post	Sanctioned Posts	In position
1	PCCF	2	1
2	Addl.PCCFs	4	4
3	CCFS	11	11
4	CFs	17	18
5	DCFs	31	27
6	Other on Deputation, Training Reserve & Leave Reserve/ Junior	41	44
7	HPFS Officers	160	151
8	XEN (Forests)	2	2
9	SDO (Forests)	5	5
10	Forest Statistician	1	-
11	FMO	1	-
12	Registrars	3	3
13	Supdt (Gazetted)	23	23
14	Dy. Controllar (F&A)	1	1
15	Section Officer (F&A)	1	1
16	Private Secretary	1	1

**Table 50: Staff Position of Field, Technical, Ministerial & Class-IV cadre**

Sl. No.	Name of Post	Sanctioned	Existing
1	Animal Attendant	26	26
2	Beldar	8	8
3	Boatman	5	5
4	Book Binder	2	2
5	Camel Cart Driver	1	1
6	Carpenter	6	6
7	Chowkidar	462	452
8	Cinema Operator	1	1
9	Clerk/Sr /Jr.Assistant	445	330
10	Compositor	4	5
11	Computer	4	1
12	Conductor	3	3
13	Daftri	10	10
14	Dak Runner	21	21
15	Dandidar	1	2
16	Darkroom Assistant	1	1
17	Demarcation Daroga	22	1
18	Depot Watcher	3	1
19	Deputy Ranger	801	801
20	Distributor	1	1
21	Dispenser	1	1
22	Draftsman	9	7
23	Driver Truck/Bus/van	82	82
24	Electric Mechanic	1	1
25	Electrician	3	4
26	Enclosure Cleaner	2	2
27	Forest Guard	2581	2488
28	Forest Rangers	296	200
29	Forest Worker	3041	3041
30	Gate Keeper	4	4
31	Gestetner Operator	1	1
32	Head Draftsman	13	13
33	Inker	1	3
34	Jamadar	30	30
35	Junior Draftsman	11	11
36	Junior Engineer	7	7

Sl. No.	Name of Post	Sanctioned	Existing
36	Junior Engineer	7	7
37	Junior Photographer	1	1
38	Junior Translator	1	1
39	Kanungo	33	28
40	Khalasi	2	2
41	Line Man	1	0
42	Machine Man	1	1
43	Malies	280	278
44	Masson	1	1
45	Muleman/Syces	19	19
46	Naib Tehsildar	8	8
47	Operator/Mechanic	1	1
48	P.T.I.	1	1
49	Packer	1	1
50	Park Cleaner	1	1
51	Patwari	68	48
52	Peon	565	565
53	Personal Assistant	6	6
54	Photographer-cum-Artist	1	0
55	Plumber	8	8
56	Proof Reader	1	1
57	Restorer	1	1
58	Sawmill Operator	1	1
59	Senior Auditor	2	2
60	Soil Surveyor Assistant	1	1
61	Sr. Assistant	223	218
62	Sr. Lab. Technician	1	0
63	Sr. Photographer	1	1
64	Sr.Scale S.grapher	23	15
65	Statistical Assistant	3	3
66	Steno Typist	13	0
67	Supdt. Gr. II	122	118
68	Surveyor	5	5
69	Sweeper	58	64
70	Taroos	7	1
71	Taxi Dermist	1	0
72	Technical Assistant	1	1
73	Timber Watcher	5	5
74	Tractor Operator	1	0
75	Truck Cleaner	4	2
76	Vet. Pharmacist	3	3
77	Workshop Mechanic	1	1

**Table 51: Forestry Administrative Units As On 31.03.2008**

Offices	Divisions		Ranges		Blocks		Beats	
	(T)	(F)	(T)	(F)	(T)	(F)	(T)	(F)
Principal Chief Conservator of Forests, H P								
CCF (M & E), Sunder Nagar	-	-	-	-	-	-	-	-
CF (Research)	-	-	-	-	-	-	-	-

Offices	Divisions		Ranges		Blocks		Beats	
	(T)	(F)	(T)	(F)	(T)	(F)	(T)	(F)
DCF (Hqrs)	-	-	-	-	-	-	-	-
CF Bilaspur	4	-	19	-	58	-	226	-
CF Chamba	5	-	18	-	57	-	201	-
CF Dharamshala	5	-	23	-	83	-	335	-
CF Kullu	4	-	16	1	43	-	139	-
CF Mandi	5	-	24	-	77	-	294	-
CF Nahan	5	-	22	-	69	-	270	-
CF Rampur	5	1	18	-	52	-	172	-
CF Shimla	4	-	22	1	63	2	230	-
Addl. Principal Chief Conservator of Forests (APD)								
CCF (Administration & HRD)	-	-	-	-	-	-	-	-
CCF (Planning & Finance)	-	-	-	-	-	-	-	-
CF (MIS & PG)	-	1	-	3	-	-	-	-
Addl. Principal Chief Conservator of Forests (Projects)								
CCF (WP), Mandi	-	4	-	-	-	-	-	-
CCF (FCA)	-	-	-	-	-	-	-	-
CF (Projects)	-	2	-	-	-	-	-	-
Addl. Principal Chief Conservator of Forests (CAT Plan)								
CCF (SC & LRM)	-	2	-	-	-	-	-	-
CF (CAT Plan)	-	-	-	-	-	-	-	-
Addl. Principal Chief Conservator of Forests (PFM&FDA), Hamirpur								
CCF (FM, Industry & Law)	-	-	-	-	-	-	-	-
CCF (PS & Audit)	-	-	-	-	-	-	-	-
CF (Policy & Law)	-	-	-	-	-	-	-	-
Chief Project Director (MHWDP)								
Regional Project Director, Bilaspur	-	5	-	-	-	-	-	-
Regional Project Director, D/Shala	-	6	-	-	-	-	-	-
Principal Chief Conservator of Forests (Wildlife) Shimla								
CCF (Eco-Tourism & NTFP)	-	-	-	-	-	-	-	-
CF (Eco-Tourism)	-	-	-	-	-	-	-	-
CCF (Protected Area & Bio-diversity)	-	-	-	-	-	-	-	-
DCF (Hqrs.)	-	-	-	-	-	-	-	-
CF WL, Dharamshala	2	-	5	1	10	-	32	-
CF WL Shimla	3	-	13	-	26	-	60	-
CF GHNP, Shamshi	1	-	8	-	22	-	57	-
Total :	43	21	188	6	560	2	2016	-

(T) - Territorial (F) - Functional

**Table 52: Forestry Personnel in Position as On 31-03-2008**

Sl. No.	Employees	Number
1	Indian Forest Services Officers	103
2	State Forest Services Officers	149
3	Other Technical/ Professional Officers	46
4	Forest Rangers	206
5	Deputy Rangers	794
6	Forest Guards	2474
7	Other Technical Staff	209
8	Ministerial	670
9	Class-IV Employees including forest Workers	4552

Sl. No.	Employees	Number
Total :		9203

Source: Himachal Forest Statistics, 2010

Understaffing and lack of training has been identified as one of the major issues in the forest department. Different types of training and their scope have been identified and described under task 6 of EMP (Establish need for training & capacity enhancement).

### **1.11 Regulatory analysis to identify any regulations that have implications on the environment (negative or positive), and compliance with the same**

Forest & Wildlife and cross sectoral policy and regulatory framework at State level shows the intent of the State Government to address environmental issues related to the sector. A list of policies, plans, programmes, projects is given below.

- National Forest Policy, 1988
- State Forest Policy, 1980
- The Forest Sector Policy. 2005 (State Forest Department)
- Forest (Conservation) Act, 1980
- HP Land Preservation Act, 1978
- HP Municipal Act, 1994
- Afforestation programme: Social and Farm Forestry including Externally aided Projects and Soil Conservation Schemes.
- State and Centrally Sponsored and Externally aided Projects schemes for rehabilitation of degraded forest lands, the village common lands and wastelands.
- The Indian Forest Act, 1927
- The Indian Forest Act (H P Second Amendment Act), 1991
- The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 and its Rules
- Joint Forest Management (JFM) Order 1990 and 2000.
- HP Participatory Forest Management Regulation 2001

- HP Forests (Protection from Fire) Rules, 1999
- Himachal Pradesh Forest (Timber Distribution to the Right Holders) Rules, 2010
- State Medicinal Plants Policy, 2005
- Comensatory Afforestation Fund Management and Planning Authority
- Social and Farm Forestry.
- Urbanisation Policy, 2009
- HP Public Premises and Land (Eviction and Rent Recovery) Act, 1994
- HP Forests (Protection from Fire) Rules, 1999
- National Environment Policy, 2006
- Wildlife Protection Act, 1973 and amendments
- Ecotourism
- National Environment Policy, 2006
- The Environment Protection Act, 1986
- Biological Diversity Act, 2002 and Biological Diversity Rules, 2004

Brief description of these regulations and their linkages to the identified environment issues are given in Sectoral Guidelines on Forests and Wildlife.

### **1.12 Inventory of flora, fauna, aquatic species, inventory of habitats, existing species, endangered species, exotic species, inventory of migratory species and information on biodiversity losses.**

The data on the abovesaid have been given in the above sections. Further, a detailed list of avifauna and plants found in PAs is given

District	National Parks / Wildlife Sanctuaries	Flora (Trees)	Flora (Other Plants)	Fauna
Bilaspur	DARL:- Darlaghat Sanctuary GOB:- Gobind Sagar Sanctuary NAI:- Naina Devi Sanctuary	<i>Acacia catechu</i> (Khair), <i>Aegle marmelos</i> (Bel, Bil), <i>Cassia fistula</i> (Alis, Amaltas), <i>Feronia</i> spp. (Baranasi), <i>Flacourtia</i> spp. (Kangu), <i>Lagerstroemia</i> spp.; <i>Acacia catechu</i> (Khair), <i>Anogeissus latifolia</i> (Chaal, Chhal), <i>Bauhinia purpurea</i> , <i>Grewia optiva</i> (Betul, Beul, Dhamman), <i>Pinus roxburghii</i> (Chil, Chir), <i>Terminalia alata</i> (Alson, Sain), <i>Acacia catechu</i> (Khair), <i>Acacia leucophloea</i> (Reur), <i>Aeglemarmelos</i> (Bel, Bil), <i>Anogeissus latifolia</i> (Chaal, Chhal), <i>Azadirachta indica</i> (Neem, Darek, Drek), <i>Bauhinia racemosa</i> (Koryale), <i>Bombax ceiba</i> (Semal, Simbal), <i>Carpinus viminea</i> (Chakri), <i>Cassia fistula</i> (Alis, Amaltas), <i>Diospyros cordifolia</i> (Dakanan), <i>Ehretia laevis</i> (Chamror), <i>Embblica officinalis</i> (Aonla, Amla), <i>Euphorbia royleana</i> , <i>Ficus benghalensis</i> (Bar), <i>Flacourtia indica</i> (Kangu), <i>Holarrhena antidysenterica</i> (Keor), <i>Mangifera indica</i> (Aam, Amb), <i>Mitragyna parvifolia</i> , <i>Pinus roxburghii</i> (Chil, Chir), <i>Sapium insigne</i> (Balodhar), <i>Syzygium cumini</i> (Jamnoa, Jamun), <i>Ulmus walliciana</i> (Maral, Marn, Moral), <i>Zanthoxylum armatum</i> (Timber)	<i>Carex nubigena</i> , <i>Carissa opaca</i> (Garna, Karaunda, Karonda), <i>Cymbopogon</i> spp., <i>Euphorbia royleana</i> (Chhoin, Chor, Thor), <i>Heteropogon montaus</i> (Makora), <i>Murraya koenigii</i> (Gadhelu, Gandhelu, Gandela), <i>Myrsine Africana</i> , <i>Banbinia vablii</i> (Tor, Taur), <i>Abrus precatorius</i> (Raktan), <i>Aldatoda zeylanica</i> (Basauti, Basuti), <i>Arstida adscensionis</i> (Ludabru), <i>Baubinia vablii</i> (Tor, Taur), <i>Bohriochloa intermedia</i> (Palman), <i>Caesalpinia decapetala</i> (Bara durghar), <i>Carissa opaca</i> (Garna, Karaunda, Karonda), <i>Chrysopogon fulvus</i> (Dhau), <i>Cissampelos pareira</i> (Bhatindu), <i>Clematis gouriana</i> (Chibru), <i>Cryptolepis buchananii</i> (Dudhli), <i>Cuscuta reflexa</i> (Akasbel, Amarbel), <i>Dendrocalamus strictus</i> (Bani), <i>Dodonaea viscosa</i> (Mendu, Mhendu), <i>Eriophorum comosum</i> (Ghor bagar), <i>Eulaliopsis binata</i> (Babhar grass, Bagar), <i>Euphorbia royleana</i> (Chhoin, Chor, Thor), <i>Ichnocarpus frutescens</i> (Bakarbel), <i>Lantana camara</i> (Pardesi buti), <i>Malotus philippensis</i> (Kamal), <i>Mimosa himalayana</i> (Durghari), <i>Murraya koenigii</i> (Gadhelu, Gandhelu, Gandela), <i>Myrsine Africana</i> , <i>Pueraria tuberosa</i> (Slod), <i>Spatholobus parviflorus</i> , <i>Themeda anathera</i> (Alunji), <i>Woodfordia fruticosa</i> , <i>Ziziphus nummularia</i> (Ber), <i>Ziziphus oenoplia</i> (Kokla ber),	Crow, House, ( <i>Corvus splendens</i> ), Junglefowl, Red, ( <i>Gallus gallus</i> ), Partridge, Black, ( <i>Francolinus francolinus</i> ), Partridge, Chukor, ( <i>Alectoris chukar</i> ), Partridge, Grey, ( <i>Francolinus pondicerianus</i> ), Peafowl, Common, ( <i>Pavo cristatus</i> ), Pheasant, Kalij, ( <i>Lophura leucomelana</i> ), Tree Pie, Indian, ( <i>Dendrocitta vagabunda</i> ); Magpie-robin, ( <i>Copsychus saularis</i> ), Pintail, ( <i>Anas acuta</i> ); Bulbul, Redvented, ( <i>Pycnonotus cafer</i> ), Crow, House, ( <i>Corvus splendens</i> ), Crow, Jungle, ( <i>Corvus macrorhynchos</i> ), Eagle, Black, ( <i>Itinaetus malayensis</i> ), Jay, Blackthroated, ( <i>Garrulus lanceolatus</i> ), Junglefowl, Red, ( <i>Gallus gallus</i> ), Myna, Hill, ( <i>Gracula religiosa</i> ), Nuthatch, Chestnutbellied, ( <i>Sitta castanea</i> ), Partridge, Black, ( <i>Francolinus francolinus</i> ), Partridge, Chukor, ( <i>Alectoris chukar</i> ), Partridge, Grey, ( <i>Francolinus pondicerianus</i> ), Peafowl, Common, ( <i>Pavo cristatus</i> ), Pheasant, Kalij, ( <i>Lophura leucomelana</i> ), Pigeon, Blue Rock, ( <i>Columba livia</i> ), Quail, Jungle Bush, ( <i>Perdicula asiatica</i> )
Chamba	GAM:- Gamgul Siahbehi Sanctuary KAI:- Kais Sanctuary KUG:- Kugti	<i>Abies spectabilis</i> (Rai), <i>Acer caesium</i> (Chrandu, Mandar, Rikhandu), <i>Acer caudatum</i> (Mandar), <i>Acer pictum</i> (Mandar, Mandlu, Rikhandlu, Rikhandu), <i>Acer thomsonii</i> (Mandar), <i>Aesculus indica</i> (Pangar, Goon, Gum, Jungli Khanoor, Khanor), <i>Albizia lebbeck</i>	<i>Aconitum chasmanthum</i> (Mohri), <i>Aconitum heterophyllum</i> (Patis, Patish), <i>Aldatoda zeylanica</i> (Basauti, Basuti), <i>Agave americana</i> (Ram ban, Ramban), <i>Ampelocissus latifolia</i> (Pani Bel), <i>Angelica glauca</i> (Chora), <i>Arisaema</i> spp. (Ki-kukri), <i>Artemisia nilagirica</i> (Charmar,	Babbler, Redbilled, ( <i>Stachyris pyrrhops</i> ), Babbler, Rustycheeked Scimitar, ( <i>Pomatorhinus erythrogenis</i> ), Barbet, Great Hill, ( <i>Megalaima virens</i> ), Barbet, Green, ( <i>Megalaima zeylanica</i> ), Bee-eater, Green, ( <i>Merops orientalis</i> ), Bulbul, Black, ( <i>Hypsipetes madagascariensis</i> ),

District	National Parks / Wildlife Sanctuaries	Flora (Trees)	Flora (Other Plants)	Fauna
	Sechu Tuan Nala Sanctuary TUN:- Tundah Sanctuary	<p><i>Alnus nitida</i> (Kosh, Piak),  <i>Azadirachta indica</i> (Neem, Darek, Drek), <i>Bauhinia variegata</i> (Kachnar, Kral), <i>Betula alnoides</i> (Bhuj, Bhujipattara, Kathbhaj),  <i>Betula utilis</i> (Bhiy, Bhoj, Bhojpatra, Bhuj), <i>Bombax ceiba</i> (Semal, Simbal), <i>Buxus wallibiana</i> (Samshad), <i>Carpinus faginea</i> (Chakri), <i>Carpinus viminea</i> (Chakri),  <i>Cedrela serrata</i> (Darle, Dauri, Kharak), <i>Cedrus deodara</i> (Deodar, Diar, Diyar), <i>Celtis australis</i> (Kharak, Khirak), <i>Cornus macrophylla</i> (Haleu), <i>Corylus colurna</i> (Thangi), <i>Cupressus torulosa</i> (Devi, diyar), <i>Dalbergia sissoo</i> (Shisham, Tali), <i>Ehretia acuminata</i> (Punna),  <i>Euonymus fimbriatus</i> (Tritu), <i>Ficus nemoralis</i> (Anzir, Phagoora), <i>Ficus palmata</i> (Phagoora), <i>Ficus racemosa</i> (Phagoora), <i>Ficus religiosa</i> (Peepal), <i>Fraxinus floribunda</i> (Angah, Sunnu, Sunuh), <i>Grewia elastica</i> (Dhamman), <i>Grewia optiva</i> (Betul, Beul, Dhamman),  <i>Juglan regia</i> (Akhrot, Kor, Than), <i>Litsea umbrosa</i> (Chrindi), <i>Litsea umbrosa</i> (Chrindi), <i>Litsea umbrosa</i> (Chrindi), <i>Macchilus odoratissima</i> (Bhadrol, Saincha),  <i>Macchilus duthiei</i> (Bhadrol), <i>Malus baccata</i> (Lewar), <i>Malus pumila</i> (Chun, Seo), <i>Morus alba</i> (Karun, Shahtoot, Shatoot), <i>Morus serrata</i> (Chimu, Karun), <i>Olea ferruginea</i> (Kau), <i>Picea spinulosa</i> (Tosh),  <i>Pinus gerardiana</i> (Neoza, Miri, Chilgoza), <i>Pinus roxburghii</i> (Chil, Chir), <i>Pinus wallibiana</i> (Kail), <i>Pistacia integerrima</i> (Kakkar, Kakeran, Kakare), <i>Populus ciliata</i> (Chalauj, Chaaloon, Pahari peepal), <i>Prunus armeniaca</i> (Chihri, Chir, Chuli), <i>Prunus cornuta</i> (Bird</p>	<p><i>Bambusa arundinacea</i> (Nari),  <i>Bauhinia vablii</i> (Tor, Taur),  <i>Benthamidia capitata</i> (Halen), <i>Berberis aristata</i> (Kashmal, Kashmal, Kemal), <i>Berberis lycium</i> (Kashmal, Kemal), <i>Berberis vulgaris</i> (Kahmal, Kemal), <i>Bergia ligulata</i> (Pathar-Tor),  <i>Cannabis sativa</i> (Bhang), <i>Clematis buchmaniana</i> (Garol), <i>Clematis montana</i> (Garol), <i>Cocculus laurifolius</i> (Nag daun), <i>Coriaria nepalensis</i> (Richh-ka-Ancha), <i>Cotoneaster bacillaris</i> (Banang, Renu; Ruins),  <i>Cotoneaster microphylla</i> (Chamror, Raonsh), <i>Cotoneaster vulgaris</i> (Renu), <i>Cuscuta reflexa</i> (Akasbel, Amarbel), <i>Daphne oleoides</i> (Jiko, Niggi), <i>Daphne papyracea</i> (Kaula, Niggi), <i>Debregeasiapoleuca, esmodium tiliacifolium</i> (Pre, Mortoi), <i>Deutzia corymbosa</i> (Bakhru, Batti), <i>Deutzia staminea</i> (Batti), <i>Dodonaea viscosa</i> (Mendu, Mhendu), <i>Duchesnea indica</i>, <i>Elsboltzia Fruticosa</i> (Dharoos), <i>Ephedra gerardiana</i> (Somlata), <i>Euphorbia royleana</i> (Chhoin, Chor, Thor), <i>Fragaria vesca</i>, <i>Girardinia heterophylla</i> (Ain),  <i>Hedera nepalensis</i> (Kural, Grumru, Grumuru), <i>Ilex diphyrena</i> (Kanderu), <i>Indigofera atropurpurea</i> (Kathi), <i>Indigofera gerardiana</i> (Kathi), <i>Indigofera hirsuta</i> (Kathi), <i>Jasminum humile</i> (Ban chameli, Malti, Sune, Jungli chambeli), <i>Jasminum officinale</i> Chambeli, (Chameli, Jungli chambeli, Malti), <i>Juniperus communis</i> (Bithal, Bither), <i>Juniperus recurva</i> (Bither), <i>Lantana indica</i>, <i>Lonicera angustifolium</i> (Kantias), <i>Lonicera hispida</i>, <i>Lonicera quinquelocularis</i> (Bakhru, Kantias),  <i>Mabonia nepaulensis</i> (Kemal), <i>Myrsine Africana</i>, <i>Otostegia limbata</i> (Boo), <i>Picrorhiza kurrooa</i> (Kaur,</p>	<p>Bulbul, Whitechecked, (<i>Pycnonotus leucogenys</i>), Bunting, Crested, (<i>Melophbus lanthami</i>), Bunting, Greyheaded, (<i>Emberiza fucata</i>), Buzzard, Honey, (<i>Pernis ptilorhynchus</i>), Buzzard- eagle, White-eyed, (<i>Butastur teesa</i>), Chat, Blue, (<i>Eritbacus brunneus</i>), Chough, Yellowbilled, (<i>Pyrrhocorax graculus</i>), Creeper, Wall, (<i>Ticodroma muraria</i>), Crow, Jungle, (<i>Corvus macrorhynchus</i>), Cuckoo, Pied Crested, (<i>Clamator jacobinus</i>), Dove, Indian Ring, (<i>Streptopelia decacto</i>), Dove, Little Brown, (<i>Streptopelia senegalensis</i>), Dove, Rufous Turtle, (<i>Streptopelia orientalis</i>), Dove, Spotted, (<i>Streptopelia chinesis</i>), Eagle, Black, (<i>Ictinaetus malayensis</i>), Eagle, Crested Serpent, (<i>Spilornis cheela</i>), Eagle, Golden, (<i>Aquila chrysaetos</i>), Eagle, Greyheaded Fishing, (<i>Ichthyophaga ichthyetus</i>), Eagle, Imperial, (<i>Aquila beliaea</i>), Eagle, Short-toed, (<i>Circus gallicus</i>), Eagle, Tawny, (<i>Aquila rapax</i>), Egret, Little, (<i>Egretta garzetta</i>), Flycatcher, Greyheaded, (<i>Calicicapa ceylonensis</i>), Flycatcher, Orangeorgeted, (<i>Muscicapa strophiaea</i>), Flycatcher, Paradise, (<i>Terpsiphone paradise</i>), Flycatcher, Rufoustailed, (<i>Muscicapa ruficauda</i>), Flycatcher, Slaty Blue, (<i>Muscicapa leucomelanura</i>), Flycatcher, Sooty, (<i>Muscicapa sibirica</i>), Flycatcher, Verditer, (<i>Muscicapa thalassina</i>), Flycatcher, Whitebrowed Blue, (<i>Muscicapa superciliosa</i>), Flycatcher, Whitethroated Fantail, (<i>Rhipidura albicollis</i>), Flycatcher, Yellowbellied Fantail, (<i>Rhipidura</i></p>



District	National Parks / Wildlife Sanctuaries	Flora (Trees)	Flora (Other Plants)	Fauna
		<p>cherry, Jammu), <i>Prunus domestica</i> (Aloocho), <i>Prunus persica</i> (Aru), <i>Pyrus communis</i> (Nakh), <i>Pyrus pashia</i> (Kainth, Shkegal, Shagal), <i>Quercus dilatata</i>, <i>Quercus incana</i> (Ban, Ban oak), <i>Quercus semecarpifolia</i> (Kharsu), <i>Rhododendron arboreum</i> (Baras, Burash, Cheo), <i>Rhododendron</i> spp., <i>Rhus punjabensis</i> (Tittri), <i>Salix alba</i> (Badda), <i>Salix babylonica</i> (Badda majnu), <i>Salix wallichiana</i> (Badda majnu), <i>Sapindus mukorossi</i> (Ritha), <i>Sorbus lanata</i> (Amlok, Mohal), <i>Symplocos paniculata</i> (Lodhar), <i>Taxus baccata</i> (Barhmi, Barmi), <i>Toona Ciliata</i> (Toon), <i>Ulmus walliciana</i> (Maral, Marn, Moral), <i>Xanthophyllum</i> spp., <i>Ziziphus oxyphylla</i> (Ber); <i>Abies pindrow</i> (Tosh), <i>Acer pictum</i> (Mandar, Mandlu, Rikhandlu, Rikhandu), <i>Aesculus inidca</i> (Pangar, Goon, Gum, Jungli Khanoor, Khanor), <i>Betula utilis</i> (Bhiy, Bhoj, Bhojpatra, Bhuj), <i>Cedrus deodara</i> (Deodar, Diar, Diyar), <i>Juglan regia</i> (Akhrot, Kor, Than), <i>Picea smithiana</i> (Rai, Tosh), <i>Pinus wallichiana</i> (Kail), <i>Prunus cornuta</i> (Bird cherry, Jammu), <i>Quercus semecarpifolia</i> (Kharsu); <i>Abies spectabilis</i> (Rai), <i>Acer caesium</i> (Chrandu, Mandar, Rikhandu), <i>Acer caudatum</i> (Mandar), <i>Acer pictum</i> (Mandar, Mandlu, Rikhandlu, Rikhandu), <i>Acer thomsonii</i> (Mandar), <i>Aesculus indica</i> (Pangar, Goon, Gum, Jungli Khanoor, Khanor), <i>Albizia lebecke</i> (Siris), <i>Albizia odoratissima</i> (Kali siris), <i>Alnus nepalensis</i> (Piak), <i>Alnus nitida</i> (Kosh, Piak), <i>Azadirachta indica</i> (Neem, Darek, Drek), <i>Bauhinia variegata</i> (Kachnar, Kral), <i>Betula alnoides</i> (Bhuj, Bhujji pattara, Kathbhoj), <i>Betula utilis</i> (Bhiy, Bhoj,</p>	<p>Karu), <i>Plectranthus rugosus</i> (Kuthal), <i>Podophyllum hexandrum</i> (Ban-kakri), <i>Prinsepia utilis</i> (Bekal, Bhekhal, Kangora), <i>Rhododendron campanulatum</i> (Sarngar, Kashmiri patha), <i>Rhus cotinus</i> (Tung), <i>Ribes</i> spp. (Rajae), <i>Rosa macrophylla</i> (Ban gulab, Karer, Pahari gulab), <i>Rosa moschata</i> (Ban gulab, Kuin, Kuja, <i>Rubus biflorus</i> (Akhre), <i>Rubus niveus</i> (Akhre), <i>Rubus paniculatus</i> (Akhre), <i>Rumex hastatus</i> (Amlora, Bhilmpira), <i>Sageretia thea</i> (Hankalu, Hanklu), <i>Salvia moorcroftiana</i> (Thuth), <i>Salvia nubicola</i> (Makhiar), <i>Sarcococa saligna</i> (Diun, Taliary), <i>Sausurea lappa</i> (Kuth), <i>Senecio</i> spp., <i>Skimmia arborens</i> (Gurl patta), <i>Smilax glaucophylla</i>, <i>Solanum violaceum</i> (Ban tambacoo), <i>Sorbaria tomentosa</i> (Kande), <i>Staphylea emodi</i> (Nagdaun), <i>Syringa emodi</i> (Chara), <i>Thalictrum foliolosum</i> (Machhar mar), <i>Thymus serpyllum</i> (Ban jawain, Pahari ajwain), <i>Valeriana jatamansi</i> (Smak mushkwala), <i>Verbascum thapsus</i>, <i>Viburnum cotinifolium</i> (Rajal, Talanj, Taliana), <i>Viburnum foetens</i> (Talanj, Tirnoi), <i>Viola odorata</i> (Banafsha), <i>Vitex negundo</i> (Banna), <i>Wikstroemia canescens</i>, <i>Woodfordia fruticosa</i>, <i>erberis</i> spp., <i>Cotoneaster micropphylla</i> (Chamror, Raonsh), <i>Desmodium</i> spp., <i>Dioscorea deltoidea</i> (Kins, Kunj, Calendi, Tardi), <i>Fragaria</i> spp., <i>Hedera nepalensis</i> (Kural, Grumru, Grumuru), <i>Iris</i> spp., <i>Polygonum</i> spp., <i>Trifolium</i> spp., <i>Vitis</i> spp.; <i>Aconitum chasmanthum</i> (Mohri), <i>Aconitum heterophyllum</i> (Patis, Patish), <i>Aibatoda zeylanica</i> (Basauti, Basuti), <i>Agave americana</i> (Ram ban, Ramban), <i>Ampelocissus latifolia</i> (Pani Bel), <i>Angelica glauca</i> (Chora), <i>Arisaema</i> spp. (Ki-kukri),</p>	<p><i>hyposantha</i>), Flycatcher-shrike, Pied, (<i>Hemipus picatus</i>), Flycatcher-warbler, Blackbrowed, (<i>Scicercus burkii</i>), Forktail, Little, (<i>Enicurus scouleri</i>), Goldfinch, (<i>Carduelis carduelis</i>), Grosbeak, Allied, (<i>Coccothraustes icteroides</i>), Hawk-cuckoo, Large, (<i>Cuculus sparverioides</i>), Hawk-eagle, Booted, (<i>Hieraactis pennatus</i>), Hawk-eagle, Crested, (<i>Spizactus cirrhatius</i>), Hawk-eagle, Hodgson's, (<i>Spizactus nipalensis</i>), Hen-harrier, (<i>Circus cyaneus</i>), Hoby, (<i>Falco subbuteo</i>), Hoopoe, (<i>Upupa epops</i>), Jay, Blackthroated, (<i>Garrulus lanceolatus</i>), Kestrel, (<i>Falco tinnunculus</i>), Kite, Pariah, (<i>Milvus migrans</i>), Koel, (<i>Eudynamis scolopacea</i>), Magpie, Redbilled Blue, (<i>Cissa erythrorhyncha</i>), Martin, House, (<i>Delichon urbica</i>), Minivet, Longtailed, (<i>Pericrocotus ethologus</i>), Munia, Spotted, (<i>Lonchura puneculata</i>), Myna, Common, (<i>Acridotheres tristis</i>), Myna, Jungle, (<i>Acridotheres fuscus</i>), Nuthatch, Common, (<i>Sitta europaea</i>), Oriole, Golden, (<i>Oriolus oriolus</i>), Owl, Tawny Wood, (<i>Strix aluco</i>), Owlet, Barred, (<i>Glaucidium cuculoides</i>), Owlet, Collared Pigmy, (<i>Glaucidium brodiei</i>), Parakeet, Alexandrine, (<i>Psittacula eupatria</i>), Parakeet, Blossomheaded, (<i>Psittacula cyanocephala</i>), Partridge, Black, (<i>Francolinus francolinus</i>), Partridge, Chukor, (<i>Alectoris chukar</i>), Partridge, Common Hill, (<i>Arborophila torquella</i>), Partridge, Snow, (<i>Lerwa lerwa</i>), Peafowl, Common, (<i>Pavo cristatus</i>), Pheasant, Chir, (<i>Catrens wallichii</i>), Pheasant, Kalij, (<i>Lophura leucomelana</i>), Pheasant, Koklas,</p>

District	National Parks / Wildlife Sanctuaries	Flora (Trees)	Flora (Other Plants)	Fauna
		Bhojpatra, Bhui), <i>Bombax ceiba</i> (Semal, Simbal), <i>Buxus wallichiana</i> (Samshad), <i>Carpinus faginea</i> (Chakri), <i>Carpinus viminea</i> (Chakri), Cedrela spp., <i>Cedrus deodara</i> (Deodar, Diar, Diyar), <i>Celtis australis</i> (Kharak, Khirak), <i>Cornus macrophylla</i> (Haleu), <i>Corylus colurna</i> (Thangi), <i>Cupressus torulosa</i> (Devi, diyar), <i>Dalbergia sissoo</i> (Shisham, Tali), <i>Ebretia acuminata</i> (Punna), <i>Euonymus fimbriatus</i> (Tritu), <i>Ficus nemoralis</i> (Anzir, Phagoora), <i>Ficus palmata</i> (Phagoora), <i>Ficus racemosa</i> (Phagoora), <i>Ficus religiosa</i> (Peepal), <i>Flacourtia</i> spp. (Kangu), <i>Grewia elastica</i>	<i>Artemisia nilagirica</i> (Charmar, Charmor, Seski), <i>Atropa belladonna</i> (Shafoo), <i>Bambusa arundinacea</i> (Nari), <i>Bauhinia vablii</i> (Tor, Taur), <i>Benthamidia capitata</i> (Halen), <i>Berberis aristata</i> (Kashmal, Kashmal, Kemal), <i>Berberis lycium</i> (Kashmal, Kemal), <i>Berberis vulgaris</i> (Kahmal, Kemal), <i>Bergia ligulata</i> (Pathar-Tor), <i>Cannabis sativa</i> (Bhang), <i>Clematis buchananiana</i> (Garol), <i>Clematis montana</i> (Garol), <i>Cocculus</i>	( <i>Pucrasia macrolopha</i> ), Pheasant, Monal, ( <i>Lophoborus impejanus</i> ), Pigeon, Wedgetailed Green, ( <i>Treron sphenura</i> ), Pigeon, Wood, ( <i>Columba palumbus</i> ), Pipit, Indian Tree, ( <i>Anthus bodgsoni</i> ), Redstart, Black, ( <i>Phoenicurus ochrurus</i> ), Rosefinch, Common, ( <i>Carpodacus erythrinus</i> ), Rosefinch, Whitebrowed, ( <i>Carpodacus thura</i> ), Rubythroat, Himalayan, ( <i>Eribacus pectoralis</i> ), Shikra, ( <i>Accipiter badius</i> ), Shrike, Baybacked, ( <i>Lanius vittatus</i> ), Shrike, Rufousbacked, ( <i>Lanius schachl</i> ), Snowcock, Himalayan, ( <i>Tetraogallus himalayensis</i> ), Sparrow, House, ( <i>Passer domesticus</i> ), Sparrow-hawk,
		(Dhamman), <i>Grewia optiva</i> (Betul, Beul, Dhamman), <i>Juglan regia</i> (Akhror, Kor, Than), <i>Litsea umbrosa</i> (Chrindi), <i>Litsea umbrosa</i> (Chrindi), <i>Macchilus odoratissima</i> (Bhadrol, Saincha), <i>Macchilus duthiei</i> (Bhadrol), <i>Malus baccata</i> (Lewar), <i>Malus pumila</i> (Chun, Seo), <i>Morus alba</i> (Karun, Shahtoot, Shatoot), <i>Morus serrata</i> (Chimu, Karun), <i>Olea ferruginea</i> (Kau), <i>Picea spinulosa</i> (Tosh), <i>Pinus gerardiana</i> (Neoza, Miri, Chilgoza), <i>Pinus roxburghii</i> (Chil, Chir), <i>Pinus wallichiana</i> (Kail), <i>Pistacia integerrima</i> (Kakkar, Kakeran, Kakare), <i>Populus ciliata</i> (Chalauj, Chaaloon, Pahari peepal), <i>Prunus armeniaca</i> (Chihri, Chir, Chuli), <i>Prunus cornuta</i> (Bird cherry, Jammu), <i>Prunus domestica</i> (Aloocha), <i>Prunus persica</i> (Aru), <i>Pyrus communis</i> (Nakh), <i>Pyrus pasbia</i> (Kainth, Shkegal, Shagal), <i>Quercus dilatata</i> , <i>Quercus incana</i> (Ban, Ban oak), <i>Quercus semecarpifolia</i> (Kharsu), <i>Rhododendron arboreum</i> (Baras, Burash, Cheo), <i>Rhus chinensis</i>	<i>Laurifolius</i> (Nag daun), <i>Coriaria nepalensis</i> (Richh-ka-Ancha), <i>Cotoneaster bacillaris</i> (Banang, Renu; Ruins), <i>Cotoneaster microphylla</i> (Chamror, Raonsh), <i>Cotoneaster vulgaris</i> (Renu), <i>Cuscuta reflexa</i> (Akasbel, Amarbel), <i>Dactylis glomerata</i> , <i>Daphne papyracea</i> (Kaula, Niggi), <i>Debregeasiuhypoleuca</i> , <i>Desmodium tiliaefolium</i> (Pre, Mortoi), <i>Deutzia corymbosa</i> (Bakhru, Batti), <i>Deutzia staminea</i> (Batti), <i>Dodonaea viscosa</i> (Mendu, Mhendu), <i>Duchesnea indica</i> , <i>Elsholtzia Fruticosa</i> (Dharoos), <i>Ephedra gerardiana</i> (Somlata), <i>Euphorbia royleana</i> (Chhoin, Chor, Thor), <i>Fragaria vesca</i> , <i>Girardinia heterophylla</i> (Ain), <i>Hedera nepalensis</i> (Kural, Grumru, Grumuru), <i>Ilex diphyrena</i> (Kanderu), <i>Indigofera atropurpurea</i> (Kathi), <i>Indigofera gerardiana</i> (Kathi), <i>Indigofera birsuta</i> (Kathi), <i>Jasminum humile</i> (Ban chameli, Malti, Sune, Jungli chambeli), <i>Jasminum officinale</i> Chambeli, (Chameli, Jungli chambeli, Malti), <i>Juniperus communis</i>	( <i>Accipiter nisus</i> ), Sparrow-hawk, Besra, ( <i>Accipiter virgatus</i> ), Sunbird, Purple, ( <i>Nectarinia asiatica</i> ), Swallow, ( <i>Hirundo rustica</i> ), Swallow, Wiretailed, ( <i>Hirundo smithii</i> ), Swift, Alpine, ( <i>Apus melba</i> ), Swift, House, ( <i>Apus affinis</i> ), Swift, Large Whiterumped, ( <i>Apus pacificus</i> ), Swift, Whitethroated Spinetail, ( <i>Chaetura caudacuta</i> ), Swiftlet, Himalayan, ( <i>Collocalia brevirostris</i> ), Tailorbird, ( <i>Orthotomus sutorius</i> ), Thrush, Blueheaded Rock, ( <i>Monticola cinclorhynchus</i> ), Thrush, Redheaded Laughing, ( <i>Garrulax erythrocephalus</i> ), Thrush, Streaked Laughing, ( <i>Garrulax lineatus</i> ), Thrush, Striated Laughing, ( <i>Garrulax striatus</i> ), Thrush, Variegated Laughing, ( <i>Garrulax variegates</i> ), Thrush, Whitethroated Laughing, ( <i>Garrulax albogularis</i> ), Tit, Greenbacked, ( <i>Parus monticolus</i> ), Tit, Grey, ( <i>Parus major</i> ), Tit- babbler, Whitebrowed, ( <i>Alcippe vinipectus</i> ),

District	National Parks / Wildlife Sanctuaries	Flora (Trees)	Flora (Other Plants)	Fauna
		<p>(Arkhar), <i>Rhus punjabensis</i> (Tittri), <i>Salix alba</i> (Badda), <i>Salix babylonica</i> (Badda majnu), <i>Salix wallichiana</i> (Badda majnu), <i>Sapindus mukorossi</i> (Ritha), <i>Sorbus lanata</i> (Amlok, Mohal), <i>Symplocos paniculata</i> (Lodhar), <i>Taxus baccata</i> (Barhmi, Barmi), <i>Toona Ciliata</i> (Toon), <i>Ulmus walliciana</i> (Maral, Marn, Moral), <i>Zanthoxylum armatum</i> (Timber), <i>Ziziphus oxyphylla</i> (Ber); <i>Abies pindrow</i> (Tosh), <i>Acer caesium</i> (Chrandu, Mandar, Rikhandu), <i>Aesculus inidca</i> (Pangar, Goon, Gum, Jungli Khanor, Khanor), <i>Alnus nitida</i> (Kosh, Piak), <i>Betula utilis</i> (Bhiy, Bhoj, Bhojpatra, Bhui), <i>Cedrus deodara</i> (Deodar, Diar, Diyar), <i>Celtis australis</i> (Kharak, Khirak), <i>Corylus colurna</i> (Thangi), <i>Cotoneaster affinis</i> (Renus), <i>Cotoneaster racemiflora</i> (Renus), <i>Cotoneaster vulgaris</i> (Renus), <i>Crataegus oxyacantha</i> (Pangyar), <i>Fraxinus floribunda</i> (Angah, Sunnu, Sunuh), <i>Fraxinus xanthoxylodes</i> (Sanjal), <i>Hippophae rhamnoides</i> (Chug), <i>Juglan regia</i> (Akhrot, Kor, Than), <i>Juniperus macropoda</i> (Bhotal), <i>Malus baccata</i> (Lewar),</p>	<p>(Bithal, Bither), <i>Juniperus recurva</i> (Bither), <i>Lantana indica</i>, <i>Lonicera angustifolium</i> (Kantias), <i>Lonicera hispida</i>, <i>Lonicera quinquelocularis</i> (Bakhru, Kantias), <i>Mabonia nepaulensis</i> (Kemal), <i>Myrsine Africana</i>, <i>Otostegia limbata</i> (Boo), <i>Parrotiopsis jacquemontiana</i> (Kilar, Killar), <i>Picrorhiza kurroa</i> (Kaur, Karu), <i>Plectranthus rugosus</i> (Kuthal), <i>Podophyllum hexandrum</i> (Ban-kakri), <i>Prinsepia utilis</i> (Bekal, Bhekhal, Kangora), <i>Rhododendron campanulatum</i> (Sarngar, Kashmiri patha), <i>Rhus cotinus</i> (Tung), <i>Ribes</i> spp. (Rajae), <i>Rosa macrophylla</i> (Ban gulab, Karer, Pahari gulab), <i>Rosa moschata</i> (Ban gulab, Kuin, Kuja), <i>Rubus biflorus</i> (Akhre), <i>Rubus niveus</i> (Akhre), <i>Rubus paniculatus</i> (Akhre), <i>Rumex hastatus</i> (Amlora, Bhilmpura), <i>Sageretia thea</i> (Hankalu, Hanklu), <i>Salvia moorcroftiana</i> (Thuth), <i>Salvia nubicola</i> (Makhlar), <i>Sarcococa saligna</i> (Diun, Taliary), <i>Sausurea lappa</i> (Kuth), <i>Senecio</i> spp., <i>Skinimia arborescens</i> (Gurl patta), <i>Smilax glaucophylla</i>, <i>Solanum</i></p>	<p>Tragopan, Western, (<i>Tragopanmelanocephalus</i>), Tree Pie, Himalayan, (<i>Dendrocitta formosae</i>), Twite, (<i>Acanthis flavirostris</i>), Vulture, Bearded, (<i>Gypaetus barbatus</i>), Vulture, Griffon, (<i>Gyps fulvus</i>), Vulture, Indian Longbilled, (<i>Gyps indicus</i>), Vulture, Indian Whitebacked, (<i>Gyps bengalensis</i>), Wagtail, Grey, (<i>Motacilla cinerea</i>), Warbler, Dusky Leaf, (<i>Phylloscopus fuscatus</i>), Warbler, Olivaceous Leaf, (<i>Phylloscopus griseolus</i>), Warbler, Orangebarred Leaf, (<i>Phylloscopus pulcher</i>), Warbler, Tytler's Leaf, (<i>Phylloscopus tytleri</i>), Warbler, Yellowbrowed Leaf, (<i>Lophophanes inornatus</i>), White-eye, (<i>Zosterops palpebrosa</i>), Woodpecker, Blacknaped Green, (<i>Picus canus</i>), Woodpecker, Scalybellied Green, (<i>Picus squamatus</i>), Wren, (<i>Troglodytes troglodytes</i>); Minivet, Scarlet, (<i>Pericrocotus flammeus</i>), Pheasant, Chir, (<i>Catreus wallichii</i>), Pheasant, Kalij, (<i>Lophura leucomelana</i>), Pheasant, Koklas, (<i>Pucrasia macrolopha</i>), Pheasant, Monal, (<i>Lophophorus impejanus</i>), Tit, Grey, (<i>Parus major</i>), Tragopan, Western Tragopan</p>
		<p><i>Malus pumila</i> (Chun, Seo), <i>Picea smithiana</i> (Rai, Tosh), <i>Pinus gerardiana</i> (Neoza, Miri, Chilgoza), <i>Pinus wallichiana</i> (Kail), <i>Populus alba</i> (Safeda), <i>Populus ciliata</i> (Chalauj, Chaaloon, Pahari peepal), <i>Prunus armeniaca</i> (Chihri, Chir, Chuli), <i>Prunus cornuta</i> (Bird cherry, Jammu), <i>Pyrus communis</i> (Nakh), <i>Salix daphnoides</i> (Bes), <i>Salix elegans</i> (Bes), <i>Salix fragilis</i> (Bes), <i>Sorbus aucuparia</i> (Jhanwar), <i>Sorbus lanata</i></p>	<p><i>Violaceum</i> (Ban tambacoo), <i>Sorbaria tomentosa</i> (Kande), <i>Spiraea</i> spp., <i>Syringa emodi</i> (Chara), <i>Thalictrum foliolosum</i> (Machhar mar), <i>Thymus serpyllum</i> (Ban jawain, Pahari ajwain), <i>Valeriana jatamansi</i> (Smak mushkwala), <i>Verbascum thapsus</i>, <i>Viburnum cotinifolium</i> (Rajal, Talanj, Taliana), <i>Viburnum foetens</i> (Talanj, Tirnoi), <i>Viola odorata</i> (Banafsha), <i>Vitex negundo</i> (Banna), <i>Wikstroemia canescens</i>, <i>Woodfordia</i></p>	<p><i>Melanocephalus</i> Babbler, Redbilled, (<i>Stachyris pyrrhops</i>), Babbler, Rustychecked Scimitar, (<i>Pomatorhinus erythrogenys</i>), Barbet, Great Hill, (<i>Megalaima virens</i>), Barbet, Green, (<i>Megalaima zeylanica</i>), Bee-eater, Green, (<i>Merops orientalis</i>), Bulbul, Black, (<i>Hypsipetes madagascariensis</i>), Bulbul, Redvented, (<i>Pycnonotus cafer</i>), Bulbul, Whitechecked, (<i>Pycnonotus leucogenys</i>), Bunting,</p>

District	National Parks / Wildlife Sanctuaries	Flora (Trees)	Flora (Other Plants)	Fauna
		<p>(Amlok, Mohal), <i>Ulmus villosa</i>;  <i>Abies spectabilis</i> (Rai), <i>Acer caesium</i>  (Chrandu, Mandar, Rikhandu),  <i>Acer caudatum</i> (Mandar), <i>Acer pictum</i>  (Mandar, Mandlu, Rikhandlu,  Rikhandu), <i>Acer thomsonii</i>  (Mandar), <i>Aesculus inida</i> (Pangar,  Goon, Gum, Jungli Khanoor,  Khanor), <i>Albizia lebecke</i> (Siris),  <i>Albizia odoratissima</i> (Kali siris),  <i>Alnus nepalensis</i> (Piak), <i>Alnus nitida</i>  (Kosh, Piak), <i>Azadirachta indica</i>  (Neem, Darek, Drek), <i>Bauhinia</i>  <i>variegata</i> (Kachnar, Kral), <i>Betula</i>  <i>alnoides</i> (Bhuj, Bhujji pattara,  Kathbhoj), <i>Betula utilis</i> (Bhiy, Bhoj,  Bhojpatra, Bhuj), <i>Bombax ceiba</i>  (Semal, Simbal), <i>Bucus wallichiana</i>  (Samshad), <i>Carpinus faginea</i>  (Chakri), <i>Carpinus viminea</i> (Chakri),  <i>Cedrela serrata</i> (Darle, Dauri,  Kharak), <i>Cedrus deodara</i> (Deodar,  Diar, Diyar), <i>Celtis australis</i>  (Kharak, Khirak), <i>Cornus</i>  <i>macrophylla</i> (Haleu), <i>Corylus colurna</i>  (Thangi), <i>Cupressus torulosa</i> (Devi,  diyar), <i>Dalbergia sissoo</i> (Shisham,  Tali), <i>Ebretia acuminata</i> (Punna),  <i>Euonymus fimbriatus</i> (Tritu), <i>Ficus</i>  <i>memoralis</i> (Anzir, Phagoora), <i>Ficus</i>  <i>palmata</i> (Phagoora), <i>Ficus racemosa</i>  (Phagoora), <i>Ficus religiosa</i> (Peepal),  <i>Ficus</i> spp., <i>Frascinus floribunda</i>  (Angah, Sunnu, Sunuh), <i>Grewia</i>  <i>elastica</i> (Dhamman), <i>Grewia optiva</i>  (Betul, Beul, Dhamman), <i>Juglan</i>  <i>regia</i> (Akhrot, Kor, Than), <i>Litsea</i>  <i>umbrosa</i> (Chrindi), <i>Macbilus</i>  <i>odoratissima</i> (Bhadrol, Saincha),  <i>Macbilus duthiei</i> (Bhadrol), <i>Malus</i>  <i>baccata</i> (Lewar), <i>Malus pumila</i>  (Chun, Seo), <i>Morus alba</i> (Karun,  Shahtoot, Shatoot), <i>Morus serrata</i>  (Chimu, Karun), <i>Olea ferruginea</i>  (Kau), <i>Picea</i></p>	<p><i>fruticosa</i>, <i>Aconitum heterophyllum</i>  (Patis, Patish), <i>Aconitum violaceum</i>  (Tilla), <i>Agropyron canaliculatum</i>,  <i>Agropyronsemicostatum</i>, <i>Andrachne</i>  <i>cordifolia</i>, <i>Angelica glauca</i> (Chora),  <i>Arisaema helleberifolium</i> (Kikuri),  <i>Artemisia maritima</i> (Gandha,  Seski), <i>Astragalus cicerifolius</i>, <i>Berberis</i>  <i>angulosa</i>, <i>Berberis aristata</i> (Kashmal,  Kashmal, Kemal), <i>Berberis</i>  <i>umbellata</i> (Kahmal), <i>Berberis vulgaris</i>  (Kahmal, Kemal), <i>Berberis</i>  <i>edgeworthii</i>, <i>Bergenia ciata</i>  (Pathartor), <i>Bothriochloa ischaemum</i>,  <i>Brachypodium sylvaticum</i>, <i>Bromus asper</i>,  <i>Bromus japonicus</i>, <i>Bromuscyodon</i>,  <i>Buddleja paniculata</i> (Safed chindwa),  <i>Calamagrostis pseudopbragmites</i>,  <i>Clematis buchananiana</i> (Garol),  <i>Clematis connata</i> (Garol), <i>Clematis</i>  <i>montana</i> (Garol), <i>Clematis orientalis</i>  (Garol), <i>Dactylis glomerata</i>,  <i>Desmodium tiliacifolium</i> (Pre, Mortoi),  <i>Deutzia corymbosa</i> (Bakhru, Batti),  <i>Deutzia staminea</i> (Batti), <i>Dioscorea</i>  <i>deltoides</i> (Kins, Kunj, Calendi,  Tardi), <i>Elaeagnus umbellata</i>  (Chindar), <i>Ephedra gerardiana</i>  (Somlata), <i>Eremurus himalaicus</i>  (Chukri), <i>Euonymus fimbriatus</i>,  <i>Euonymus hamiltonianus</i> (Pappar),  <i>Festuca rubra</i>, <i>Indigofera bebetata</i>  (Ban shagal), <i>Jasminum humile</i> (Ban  chameli, Malti, Sune, Jungli  chambeli), <i>Jasminum officinale</i>  Chambeli, Chameli, Jungli  chambeli, Malti), <i>Juniperus communis</i>  (Bithal, Bither), <i>Juniperus squamata</i>,  <i>Juniperus wallichiana</i>, <i>Jurinea</i>  <i>macrocephala</i> (Dhup), <i>Koeleria</i>  <i>cristata</i>, <i>Lonicera angustifoliacum</i>  (Kantias), <i>Lonicera hispida</i>,  <i>Lonicera</i></p>	<p>Crested, (<i>Melophus lantbami</i>),  Bunting, Greyheaded, (<i>Emberiza</i>  <i>fucata</i>), Buzzard, Honey, (<i>Pernis</i>  <i>ptilorhynchus</i>), Buzzard- eagle,  White-eyed, (<i>Butastur teesa</i>), Chat,  Blue, (<i>Eritbacus brunneus</i>),  Chough, Yellowbilled,  (<i>Pyrhocorax graculus</i>), Creeper,  Wall, (<i>Ticodroma muraria</i>), Crow,  Jungle, (<i>Corvus macrorhynchus</i>),  Cuckoo, Pied Crested, (<i>Clamator</i>  <i>jacobinus</i>), Dove, Indian Ring,  (<i>Streptopelia decaocto</i>), Dove,  Little Brown, (<i>Streptopelia</i>  <i>senegalensis</i>), Dove, Rufous Turtle,  (<i>Streptopelia orientalis</i>), Dove,  Spotted, (<i>Streptopelia chinesis</i>),  Drongo, Black, (<i>Dicrurus</i>  <i>adsimilis</i>), Eagle, Black, (<i>Ictinaetus</i>  <i>malayensis</i>), Eagle, Crested  Serpent, (<i>Spilornis cheela</i>), Eagle,  Golden, (<i>Aquila chrysaetos</i>), Eagle,  Greyheaded Fishing,  (<i>Ichthyophagaichthyaetus</i>), Eagle,  Imperial, (<i>Aquila beliaea</i>), Eagle,  Short-toed, (<i>Circus gallicus</i>),  Eagle, Tawny, (<i>Aquila rapax</i>),  Flycatcher, Greyheaded,  (<i>Culicicapa ceylonensis</i>), Flycatcher,  Orangeorgeted, (<i>Muscicapa</i>  <i>strophitata</i>), Flycatcher, Paradise,  (<i>Terpsiphone paradise</i>), Flycatcher,  Rufoustailed, (<i>Muscicapa</i>  <i>ruficauda</i>), Flycatcher,  Slaty Blue, (<i>Muscicapa</i>  <i>leucomelanura</i>), Flycatcher, Sooty,  (<i>Muscicapa sibirica</i>), Flycatcher,  Verditer, (<i>Muscicapa thalassina</i>),  Flycatcher,  Whitebrowed Blue, (<i>Muscicapa</i>  <i>superciliaris</i>), Flycatcher,  Whitethroated Fantailm,  (<i>Rhipidura albicollis</i>), Flycatcher-  shrike, Pied, (<i>Hemipus picatus</i>),  Flycatcher-warbler, Blackbrowed,</p>

District	National Parks / Wildlife Sanctuaries	Flora (Trees)	Flora (Other Plants)	Fauna
		<p><i>spinulosa</i> (Tosh), <i>Pinus gerardiana</i> (Neoza, Miri, Chilgoza), <i>Pinus roxburghii</i> (Chil, Chir), <i>Pinus wallichiana</i> (Kail), <i>Pistacia integerrima</i> (Kakkar, Kakeran, Kakare), <i>Populus ciliata</i> (Chalauj, Chaaloon, Pahari peepal), <i>Prunus armeniaca</i> (Chihri, Chir, Chuli), <i>Prunus cornuta</i> (Bird cherry, Jammu), <i>Prunus domestica</i> (Aloocho), <i>Prunus persica</i> (Aru), <i>Pyrus communis</i> (Nakh), <i>Pyrus pasbia</i> (Kainth, Shkegal, Shagal), <i>Quercus dilatata</i>, <i>Quercus incana</i> (Ban, Ban oak), <i>Quercus semecarpifolia</i> (Kharsu), <i>Rhododendron arboreum</i> (Baras, Burash, Cheo), <i>Rhus chinensis</i> (Arkhar), <i>Rhus punjabensis</i> (Tittri), <i>Salix alba</i> (Badda), <i>Salix babylonica</i> (Badda majnu), <i>Salix wallichiana</i> (Badda majnu), <i>Sapindus mukerossi</i> (Ritha), <i>Sorbus lanata</i> (Amlok, Mohal), <i>Symplocos paniculata</i> (Lodhar), <i>Taxus baccata</i> (Barhmi, Barmi), <i>Toona ciliata</i> (Toon), <i>Ulmus walliciana</i> (Maral, Marn, Moral), <i>Zanthoxylum armatum</i> (Timber), <i>Ziziphus oxyphylla</i> (Ber).</p>	<p><i>obovata</i>, <i>Loniceraorientalis</i>, <i>Lonicera parvifolia</i>, <i>Lonicera purpurascens</i>, <i>Lonicera quinquelocularis</i> (Bakhru, Kantias), <i>Morchella esculanta</i> (Guchhi), <i>Parrotiopsis jacquemontiana</i> (Kilar, Killar), <i>Pergularia daemia</i> (Trotu), <i>Perovskia atriplicifolia</i>, <i>Picrorhiza kurroa</i> (Kaur, Karu), <i>Podophyllum hexandrum</i> (Ban-kakri), <i>Potentilla salesoviana</i>, <i>Prunus jacquemontii</i>, <i>Prunus prostrate</i>, <i>Rhamnus virgatus</i>, <i>Rhododendronanthopogon</i>, <i>Rhododendron campanulatum</i> (Sarngar, Kashmiri patha), <i>Rhododendron lepidotum</i> (Sumral), <i>Ribes alpestre</i> (Tara amlu), <i>Ribes orientale</i> (Thala arulu), <i>Ribes rubrum</i> (Nabhar), <i>Rosa centifolia</i> (Gulab), <i>Rosa foetida</i> (Pila gulab), <i>Rosa macrophylla</i> (Ban gulab, Karer, Pahari gulab), <i>Rosa moschata</i> (Ban gulab, Kuin, Kuja), <i>Rosa webbiana</i> (Gulab), <i>Rubus biflorus</i> (Akhre), <i>Sageretia thea</i> (Hankalu, Hanklu), <i>Salix lindleyana</i>, <i>Salix viminalis</i>, <i>Salvia moorcroftiana</i> (Thuth), <i>Salvia nubicola</i> (Makhlar), <i>Sausurea lappa</i> (Kuth), <i>Sorbaria tomentosa</i> (Kande), <i>Spiraea bella</i>, <i>Spiraea canescens</i>, <i>Sitpa himalaica</i>, <i>Thymus serpyllum</i> (Ban jawain, Pahari ajwain), <i>Valeriana jatamansi</i> (Smak mushkwala), <i>Viburnum cotinifolium</i> (Rajal, Talanj, Taliana), <i>Viburnum grandiflorum</i> (Talanj), <i>Aconitum chasmanthum</i> (Mohri), <i>Aconitum heterophyllum</i> (Patis, Patish), <i>Adhatoda zeylanica</i> (Basauti, Basuti), <i>Agave americana</i> (Ram ban, Ramban), <i>Ampelocissus latifolia</i> (Pani Bel), <i>Angelica glauca</i> (Chora), <i>Arisaema</i> spp. (Ki-kuktri), <i>Artemisia nilagirica</i> (Charmar, Charmor, Seski), <i>Atropa belladonna</i> (Shafoo), <i>Bambusa arundinacea</i> (Nari),</p>	<p>(<i>Scicercus burkii</i>), Flycatcher-warbler, Greyheaded, (<i>Scicercus xanthoschistos</i>), Forktail, Spotted, (<i>Enicurus maculatus</i>), Goldfinch, (<i>Carduelis carduelis</i>), Grosbeak, Allied, (<i>Coccothraustes icteroides</i>), Hawk-cuckoo, Large, (<i>Cuculus sparveroides</i>), Hawk-eagle, Booted, (<i>Hieraetus pennatus</i>), Hawk-eagle, Crested, (<i>Spizactus cirrhatius</i>), Hawk-eagle, Hodgson's, (<i>Spizactus nipalensis</i>), Hen-harrier, (<i>Circus cyaneus</i>), Hoby, (<i>Falco subbuteo</i>), Hoopoe, (<i>Upupa epops</i>), Jay, Blackthroated, (<i>Garrulus lanceolatus</i>), Kestrel, (<i>Falco tinnunculus</i>), Kite, Pariah, (<i>Milvus migrans</i>), Koel, (<i>Endynamys scolopacea</i>), Magpie, Redbilled Blue, (<i>Cissa erythrorhyncha</i>), Martin, House, (<i>Delichon urbica</i>), Minivet, Longtailed, (<i>Pericrocotus ethologus</i>), Munia, Spotted, (<i>Lonchura puneculata</i>), Myna, Common, (<i>Acridotheres tristis</i>), Myna, Jungle, (<i>Acridotheres fuscus</i>), Nuthatch, Whitecheeked, (<i>Sitta leucopsis</i>), Oriole, Golden, (<i>Oriolus oriolus</i>), Owl, Tawny Wood, (<i>Strix aluco</i>), Owllet, Barred, (<i>Glaucidium cuculoides</i>), Owllet, Collared Pigmy, (<i>Glaucidium brodiei</i>), Parakeet, Alexandrine, (<i>Psittacula eupatria</i>), Parakeet, Blossomheaded, (<i>Psittacula cyanocephala</i>), Partridge, Black, (<i>Francolinus francolinus</i>), Partridge, Chukor, (<i>Alectoris chukar</i>), Partridge, Common Hill, (<i>Arborophila torqueola</i>), Partridge, Snow, (<i>Lerwa lerwa</i>), Peafowl, Common, (<i>Pavo cristatus</i>), Pheasant, Chir, (<i>Catrens wallichii</i>), Pheasant, Kalij, (<i>Lophura leucomelana</i>), Pheasant, Koklas, (<i>Pucrasia macrolopha</i>), Pheasant,</p>

District	National Parks / Wildlife Sanctuaries	Flora (Trees)	Flora (Other Plants)	Fauna
			<p><i>Bauhinia vahlia</i> (Tor, Taur),  <i>Benthamidia capitata</i> (Halen), <i>Berberis aristata</i> (Kashmal, Kashmal, Kemal), <i>Berberis lycium</i> (Kashmal, Kemal), <i>Berberis vulgaris</i> (Kahmal, Kemal), <i>Bergia ligulata</i> (Pathar-Tor), <i>Cannabis sativa</i> (Bhang), <i>Clematis montana</i> (Garol), <i>Cocculus laurifolius</i> (Nag daun), <i>Coriaria nepalensis</i> (Richh-ka-Ancha), <i>Cotoneaster bacillaris</i> (Banang, Renus Ruins), <i>Cotoneaster microphylla</i></p>	<p>Monal, (<i>Lophoborus impejanus</i>), Pigeon, Wedgetailed Green, (<i>Treron sphenura</i>), Pigeon, Wood, (<i>Columba palumbus</i>), Pipit, Indian Tree, (<i>Anthus hodgsoni</i>), Redstart, Black, (<i>Phoenicurus ochruros</i>), Rosefinch, Common, (<i>Carpodacus erythrinus</i>), Rosefinch, Whitebrowed, (<i>Carpodacus thura</i>), Rubythroat, Himalayan, (<i>Eritrichus pectoralis</i>), Shikra, (<i>Accipiter badius</i>), Shrike, Baybacked, (<i>Lanius vittatus</i>), Shrike, Rufousbacked, (<i>Lanius schach</i>), Snowcock, Himalayan, (<i>Tetraogallus himalayensis</i>), Sparrow, House, (<i>Passer domesticus</i>), Sparrow-hawk,</p>
			<p>(Chamror, Raonsh), <i>Cotoneaster vulgaris</i> (Renus), <i>Cuscuta reflexa</i> (Akasbel, Amarbel), <i>Daphne oleoides</i> (Jiko, Niggi), <i>Daphne papyracea</i> (Kaula, Niggi), <i>Debregeasia hypoleuca</i>, <i>Desmodium tiliaefolium</i> (Pre, Mortoi), <i>Deutzia corymbosa</i> (Bakhru, Batti), <i>Deutzia staminea</i> (Batti), <i>Dodonaea viscosa</i> (Mendu, Mhendu), <i>Duchesnea indica</i>, <i>Elsholtzia Fruticosa</i> (Dharoos), <i>Ephedra gerardiana</i> (Somlata), <i>Euphorbia royleana</i> (Chhoin, Chor, Thor), <i>Fragaria vesca</i>, <i>Girardinia heterophylla</i> (Ain), <i>Hedera nepalensis</i> (Kural, Grumru, Grumuru), <i>Ilex diphyrena</i> (Kanderu), <i>Indigofera atropurpurea</i> (Kathi), <i>Indigofera gerardiana</i> (Kathi), <i>Indigofera hirsuta</i> (Kathi), <i>Jasminum humile</i> (Ban chameli, Malti, Sune, Jungli chambeli), <i>Jasminum officinale</i> (Chambeli, Chameli, Jungli chambeli, Malti), <i>Juniperus communis</i> (Bithal, Bither), <i>Juniperus recurva</i> (Bither), <i>Lantana indica</i>, <i>Lonicera angustifolium</i> (Kantias), <i>Lonicera hispida</i>, <i>Lonicera quinquelocularis</i></p>	<p>(<i>Accipiter nisus</i>), Sparrow-hawk, Besra, (<i>Accipiter virgatus</i>), Sunbird, Purple, (<i>Nectarinia asiatica</i>), Swallow, (<i>Hirundo rustica</i>), Swallow, Wiretailed, (<i>Hirundo smithii</i>), Swift, Alpine, (<i>Apus melba</i>), Swift, House, (<i>Apus affinis</i>), Swift, Large Whiterumped, (<i>Apus pacificus</i>), Swift, Whitethroated Spinetail, (<i>Chaetura caudacuta</i>), Swiftlet, Himalayan, (<i>Collocalia brevirostris</i>), Tailorbird, (<i>Orthotomus sutorius</i>), Thrush, Blueheaded Rock, (<i>Monticola cinclorhynchus</i>), Thrush, Streaked Laughing, (<i>Garrulax lineatus</i>), Thrush, Striated Laughing, (<i>Garrulax striatus</i>), Thrush, Variegated Laughing, (<i>Garrulax variegates</i>), Thrush, Whitecrested Laughing, (<i>Garrulax leucolophus</i>), Tit, Brown Crested, (<i>Parus dichrous</i>), Tit, Greenbacked, (<i>Parus monticolus</i>), Tit, Grey, (<i>Parus major</i>), Tragopan, Western, (<i>Tragopan melanocephalus</i>), Tree Pie, Himalayan, (<i>Dendrocitta formosae</i>), Tree Pie, Indian,</p>

District	National Parks / Wildlife Sanctuaries	Flora (Trees)	Flora (Other Plants)	Fauna
			<p>(Bakhru, Kantias), <i>Mabonia nepaulensis</i> (Kemal), <i>Myrsine Africana</i>, <i>Otostegia limbata</i> (Boo), <i>Parrotiopsis jacquemontiana</i> (Kilar, Killar), <i>Picrorhiza kurrooa</i> (Kaur, Karu), <i>Plectranthus rugosus</i> (Kuthal), <i>Podophyllum hexandrum</i> (Ban-kakri) <i>Prinsepia utilis</i> (Bekal, Bhekhal, Kangora), <i>Rhododendron campanulatum</i> (Sarngar, Kashmiri patha), <i>Rhus cotinus</i> (Tung), <i>Ribes</i> spp. (Rajae), <i>Rosa macrophylla</i> (Ban gulab, Karer, Pahari gulab), <i>Rosa moschata</i> (Ban gulab, Kuin, Kuja), <i>Rubus biflorus</i> (Akhre), <i>Rubus niveus</i> (Akhre), <i>Rubus paniculatus</i> (Akhre), <i>Rumex hastatus</i> (Amlora, Bhilmpura), <i>Sageretia thea</i> (Hankalu, Hanklu), <i>Salvia moorcroftiana</i> (Thuth), <i>Salvia nubicola</i> (Makhlar), <i>Sarcococa saligna</i> (Diun, Taliary), <i>Saussurea lappa</i> (Kuth), <i>Senecio</i> spp., <i>Skimmia arborescens</i> (Gurl patta), <i>Smilax glaucophylla</i>, <i>Solanum violaceum</i> (Ban tambacoo), <i>Sorbaria tomentosa</i> (Kande), <i>Staphylea emodi</i> (Nagdaun),</p>	<p>(<i>Dendrocitta vagabunda</i>), Vulture, Bearded, (<i>Gypaetus barbatus</i>), Vulture, Griffon, (<i>Gyps fulvus</i>), Vulture, Indian Longbilled, (<i>Gyps indicus</i>), Vulture, Indian Whitebacked, (<i>Gyps bengalensis</i>), Wagtail, Grey, (<i>Motacilla cinerea</i>), Wagtail, Large Pied, (<i>Motacilla maderaspatensis</i>), Warbler, Dusky Leaf, (<i>Phylloscopus fuscatus</i>), Warbler, Olivaceous Leaf, (<i>Phylloscopus griseolus</i>), Warbler, Orangebarred Leaf, (<i>Phylloscopus pulcher</i>), Warbler, Tytler's Leaf, (<i>Phylloscopus tytleri</i>), Warbler, Yellowbrowed Leaf, (<i>Phylloscopus inornatus</i>), White-eye, (<i>Zosterops palpebrosa</i>), Woodpecker, Blacknaped Green, (<i>Picus canus</i>), Woodpecker, Scalybellied Green, (<i>Picus squamatus</i>), Wren-babbler, Scalybreasted, (<i>Phoebe pyga albiventer</i>); Accentor, Alpine, (<i>Prunella collaris</i>), Babbler, Saltyheaded Scimitar, (<i>Pomatorhinus horsfieldii</i>), Chat, Dark-grey Bush, (<i>Saxicola ferrea</i>), Creeper, Himalayan Tree, (<i>Certhia himalayana</i>), Junglefowl, Red, (<i>Gallus gallus</i>), Magpie, Redbilled Blue, (<i>Cissa erythrorhyncha</i>),</p>
			<p><i>Syringa emodi</i> (Chara), <i>Thalictrum foliolosum</i> (Machhar mar), <i>Thymus serpyllum</i> (Ban jawain, Pahari ajwain), <i>Valeriana jatamansi</i> (Smak mushkwala), <i>Verbascum thapsus</i>, <i>Viburnum cotinifolium</i> (Rajal, Talanj, Taliana), <i>Viburnum foetens</i> (Talanj, Tirnoi), <i>Viola canescens</i> (Banfsha, Bankasha, Banksha), <i>Viola odorata</i> (Banafsha), <i>Vitex negundo</i> (Banna), <i>Wikstroemia canescens</i>, <i>Woodfordia fruticosa</i></p>	<p>Martin, House, (<i>Delichon urbica</i>), Nutcracker, (<i>Nucifraga caryocatactes</i>), Partridge, Chukor, (<i>Alectoris chukar</i>), Pheasant, Koklas, (<i>Pucrasia macrolopha</i>), Pheasant, Monal, (<i>Lophophorus impejanus</i>), Snowcock, Himalayan, (<i>Tetraogallus himalayensis</i>), Thrush, Variegated Laughing, (<i>Garrulax variegates</i>), Tragopan, Western, (<i>Tragopan melanocephalus</i>), Wagtail, Yellowheaded, (<i>Motacilla citreola</i>), Woodcock, (<i>Scolopax rusticola</i>);</p>

District	National Parks / Wildlife Sanctuaries	Flora (Trees)	Flora (Other Plants)	Fauna
				<p>Babbler, Redbilled, (<i>Stachyris pyrrhops</i>), Babbler, Rustycheeked Scimitar, (<i>Pomatorhinus erythrogastrus</i>), Barbet, Great Hill, (<i>Megalaima virens</i>), Barbet, Green, (<i>Megalaima zeylanica</i>), Bee-eater, Bluetailed, (<i>Merops philippinus</i>), Bulbul, Black, (<i>Hypsipetes madagascariensis</i>), Bulbul, Redvented, (<i>Pycnonotus cafer</i>), Bulbul, Whitechecked, (<i>Pycnonotus leucogenys</i>), Bunting, Crested, (<i>Melophus lanthami</i>), Bunting, Greyheaded, (<i>Emberiza fucata</i>), Buzzard, Honey, (<i>Pernis ptilorhynchus</i>), Buzzard- eagle, White-eyed, (<i>Butastur teesa</i>), Chat, Blue, (<i>Erithacus brunneus</i>), Chough, Yellowbilled, (<i>Pyrrhocorax graculus</i>), Creeper, Wall, (<i>Tichodroma muraria</i>), Crow, Jungle, (<i>Corvus macrorhynchos</i>), Cuckoo, Pied Crested, (<i>Clamator jacobinus</i>), Dove, Indian Ring, (<i>Streptopelia decaocto</i>), Dove, Little Brown, (<i>Streptopelia senegalensis</i>), Dove, Rufous Turtle, (<i>Streptopelia orientalis</i>), Dove, Spotted, (<i>Streptopelia chinensis</i>), Drongo, Black, (<i>Dicurus adsimilis</i>), Eagle, Black, (<i>Ictinaetus malayensis</i>), Eagle, Crested Serpent, (<i>Spilornis cheela</i>), Eagle, Golden, (<i>Aquila chrysaetos</i>), Eagle, Greyheaded Fishing, (<i>Ichthyophaga ichthyaeus</i>), Eagle, Imperial, (<i>Aquila heliaca</i>), Eagle, Short-toed, (<i>Circus gallicus</i>), Eagle, Tawny, (<i>Aquila rapax</i>), Flycatcher, Greyheaded, (<i>Culicicapa ceylonensis</i>), Flycatcher, Orangeorgeted, (<i>Muscicapa strophiatea</i>), Flycatcher, Paradise, (<i>Terpsiphone paradise</i>), Flycatcher, Rufoustailed, (<i>Muscicapa ruficauda</i>),</p>



District	National Parks / Wildlife Sanctuaries	Flora (Trees)	Flora (Other Plants)	Fauna
				<p>Flycatcher, Slaty Blue, (<i>Muscicapa leucomelanura</i>), Flycatcher, Sooty, (<i>Muscicapa sibirica</i>), Flycatcher, Verditer, (<i>Muscicapa thalassina</i>), Flycatcher, Whitebrowed Blue, (<i>Muscicapa supercilaris</i>), Flycatcher, Whitethroated Fantail, (<i>Rhipidura albicollis</i>), Flycatcher, Yellowbellied Fantail, (<i>Rhipidura hypoxantha</i>), Flycatcher-shrike, Pied, (<i>Hemipus picatus</i>), Flycatcher-warbler, Blackbrowed, (<i>Scircus burkii</i>), Forktail, Little, (<i>Enicurus scouleri</i>), Goldfinch, (<i>Carduelis carduelis</i>), Grosbeak, Allied, (<i>Coccothraustes icteroides</i>), Hawk-cuckoo, Large, (<i>Cuculus sparverioides</i>), Hawk-eagle, Booted, (<i>Hieraactus pennatus</i>), Hawk-eagle, Crested, (<i>Spizactus cirrhatu</i>), Hawk-eagle, Hodgson's, (<i>Spizactus nipalensis</i>), Hen-harrier, (<i>Circus cyaneus</i>), Hobby, (<i>Falco subbuteo</i>), Hoopoe, (<i>Upupa epops</i>), Jay, Blackthroated, (<i>Garrulus lanceolatus</i>), Kestrel, (<i>Falco tinnunculus</i>), Kite, Pariah, (<i>Milvus migrans</i>), Koel, (<i>Eudynamis scolopacea</i>), Magpie, Redbilled Blue, (<i>Cissa erythrorhyncha</i>), Martin, House, (<i>Delichon urbica</i>), Minivet, Longtailed, (<i>Pericrocotus ethologus</i>), Munia, Spotted, (<i>Lonchura puneculata</i>), Myna, Common, (<i>Acridotheres tristis</i>), Myna, Jungle, (<i>Acridotheres fuscus</i>), Nuthatch, Whitecheeked, (<i>Sitta leucopsis</i>), Oriole, Golden, (<i>Oriolus oriolus</i>), Owl, Tawny Wood, (<i>Strix aluco</i>), Owlet, Barred, (<i>Glaucidium cuculoides</i>), Owlet, Collared Pigmy, (<i>Glaucidium brodiei</i>), Parakeet, Alexandrine, (<i>Psittacula eupatria</i>),</p>

District	National Parks / Wildlife Sanctuaries	Flora (Trees)	Flora (Other Plants)	Fauna
				<p>Parakeet, Blossomheaded, (<i>Pittacula cyanocephala</i>), Partridge, Black, (<i>Francolinus francolinus</i>), Partridge, Chukor, (<i>Alectoris chukar</i>), Partridge, Common Hill, (<i>Arborophila torqueola</i>), Partridge, Snow, (<i>Lerwa lerva</i>), Peafowl, Common, (<i>Pavo cristatus</i>), Pheasant, Chir, (<i>Catrens wallichii</i>), Pheasant, Kalij, (<i>Lophura leucomelana</i>), Pheasant, Koklas, (<i>Pucrasia macrolopha</i>), Pheasant, Monal, (<i>Lophoborus impejanus</i>), Pigeon, Wedgetailed Green, (<i>Treron sphenura</i>), Pigeon, Wood, (<i>Columba palumbus</i>), Pipit, Indian Tree, (<i>Anthus hodgsoni</i>), Redstart, Black, (<i>Phoenicurus ochruros</i>), Rosefinch, Common, (<i>Carpodacus erythrinus</i>), Rosefinch, Whitebrowed, (<i>Carpodacus thura</i>), Rubythroat, Himalayan, (<i>Erythacus pectoralis</i>), Shikra, (<i>Accipiter badius</i>), Shrike, Baybacked, (<i>Lanius vittatus</i>), Shrike, Rufousbacked, (<i>Lanius schach</i>), Snowcock, Himalayan, (<i>Tetraogallus himalayensis</i>), Sparrow, House, (<i>Passer domesticus</i>), Sparrow-hawk, (<i>Accipiter nisus</i>), Sparrow-hawk, Besra, (<i>Accipiter virgatus</i>), Sunbird, Purple, (<i>Nectarinia asiatica</i>), Swallow, (<i>Hirundo rustica</i>), Swallow, Wiretailed, (<i>Hirundo smithii</i>), Swift, Alpine, (<i>Apus melba</i>), Swift, House, (<i>Apus affinis</i>), Swift, Large Whiterumped, (<i>Apus pacificus</i>), Swift, Whitethroated Spinetail, (<i>Chaetura caudacuta</i>), Swiftlet, Himalayan, (<i>Collocalia brevirostris</i>), Tailorbird, (<i>Orthotomus sutorius</i>), Thrush, Blueheaded Rock, (<i>Monticola cinclorhynchus</i>), Thrush, Redheaded Laughing,</p>

District	National Parks / Wildlife Sanctuaries	Flora (Trees)	Flora (Other Plants)	Fauna
				<p>Parakeet, Blossomheaded, (<i>Pittacula cyanocephala</i>), Partridge, Black, (<i>Francolinus francolinus</i>), Partridge, Chukor, (<i>Alectoris chukar</i>), Partridge, Common Hill, (<i>Arborophila torqueola</i>), Partridge, Snow, (<i>Lerwa lerva</i>), Peafowl, Common, (<i>Pavo cristatus</i>), Pheasant, Chir, (<i>Catrens wallichii</i>), Pheasant, Kalij, (<i>Lophura leucomelana</i>), Pheasant, Koklas, (<i>Pucrasia macrolopha</i>), Pheasant, Monal, (<i>Lophoborus impejanus</i>), Pigeon, Wedgetailed Green, (<i>Treron sphenura</i>), Pigeon, Wood, (<i>Columba palumbus</i>), Pipit, Indian Tree, (<i>Anthus hodgsoni</i>), Redstart, Black, (<i>Phoenicurus ochruros</i>), Rosefinch, Common, (<i>Carpodacus erythrinus</i>), Rosefinch, Whitebrowed, (<i>Carpodacus thura</i>), Rubythroat, Himalayan, (<i>Erythacus pectoralis</i>), Shikra, (<i>Accipiter badius</i>), Shrike, Baybacked, (<i>Lanius vittatus</i>), Shrike, Rufousbacked, (<i>Lanius schach</i>), Snowcock, Himalayan, (<i>Tetraogallus himalayensis</i>), Sparrow, House, (<i>Passer domesticus</i>), Sparrow-hawk, (<i>Accipiter nisus</i>), Sparrow-hawk, Besra, (<i>Accipiter virgatus</i>), Sunbird, Purple, (<i>Nectarinia asiatica</i>), Swallow, (<i>Hirundo rustica</i>), Swallow, Wiretailed, (<i>Hirundo smithii</i>), Swift, Alpine, (<i>Apus melba</i>), Swift, House, (<i>Apus affinis</i>), Swift, Large Whiterumped, (<i>Apus pacificus</i>), Swift, Whitethroated Spinetail, (<i>Chaetura caudacuta</i>), Swiftlet, Himalayan, (<i>Collocalia brevirostris</i>), Tailorbird, (<i>Orthotomus sutorius</i>), Thrush, Blueheaded Rock, (<i>Monticola cinclorhynchus</i>), Thrush, Redheaded Laughing,</p>

District	National Parks / Wildlife Sanctuaries	Flora (Trees)	Flora (Other Plants)	Fauna
				<p>(<i>Garrulax erythrocephalus</i>), Thrush, Streaked Laughing, (<i>Garrulax lineatus</i>), Thrush, Striated Laughing, (<i>Garrulax striatus</i>), Thrush, Variegated Laughing, (<i>Garrulax variegates</i>), Thrush, Whitethroated Laughing, (<i>Garrulax albogularis</i>), Tit, Greenbacked, (<i>Parus monticolus</i>), Tit, Grey, (<i>Parus major</i>), Tit, Redheaded, (<i>Aegithalos concinnus</i>), Tit- babbler, Whitebrowed, (<i>Alcippe vinipectus</i>), Tragopan, Western, (<i>Tragopan melanocephalus</i>), Tree Pic, Himalayan, (<i>Dendrocitta formosae</i>), Twite, (<i>Acanthis flavirostris</i>), Vulture, Bearded, (<i>Gypaetus barbatus</i>), Vulture, Griffon, (<i>Gyps fulvus</i>), Vulture, Indian Longbilled, (<i>Gyps indicus</i>), Vulture, Indian Whitebacked, (<i>Gyps bengalensis</i>), Wagtail, Grey, (<i>Motacilla cinerea</i>), Warbler, Dusky Leaf, (<i>Phylloscopus fuscatus</i>), Warbler, Olivaceous Leaf, (<i>Phylloscopus griseolus</i>), Warbler, Orangebarred Leaf, (<i>Phylloscopus pulcher</i>), Warbler, Tytler's Leaf, (<i>Phylloscopus tytleri</i>), Warbler, Yellowbrowed Leaf, (<i>L. phylloscopus inornatus</i>), White-eye, (<i>Zosterops palpebrosa</i>), Woodpecker, Blacknaped Green, (<i>Picus canus</i>), Woodpecker, Scalybellied Green, (<i>Picus squamatus</i>), Wren-babbler, Scalybreasted, (<i>Phoebastria albiventer</i>)</p>
Kangra	PON:- Pong Lake Sanctuary	Acacia spp., Aesculus spp., Bauhinia variegata (Kachnar, Kral), Bombax ceiba (Semal, Simbal), Casearia elliptica (Goela), Dalbergia sissoo (Shisham, Tali), Emblica officinalis (Aonla, Amla), Ficus spp., Mangifera indica (Aam, Amb), Punica spp., Pyrus	Agave spp., Arundinaria spp., Bauhinia spp., Carissa opaca (Garna, Karaunda, Karonda), Cyperus spp., Dendrocalamus strictus (Banj), Morchella esculanta (Guchhi), Saccharum munja,	Warbler, Pallas's Leaf, ( <i>Phylloscopus proregulus</i> ), Warbler, Plain Leaf, ( <i>Phylloscopus neglectus</i> ), Warbler, Striated Marsh, ( <i>Megalurus palustris</i> ), Warbler, Tickell's, ( <i>Phylloscopus affinis</i> ), Warbler, Yellowbrowed Leaf, ( <i>L. phylloscopus inornatus</i> ), Waterhen,

District	National Parks / Wildlife Sanctuaries	Flora (Trees)	Flora (Other Plants)	Fauna
		pashia (Kainth, Shkegal, Shagal), Sapindus spp., Syzygium cumini (Jamnoa, Jamun), Terminalia spp.,		Whitebreasted, (Amaurornis phoenicurus), Wheatear, (Oenanthe oenanthe), White-eye, (Zosterops palpebrosa), Whitethroat, Lesser, (Sylvia curruca), Wigeon, (Anas Penelope), Woodpecker, Blacknaped Green, (Picus canus), Woodpecker, Greycrowned Pigmy, (Picoides canicapillus), Woodpecker, Lesser Goldenbacked, (Dinopium benghalense), Woodpecker, Scalybellied Green, (Picus squamatus), Woodpecker, Yellowfronted Pied, (Picoides mabarattensis), Wren-warbler, Ashy, (Prinia socialis), Wren-warbler, Franklin's, (Prinia hodgsonii), Wryneck, (Jynx torquilla)
Kullu	GRE:- Great Himalayan National Park KAI:- Kais Sanctuary KAN:- Kanawar Sanctuary KHO:- Khokhan Sanctuary MAN:- Manali Sanctuary TIR:- Tirthan Sanctuary	Abies pindrow (Tosh), Acer caesium (Chrandu, Mandar, Rikhandu), Acer pictum (Mandar, Mandlu, Rikhandlu, Rikhandu), Aesculus indica (Pangar, Goon, Gum, Jungli Khanoor, Khanor), Betula utilis (Bhiy, Bhoj, Bhojpatra, Bhuj), Cedrela serrata (Darle, Dauri, Kharak), Cedrus deodara (Deodar, Diar, Diyar), Celtis australis (Kharak, Khirak), Fraxinus spp., Juglan regia (Akhrot, Kor, Than), Lonicera quinquelocularis, Parrotiopsis jacquemontiana, Picea smithiana (Rai, Tosh), Pinus wallichiana (Kail), Prunus spp., Quercus dilatata, Quercus incana (Ban, Ban oak), Quercus semecarpifolia (Kharsu), Rhododendron arboreum (Baras, Burash, Cheo), Ulmus walliciana (Maral, Marn, Moral), Abies pindrow (Tosh), Acer pictum (Mandar, Mandlu, Rikhandlu, Rikhandu), Aesculus indica (Pangar, Goon, Gum, Jungli Khanoor, Khanor), Betula utilis	Artemisia nilagirica (Charmar, Charmor, Seski), Berberis spp., Cotoneaster spp., Daphne papyracea (Kaula, Niggi), Desmodium spp., Deutzia spp., Fragaria spp., Iris spp., Jasminum officinale Chambeli, Chameli, Jungli chambeli, Malti), Rosa moschata (Ban gulab, Kuin, Kuja), Salvia spp., Sarcococca spp., Spiraea spp., Valeriana spp., Viola canescens (Banfsha, Bankasha, Banksha), Berberis spp., Cotoneaster microphylla (Chamror, Raonsh), Desmodium spp., Dioscorea deltoidea (Kins, Kunj, Calendi, Tardi), Fragaria spp., Hedera nepalensis (Kural, Grumru, Grumuru), Iris spp., Polygonum spp., Trifolium spp., Vitis spp.; Aralia cachemirica, Artemisia nilagirica (Charmar, Charmor, Seski), Arundinaria falcate, Asplenium spp., Berberis coriaria (Kahmal), Berberis spp., Carex nubigena, Cotoneaster bacillaris (Banang, Renus; Ruins), Dioscorea deltoidea (Kins, Kunj,	Babbler, Redbilled, (Stachyris pyrrhops), Babbler, Rustychecked Scimitar, (Pomatorhinus erythrogyens), Babbler, Saltyheaded Scimitar, (Pomatorhinus horsfieldii), Barbet, Great Hill, (Megalaima virens), Blackbird, (Turdus merula), Blackbird, Greywinged, (Turdus boulboul), Blackbird, Whitecollared, (Turdus albocinctus), Bulbul, Black, (Hypsipetes madagascariensis), Bulbul, Whitechecked, (Pycnonotus leucogenys), Bullfinch, Brown, (Lpyrrhula nipalensis), Bullfinch, Redheaded, Pyrrhula erythrocephala), Bunting, Crested, (Melophus lanthami), Bunting, Rock, (Emberiza cia), Chat, Dark-grey Bush, (Saxicola ferrea), Chough, Redbilled, (Pyrrhocorax pyrrhocorax), Creeper, Himalayan Tree, (Certhia himalayana) Creeper, Tree, (Certhia familiaris), Crossbill, (Loxia curvirostra), Crow, Jungle, (Corvus macrorhynchos), Cuckoo,

District	National Parks / Wildlife Sanctuaries	Flora (Trees)	Flora (Other Plants)	Fauna
		(Bhiy, Bhoj, Bhojpatra, Bhuj), <i>Cedrus deodara</i> (Deodar, Diar, Diyar), <i>Juglan regia</i> (Akhrot, Kor, Than), <i>Picea smithiana</i> (Rai, Tosh), <i>Pinus wallichiana</i> (Kail), <i>Prunus cornuta</i> (Bird cherry, Jammu), <i>Acer caesium</i> (Chrandu, Mandar, Rikhandu), <i>Acer pictum</i> (Mandar, Mandlu, Rikhandu, Rikhandu), <i>Aesculus inidca</i> (Pangar, Goon, Gum, Jungli Khanoor, Khanor), <i>Alnus</i> spp., <i>Bauhinia</i> spp., <i>Cedrus deodara</i> (Deodar, Diar, Diyar), <i>Celtis australis</i> (Kharak, Khirak), <i>Cornus macrophylla</i> (Haleu), <i>Cupressus torulosa</i> (Devi, diyar), <i>Deutzia staminea</i> , <i>Juglan regia</i> (Akhrot, Kor, Than), <i>Juniperus</i> spp., <i>Machilus duthiei</i> (Bhadrol), <i>Meliosma dilleniaefolia</i> , <i>Morus serrata</i> (Chimu, Karun), <i>Myrsine semiserrata</i> , <i>Parrotiopsis jacquemontiana</i> , <i>Philadelphus coronarius</i> , <i>Picea smithiana</i> (Rai, Tosh), <i>Picrasma quassioides</i> , <i>Pinus roxburghii</i> (Chil, Chir), <i>Pinus wallichiana</i> (Kail), <i>Prunus cornuta</i> (Bird cherry, Jammu), <i>Punica</i> spp., <i>Quercus incana</i> (Ban, Ban oak), <i>Rhododendron arboreum</i> (Baras, Burash, Cheo), <i>Rubus</i> spp., <i>Salix daphnoides</i> (Bes), <i>Salix denticulata</i> (Bhashal), <i>Sarcococca saligna</i> , <i>Staphylea emodi</i> , <i>Taxus baccata</i> (Barhmi, Barmi)	Calendi, Tardi), <i>Dodonaea viscosa</i> (Mendu, Mhendu), <i>Euphorbia royleana</i> (Chhoin, Chor, Thor), <i>Fagopyrum cymosum</i> , <i>Ficus pumila</i> , <i>Fragaria vesca</i> , <i>Girardinia diversifolia</i> (Bichchu Buti), <i>Hedera nepalensis</i> (Kural, Grumru, Grumuru), <i>Hordeum</i> spp., <i>Impatiens</i> spp., <i>Indigofera gerardiana</i> (Kathi), <i>Iris kumaonensis</i> , <i>Jasminum officinale</i> Chambeli, Chameli, Jungli chambeli, Malti), <i>Lamium</i> spp., <i>Oplismenus</i> spp., <i>Plarthenociss semicordata</i> , <i>Polygonum amplexicaule</i> , <i>Polygonum chinense</i> , <i>Polygonum sibiricum</i> , <i>Polystichum</i> spp., <i>Prinsepia</i> spp., <i>Pteris</i> spp., <i>Rhododendron campanulatum</i> (Sarngar, Kashmiri patha), <i>Rosa moschata</i> (Ban gulab, Kuin, Kuja), <i>Rubus ellipticus</i> (Lal anchu akhi, Hinsar), <i>Rubus niveus</i> (Akhre), <i>Salvia</i> spp., <i>Senecio</i> spp., <i>Smilax glaucophylla</i> , <i>Sorbaria tomentosa</i> (Kande), <i>Spiraea</i> spp., <i>Stellaria monosperma</i> , <i>Viburnum cotinifolium</i> (Rajal, Talanj, Taliana), <i>Viburnum foetens</i> (Talanj, Tirnoi), <i>Buddleja paniculata</i> (Safed chindwa), <i>Cotoneaster microphylla</i> (Chamror, Raonsh), <i>Desmodium tiliacifolium</i>	Indian, ( <i>Cuculus micropterus</i> ) Cuckoo, Indian Plaintive, ( <i>Cacomantis passerinus</i> ), Cuckoo, The, ( <i>Cuculus canorus</i> ), Dipper, Brown, ( <i>Cinclus pallasi</i> ), Dove, Indian Ring, ( <i>Streptopelia decaocto</i> ), Dove, Rufous Turtle, ( <i>Streptopelia orientalis</i> ), Dove, Spotted, ( <i>Streptopelia chinensis</i> ), Drongo, Black, ( <i>Dicrurus adsimilis</i> ), Eagle, Golden, ( <i>Aquila chrysaetos</i> ), Finch, Redbrowed, ( <i>Callacanthus burtoni</i> ), Flycatcher, Greyheaded, ( <i>Callicapca ceylonensis</i> ), Flycatcher, Orangeorgeted, ( <i>Muscicapa strophiatea</i> ), Flycatcher, Sooty, ( <i>Muscicapa sibirica</i> ), Flycatcher, Verditer, ( <i>Muscicapa thalassina</i> ), Flycatcher, Whitebrowed Blue, ( <i>Muscicapa supercilaris</i> ), Flycatcher, Whitethroated Fantail, ( <i>Rhipidura albicollis</i> ), Flycatcher, Yellowbellied Fantail, ( <i>Rhipidura hypoxantha</i> ), Flycatcher-warbler, Greyheaded, ( <i>Scicercus xanthoschistos</i> ), Forktail, Little, ( <i>Enicurus sconleri</i> ), Forktail, Spotted, ( <i>Enicurus maculatus</i> ), Goldcrest, ( <i>Regulus regulus</i> ), Grandala, Hodgson's, ( <i>Grandala coelicolor</i> ), Greenfinch, Himalayan ( <i>Carduelis spinoides</i> ), Greenshank, ( <i>Gyps himalayensis</i> ),
		<i>Abies pindrow</i> (Tosh), <i>Acer caesium</i> (Chrandu, Mandar, Rikhandu), <i>Acer pictum</i> (Mandar, Mandlu, Rikhandu, Rikhandu), <i>Cedrus deodara</i> (Deodar, Diar, Diyar), <i>Ilex diphyrena</i> (Kandru), <i>Picea smithiana</i> (Rai, Tosh), <i>Pinus wallichiana</i> (Kail), <i>Prunus cornuta</i> (Bird cherry, Jammu), <i>Quercus semecarpifolia</i> (Kharsu), <i>Abies pindrow</i> (Tosh), <i>Acer cappadocicum</i> (Maple), <i>Aesculus</i>	(Pre Mortoi), <i>Jasminum humile</i> (Ban chambeli, Malti, Sune, Jungli chambeli), <i>Prinsepia utilis</i> (Bekal, Bhekhal, Kangora), <i>Rubus ellipticus</i> (Lal anchu akhi, Hinsar), <i>Sarcococca saligna</i> (Diun, Taliary), <i>Ainsliaea aptera</i> , <i>Arisaema</i> spp. (Kikukri), <i>Berberis aristata</i> (Kashmal, Kashmal, Kemal), <i>Buddleja paniculata</i> (Safed chindwa), <i>Cotoneaster microphylla</i> (Chamror,	Griffon, Himalayan, ( <i>Coccothraustes affinis</i> ), Grosbeak, Allied, ( <i>Coccothraustes icteroides</i> ), Grosbeak, Black- and-Yellow, ( <i>Coccothraustes mclanozanthos</i> ), Hawk-cuckoo, Large, ( <i>Cuculus sparverioides</i> ), Hawk-eagle, Booted, ( <i>Hieraactus pennatus</i> ), Hen-harrier, ( <i>Circus cyaneus</i> ), Hoby, ( <i>Falco subbuteo</i> ), Hoopoe, ( <i>Upupa epops</i> ),

District	National Parks / Wildlife Sanctuaries	Flora (Trees)	Flora (Other Plants)	Fauna
		<p><i>inidea</i> (Pangar, Goon, Gum, Jungli Khanoor, Khanor), <i>Betula utilis</i> (Bhiy, Bhoj, Bhojpatra, Bhuj), <i>Cedrus deodara</i> (Deodar, Diar, Diyar), <i>Juglan regia</i> (Akhrot, Kor, Than), <i>Picea smithiana</i> (Rai, Tosh), <i>Pinus wallichiana</i> (Kail), <i>Prunus cornuta</i> (Bird cherry, Jammu), <i>Quercus dilatata</i>, <i>Quercus semecarpifolia</i> (Kharsu), <i>Rhododendron</i> spp., <i>Abies pindrow</i> (Tosh), <i>Acer caesium</i> (Chrandu, Mandar, Rikhandu), <i>Acer pictum</i> (Mandar, Mandlu, Rikhandlu, Rikhandu), <i>Aesculus inidea</i> (Pangar, Goon, Gum, Jungli Khanor, Khanor), <i>Cedrus deodara</i> (Deodar, Diar, Diyar), <i>Fraxinus floribunda</i> (Angah, Sunnu, Sunuh), <i>Juglan regia</i> (Akhrot, Kor, Than), <i>Litsea</i> spp., <i>Parrotiopsis jacquemontiana</i>, <i>Picea smithiana</i> (Rai, Tosh), <i>Pinus wallichiana</i> (Kail), <i>Populus ciliata</i> (Chalauj, Chaaloon, Pahari peepal), <i>Prunus cornuta</i> (Bird cherry, Jammu), <i>Quercus semecarpifolia</i> (Kharsu), <i>Sarcococca saligna</i>, <i>Taxus baccata</i> (Barhmi, Barmi), <i>Ulmus villosa</i>, <i>Ulmus walliciana</i> (Maral, Marn, Moral)</p>	<p>Raonsh), <i>Deutzia compacta</i> (Bathi), <i>Dioscorea deltoidea</i> (Kins, Kunj, Calendi, Tardi), <i>Duchesnea indica</i>, <i>Hedera nepalensis</i> (Kural, Grumru, Grumuru), <i>Indigofera atropurpurea</i> (Kathi), <i>Iris</i> spp., <i>Juniperus</i> spp., <i>Parthenocissus himalayana</i>, <i>Polygonum</i> spp., <i>Rabdosia rugosa</i>, <i>Rhododendron anthopogon</i>, <i>Rhododendron campanulatum</i> (Sarngar, Kashmiri patha), <i>Rhododendron lepidotum</i> (Sumral), <i>Trifolium dubium</i>, <i>Trifolium minus</i>, <i>Trifolium repens</i>, <i>Artemisia nilagirica</i> (Charmar, Charmor, Seski), <i>Berberis lycium</i> (Kashmal, Kemal), <i>Lonicera quinquelocularis</i> (Bakhru, Kantias), <i>Loranthus</i> spp., <i>Rubus ellipticus</i> (Lal anchu akhi, Hinsar), <i>Salvia nubicola</i> (Makhjar), <i>Viburnum cotinifolium</i> (Rajal, Talanj, Taliana), <i>Viola canescens</i> (Banfsha, Bankasha, Banksha), <i>Vitis</i> spp.,</p>	<p>Kestrel, (<i>Falco tinnunculus</i>), Kite, Pariah, (<i>Milvus migrans</i>), Martin, House, (<i>Delichon urbica</i>), Minivet, Longtailed, (<i>Pericrocotus etbologus</i>), Myna, Common, (<i>Acridotheres tristis</i>), Nightjar, Indian Jungle, (<i>Caprimulgus indicus</i>), Niltava, Rufousbellied, (<i>Muscicapa sundara</i>), Nutcracker, (<i>Nucifraga caryocatactes</i>), Nuthatch, Whitechecked, (<i>Sitta leucopsis</i>), Nuthatch, Whitetailed, (<i>Sitta himalayensis</i>), Owl, Spotted Scops, (<i>Otus spilocephalus</i>), Owl, Tawny Wood, (<i>Strix aluco</i>), Owlet, Barred, (<i>Glaucidium cuculoides</i>), Owlet, Collared Pigmy, (<i>Glaucidium brodiei</i>, Parakeet, Blossomheaded, (<i>Psittacula cyanocephala</i>), Parakeet, Slatyheaded, (<i>Pisittacula himalayana</i>), Partridge, Black, (<i>Francolinus francolinus</i>), Partridge, Chukor, (<i>Alectoris chukar</i>), Partridge, Common Hill, (<i>Arborophila torqueola</i>), Peafowl, Common, (<i>Pavo cristatus</i>), Pheasant, Chir, (<i>Catrens wallichii</i>), Pheasant, Kalij (<i>Lophura leucomelana</i>), Pheasant, Koklas, (<i>Pucrasia macrolopha</i>), Pheasant, Monal, (<i>Lophophorus impejanus</i>), Piculet, Speckled, (<i>Picumnus innominatus</i>), Pigeon, Ashy Wood, (<i>Columba pulchricollis</i>), Pigeon, Speckled Wood, (<i>Columba hodgsonii</i>), Pigeon, Wedgetailed Green, (<i>Treeron sphenura</i>), Pipit, Indian Tree, (<i>Anthus hodgsoni</i>), Pipit, Upland, (<i>Anthus sylvanus</i>), Redstart, Bluefronted, (<i>Phoenicurus frontalis</i>), Redstart, Plumbeous, (<i>Rhyacornis fuliginosus</i>), Redstart, Whitecapped, (<i>Chaimarrornis leucocephalus</i>),</p>

District	National Parks / Wildlife Sanctuaries	Flora (Trees)	Flora (Other Plants)	Fauna
				<p>Rosefinch, Pinkbrowed, (<i>Carpodacus rhodochrous</i>), Rubythroat, (<i>Erythacus calliope</i>), Shikra, (<i>Lanius schach</i>), Shrike- babbler, Redwinged, (<i>Pteruthius flaviscapis</i>), Sibia, Blackcapped, (<i>Heterophasia capistrata</i>), Siva, Barthroated, (<i>Minla strigula</i>), Snowcock, Himalayan, (<i>Tetragallus himalayensis</i>), Sparrow, Cinnamon Tree, (<i>Passer rutilans</i>), Sparrow, House, (<i>Passer domesticus</i>), Sparrow-hawk, (<i>Accipiter nisus</i>), Sunbird, Yellowbacked, (<i>Aethopyga siparaja</i>), Swift, Alpine, (<i>Apus melba</i>), Swift, Large Whiterumped, (<i>Apus pacificus</i>), Swiftlet, Himalayan, (<i>Collocalia brevirostris</i>), Thrush, Blue Whistling, (<i>Myiophonus caeruleus</i>), Thrush, Greyheaded, (<i>Turdus rubrocanus</i>), Thrush, Large Brown, (<i>Zoothera monticola</i>), Thrush, Mistle, (<i>Turdus viscivorus</i>), Thrush, Plainbacked Mountain, (<i>Zoothera mollissima</i>), Thrush, Redheaded Laughing, (<i>Garrulax erythrocephalus</i>), Thrush, Streaked Laughing, (<i>Garrulax lineatus</i>), Thrush, Striated Laughing, (<i>Garrulax striatus</i>), Thrush, Variegated Laughing, (<i>Garrulax variegates</i>), Thrush, Whitethroated Laughing, (<i>Garrulax albogularis</i>), Tit, Brown Crested, (<i>Parus dichrous</i>), Tit, Crested Black, (<i>Parus melanolobus</i>), Tit, Firecapped, (<i>Cephalopyrus flammiceps</i>), Tit, Greenbacked, (<i>Parus monticolus</i>), Tit, Grey, (<i>Parus major</i>), Tit, Simla Black, (<i>Parus rufonuchalis</i>), Tit, Whitethroated, (<i>Aegithalos</i></p>



District	National Parks / Wildlife Sanctuaries	Flora (Trees)	Flora (Other Plants)	Fauna
				<p><i>niveogularis</i>), Tit, Yellowbrowed, (<i>Sylviparus modestus</i>), Tit-babbler, Whitebrowed, (<i>Alcippe vinipectus</i>), Tragopan, Western, (<i>Tragopan melanocephalus</i>), Tree Pie, Himalayan, (<i>Dendrocitta formosae</i>), Vulture, Bearded, (<i>Gypaetus barbatus</i>), Vulture, Indian Whitebacked, (<i>Gyps bengalensis</i>), Wagtail, Grey, (<i>Motacilla cinerea</i>), Wagtail, White, (<i>Motacilla alba</i>), Warbler, Blyth's Leaf, (<i>Phylloscopus reguloides</i>), Warbler, Blyth's Reed, (<i>Acrocephalus dumetorum</i>), Warbler, Brown Hill, (<i>Prinia criniger</i>), Warbler, Chestnut-headed Ground, (<i>Tesia castaneocoronata</i>), Warbler, Dull Green Leaf, (<i>Phylloscopus trochiloides</i>), Warbler, Greyfaced Leaf, (<i>Phylloscopus maculipennis</i>), Warbler, Large Crowned Leaf, (<i>Phylloscopus occipitalis</i>), Warbler, Orangebarred Leaf, (<i>Phylloscopus pulcher</i>), Warbler, Pallas's Leaf, (<i>Phylloscopus proregulus</i>), Warbler, Rufouscapped Bush, (<i>Cettia brunnifrons</i>), Warbler, Strongfooted Bush, (<i>Cettia Montana</i>), Warbler, Yellowbrowed Leaf, (<i>Phylloscopus inornatus</i>), White-eye, (<i>Zosterops palpebrosa</i>), Woodcock, (<i>Scolopax rusticola</i>), Woodpecker, Brownfronted Pied, (<i>Picoides auriceps</i>), Woodpecker, Himalayan Pied, (<i>Picoides himalayensis</i>), Woodpecker, Scalybellied Green, (<i>Picus squamatus</i>), Wren, (<i>Troglodytes troglodytes</i>), Wren-babbler, Scalybreasted, (<i>Phoebe albibenter</i>), Yuhina, Yellownaped, (<i>Yuhina flavicollis</i>), Minivet, Scarlet, (<i>Pericrocotus flammeus</i>), Pheasant, Chir, (<i>Catreus wallichii</i>), Pheasant,</p>

District	National Parks / Wildlife Sanctuaries	Flora (Trees)	Flora (Other Plants)	Fauna
				<p>Kalij, (<i>Lophura leucomelana</i>), Pheasant, Koklas, (<i>Pucrasia macrolopha</i>), Pheasant, Monal, (<i>Lophophorus impejanus</i>), Tit, Grey, (<i>Parus major</i>), Tragopan, Western (<i>Tragopan melanocephalus</i>), Blackbird, Greywinged, (<i>Turdus boulboul</i>), Blackbird, Whitecollared, (<i>Turdus albocinctus</i>), Bulbul, Black, (<i>Hypsipetes madagascariensis</i>), Bulbul, Whitechecked, (<i>Pycnonotus leucogenys</i>), Bullfinch, Brown, (<i>Pyrrhula nipalensis</i>), Bullfinch, Redheaded, (<i>Pyrrhula erythrocephala</i>), Bunting, Rock, (<i>Emberiza cia</i>), Chat, Dark-grey Bush, (<i>Saxicola ferrea</i>), Chough, Redbilled, (<i>Pyrrhocorax pyrrhocorax</i>), Creeper, Himalayan Tree, (<i>Certhia himalayana</i>), Crow, Jungle, (<i>Corvus macrorhynchos</i>), Dipper, Brown, (<i>Cinclus pallasii</i>), Dove, Rufous Turtle, (<i>Streptopelia orientalis</i>), Dove, Spotted, (<i>Streptopelia chinensis</i>), Drongo, Black, (<i>Dicrurus adsimilis</i>), Eagle, Golden, (<i>Aquila chrysaetos</i>), Finch, Redbrowed, (<i>Callacantbis burtoni</i>), Flowerpecker, Firebreasted, (<i>Dicaeum ignipectus</i>), Flycatcher, Greyheaded, (<i>Culicicapa ceylonensis</i>), Flycatcher, Rufoustailed, (<i>Muscicapa ruficauda</i>), Flycatcher, Sooty, (<i>Muscicapa sibirica</i>), Flycatcher, Verditer, (<i>Muscicapa thalassina</i>), Flycatcher, Whitebrowed Blue, (<i>Muscicapa superciliaris</i>), Forktail, Spotted, (<i>Enicurus maculatus</i>), Goldcrest, (<i>Regulus regulus</i>), Grebe, Great Crested, (<i>Podiceps cristatus</i>), Grosbeak, Spottedwinged, (<i>Larus ridibundus</i>),</p>

District	National Parks / Wildlife Sanctuaries	Flora (Trees)	Flora (Other Plants)	Fauna
				<p>Hoby, (<i>Falco subbuteo</i>),  Hoopoe, (<i>Upupa epops</i>), Kestrel,  (<i>Falco tinnunculus</i>), Kite,  Blackwinged, (<i>Elanus caeruleus</i>),  Martin, House, (<i>Delichon urbica</i>),  Minivet, Longtailed,  (<i>Pericrocotus ethologus</i>),  Nightjar,  Indian Jungle, (<i>Caprimulgus indicus</i>),  Niltava, Rufousbellied,  (<i>Muscicapa sundara</i>),  Owl,  Scops, (<i>Otus scops</i>),  Parakeet,  Slatyheaded, (<i>Pisittacula himalayana</i>),  Partridge, Black,  (<i>Francolinus francolinus</i>),  Partridge,  Chukor, (<i>Alectoris chukar</i>),  Pheasant, Chir, (<i>Catrens wallichii</i>),  Pheasant, Kalij, (<i>Lophura leucomelana</i>),  Pheasant, Koklas, (<i>Pucrasia macrolopha</i>),  Pheasant, Monal, (<i>Lophophorus impejanus</i>),  Pigeon, Ashy Wood, (<i>Columba pulchricollis</i>),  Pigeon, Speckled Wood, (<i>Columba badsonii</i>),  Pipit, Upland, (<i>Anthus sylvanus</i>),  Redstart, Guidentstadt's, (<i>Phoenicurus erythrogaster</i>),  Redstart, Plumbeous, (<i>Rhyacornis fuliginosus</i>),  Redstart, Whitecapped, (<i>Chaimarrornis leucocephalus</i>),  Rosefinch, Pinkbrowed, (<i>Carpodacus rhodochrous</i>),  Shrike, Rufousbacked, (<i>Lanius schachl</i>),  Sibia, Blackcapped, (<i>Heterophasia capistrata</i>),  Siva, Barthroated, (<i>Minla strigula</i>),  Snowcock, Himalayan, (<i>Tetraogallus himalayensis</i>),  Sparrow, Cinnamon Tree, (<i>Passer rutilans</i>),  Sparrow, House, (<i>Passer domesticus</i>),  Swiftlet, Himalayan, (<i>Collocalia brevirostris</i>),  Thrush, Large Brown, (<i>Zoothera monticola</i>),  Thrush, Plainbacked Mountain, (<i>Zoothera mollissima</i>),  Thrush, Redheaded Laughing,</p>

District	National Parks / Wildlife Sanctuaries	Flora (Trees)	Flora (Other Plants)	Fauna
				<p>(<i>Garrulax erythrocephalus</i>), Thrush, Streaked Laughing, (<i>Garrulax lineatus</i>), Thrush, Variegated Laughing, (<i>Garrulax variegates</i>), Tit, Brown Crested, (<i>Parus dichrous</i>), Tit, Crested Black, (<i>Parus melanolophus</i>), Tit, Greenbacked, (<i>Parus monticolus</i>), Tit, Grey, (<i>Parus major</i>), Tragopan, Western, (<i>Tragopan melanocephalus</i>), Vulture, Bearded, (<i>Gypaetus barbatus</i>), Wagtail, Grey, (<i>Motacilla cinerea</i>), Wagtail, Yellow, (<i>Motacilla flava</i>), Warbler, Brown Hill, (<i>Prinia criniger</i>), Warbler, Brown Leaf, (<i>Phylloscopus collybita</i>), Warbler, Greyfaced Leaf, (<i>Phylloscopus maculipennis</i>), Warbler, Large Crowned Leaf, (<i>Phylloscopus occipitalis</i>), Warbler, Rufouscapped Bush, (<i>Cettia brunnifrons</i>), Woodcock, (<i>Scolpax rusticola</i>), Woodpecker, Scalybellied Green, (<i>Picus squamatus</i>), Wren, (<i>Troglodytes troglodytes</i>), Yuhina, Yellownaped, (<i>Yuhina flavicollis</i>); Pheasant, Koklas, (<i>Pucrasia macrolopha</i>), Pheasant, Monal, (<i>Lophophorus impejanus</i>), Tragopan, Western, (<i>Tragopan melanocephalus</i>), Blackbird, Greywinged, (<i>Turdus boulboul</i>), Buzzard, Longlegged, (<i>Buteo rufinus</i>), Buzzard, Upland, (<i>Buteo hemilasius</i>), Creeper, Tree, (<i>Certhia familiaris</i>), Cuckoo, The, (<i>Cuculus canorus</i>), Dove, Rufous Turtle, (<i>Streptopelia orientalis</i>), Eagle, Golden, (<i>Aquila chrysaetos</i>), Flycatcher, Whitebrowed Blue, (<i>Muscicapa supercilaris</i>), Grosbeak, Spottedwinged, (<i>Larus ridibundus</i>), Kestrel, (<i>Falco tinnunculus</i>), Minivet, Scarlet, (<i>Pericrocotus flammens</i>), Niltava, Rufousbellied,</p>

District	National Parks / Wildlife Sanctuaries	Flora (Trees)	Flora (Other Plants)	Fauna
				( <i>Muscicapa sundara</i> ), Partridge, Snow, ( <i>Lerwa lerwa</i> ), Pheasant, Chir, ( <i>Catreus wallichii</i> ), Pheasant, Koklas, ( <i>Pucrasia macrolopha</i> ), Pheasant, Monal, ( <i>Lophoborhis impejanus</i> ), Redstart, Bluefronted, ( <i>Phoenicurus frontalis</i> ), Rosefinch, Common, ( <i>Carpodacus erythrinus</i> ), Shikra, ( <i>Accipiter badius</i> ), Siva, Barthroated, ( <i>Minla strigula</i> ), Snowcock, Himalayan, ( <i>Tetraogallus himalayensis</i> ), Thrush, Blueheaded Rock, ( <i>Monticola cinclorhynchus</i> ), Tit, Greenbacked, ( <i>Parus monticolus</i> ), Tragopan, Western, ( <i>Tragopan melanocephalus</i> ), Vulture, Bearded, ( <i>Gypaetus barbatus</i> ), Vulture, Griffon, ( <i>Cypis fulvus</i> ), Pheasant, Chir, ( <i>Catreus wallichii</i> ), Pheasant, Koklas, ( <i>Pucrasia macrolopha</i> ), Pheasant, Monal, ( <i>Lophoborhis impejanus</i> ), Tragopan, Western, ( <i>Tragopan melanocephalus</i> )
Kinnaur	LIP:-Lippa Asrang Sanctuary RAK:- Rakchham Chitkul Sanctuary RUP:- Rupi Bhaba Sanctuary	<i>Abies pindrow</i> (Tosh), <i>Aesculus inidca</i> (Pangar, Goon, Gum, Jungli Khanoor, Khanor), <i>Alnus nitida</i> (Kosh, Piak), <i>Betula alnoides</i> (Bhuj, Bhuj pattara, Kathbhoj), <i>Fraxinus</i> spp., Juglan regia (Akhrot, Kor, Than), <i>Picea smithiana</i> (Rai, Tosh), <i>Pinus gerardiana</i> (Neoza, Miri, Chilgoza), <i>Rhododendron</i> spp., <i>Salix tetrasperma</i> (Beuns), <i>Abies pindrow</i> (Tosh), <i>Acer pictum</i> (Mandar, Mandlu, Rikhandlu, Rikhandu), <i>Alnus nitida</i> (Kosh, Piak), <i>Baubinia</i> spp., <i>Betula alnoides</i> (Bhuj, Bhuj pattara, Kathbhoj), <i>Cedrus deodara</i> (Deodar, Diar, Diyar), <i>Fraxinus micrantha</i> (Angu), Juglan regia (Akhrot, Kor, Than), <i>Litsea</i> spp., <i>Olea ferruginea</i> (Kau), <i>Picea smithiana</i> (Rai, Tosh), <i>Pinus gerardiana</i> (Neoza, Miri, Chilgoza), <i>Pistacia</i>	<i>Aconitum heterophyllum</i> (Patis, Patish), <i>Artemisia</i> spp., <i>Clematis orientalis</i> (Garol), <i>Desmodium</i> spp., <i>Ephedra gerardiana</i> (Somlata), <i>Rosa webbiana</i> (Gulab), <i>Aconitum heterophyllum</i> (Patis, Patish), <i>Artemisia</i> spp., <i>Berberis</i> spp., <i>Clematis</i> spp., <i>Cymbopogon</i> spp., <i>Dactylis glomerata</i> , <i>Ephedra gerardiana</i> (Somlata), <i>Ficus pumila</i> , <i>Juniperus</i> spp., <i>Picrorhiza kurrooa</i> (Kaur, Karu), <i>Prinsepia</i> spp., <i>Rumex</i> spp., <i>Smilax</i> spp.,; <i>Aconitum heterophyllum</i> (Patis, Patish), <i>Artemisia maritima</i> (Gandha, Seski), <i>Berberis aristata</i> (Kashmal, Kashmal, Kemal), <i>Clematis connata</i> (Garol), <i>Cotinus coggryia</i> , <i>Cotoneaster acuminata</i> (Banang), <i>Cotoneaster microphylla</i> (Chamror, Raonsh), <i>Daphne</i>	Chough, Yellowbilled, ( <i>Pyrrhocorax graculus</i> ), Partridge, Chukor, ( <i>Alectoris chukar</i> ), Pheasant, Koklas, ( <i>Pucrasia macrolopha</i> ), Pheasant, Monal, ( <i>Lophoborhis impejanus</i> ), Raven, ( <i>Corvus corax</i> ), Snowcock, Himalayan, ( <i>Tetraogallus himalayensis</i> ), Tragopan, Western, ( <i>Tragopan melanocephalus</i> ), Vulture, Bearded, ( <i>Gypaetus barbatus</i> ), Accentor, Alpine, ( <i>Prunella collaris</i> ), Chough, Redbilled, ( <i>Pyrrhocorax pyrrhocorax</i> ), Chough, Yellowbilled, ( <i>Pyrrhocorax graculus</i> ), Creeper, Wall, ( <i>Tichodroma muraria</i> ), Dipper, Brown, ( <i>Cinclus pallasi</i> ), Partridge, Chukor, ( <i>Alectoris chukar</i> ), Pheasant, Koklas, ( <i>Pucrasia macrolopha</i> ), Pheasant,

District	National Parks / Wildlife Sanctuaries	Flora (Trees)	Flora (Other Plants)	Fauna
		<p><i>integerrima</i> (Kakkar, Kakeran, Kakare), <i>Populus alba</i> (Safeda), <i>Quercus semecarpifolia</i> (Kharsu), <i>Salix</i> spp., <i>Abies pindrow</i> (Tosh), <i>Acer caesium</i> (Chrandu, Mandar, Rikhandu), <i>Aesculus inidea</i> (Pangar, Goon, Gum, Jungli Khanoor, Khanor), <i>Alnus nitida</i> (Kosh, Piak), <i>Betula alnoides</i> (Bhuj, Bhujipattara, Kathbhoj), <i>Betula utilis</i> (Bhiy, Bhoj, Bhojpatra, Bhuj), <i>Cedrus deodara</i> (Deodar, Diar, Diyar), <i>Fraxinus micrantha</i> (Angu), <i>Juglan regia</i> (Akhrot, Kor, Than), <i>Morus serrata</i> (Chimu, Karun), <i>Picea smithiana</i> (Rai, Tosh), <i>Pinus roxburghii</i> (Chil, Chir), <i>Pinus wallichiana</i> (Kail), <i>Populus ciliata</i> (Chalauj, Chaaloon, Pahari peepal), <i>Prunus armeniaca</i> (Chihri, Chir, Chuli), <i>Pyrus pashia</i> (Kainth, Shkegal, Shagal), <i>Quercus dilatata</i>, <i>Quercus incana</i> (Ban, Ban oak), <i>Quercus semecarpifolia</i> (Kharsu), <i>Rhododendron arboreum</i> (Baras, Burash, Cheo), <i>Taxus baccata</i> (Barhmi, Barmi);</p>	<p><i>oleoides</i> (Jiko, Niggi), <i>Delphinium denudatum</i> (Nirvisi), <i>Dioscorea deltoidea</i> (Kins, Kunj, Calendi, Tardi), <i>Hedera nepalensis</i> (Kural, Grumru, Grumuru), <i>Indigofera atropurpurea</i> (Kathi), <i>Jasminum officinale</i> Chambeli, Chameli, Jungli chambeli, Malti), <i>Mehtha longifolia</i>, <i>Potentilla fruticosa</i> (Dora), <i>Primula denticulata</i> (Phantigoo), <i>Rosa macrophylla</i> (Ban gulab, Karer, Pahari gulab), <i>Rosa moschata</i> (Ban gulab, Kuin, Kuja, Sausurea lappa (Kuth), <i>Thymus serpyllum</i> (Ban jawain, Pahari ajwain), <i>Trifolium pratense</i> (Kuthe), <i>Viburnum cotinifolium</i> (Rajal, Talanj, Taliana), <i>Viburnum grandiflorum</i> (Talanj), <i>Viburnum mullaha</i>, <i>Viola canescens</i> (Banfsha, Bankasha, Banksha), <i>Vitex trifolia</i> (Pola), <i>Woodfordia fruticosa</i>,</p>	<p>Monal, (<i>Lophoborus impejanus</i>), Raven, (<i>Corvus corax</i>), Redstart, Plumbeous, (<i>Rhyacornis fuliginosus</i>), Redstart, Whitecapped, (<i>Chaimarrornis leucocephalus</i>), Snowcock, Himalayan, (<i>Tetraogallus himalayensis</i>), Vulture, Bearded, (<i>Gypaetus barbatus</i>), Vulture, Griffon, (<i>Gyps fulvus</i>); Creeper, Wall, (<i>Tichodroma muraria</i>), Kestrel, (<i>Falco tinnunculus</i>), Partridge, Chukor, (<i>Alectoris chukar</i>), Pheasant, Kalij, (<i>Lophura leucomelana</i>), Pheasant, Koklas, (<i>Pucrasia macrolopha</i>), Pheasant, Monal, (<i>Lophophorus impejanus</i>), Redstart, Plumbeous, (<i>Rhyacornis fuliginosus</i>), Redstart, Whitecapped, (<i>Chaimarrornis leucocephalus</i>), Tragopan, Western, (<i>Tragopan melanocephalus</i>)</p>
Lahaul & Spiti	PIN:- Pin Valley National Park	<p><i>Betula utilis</i> (Bhiy, Bhoj, Bhojpatra, Bhuj), <i>Juniperus macropoda</i> (Bhotal), <i>Populus</i> spp., <i>Salix</i> spp.</p>	<p><i>Agropyron</i> spp., <i>Anemone obtusiloba</i>, <i>Artemisia</i> spp., <i>Caltha palustris</i>, <i>Crataegus oxyacantha</i>, <i>Ephedra gerardiana</i> (Somlata), <i>Lonicera</i> spp., <i>Poa</i> spp., <i>Potentilla argyrophylla</i>, <i>Primula</i> spp., <i>Ranunculus</i> spp., <i>Rosa macrophylla</i> (Ban gulab, Karer, Pahari gulab), <i>Trifolium repens</i></p>	<p>Chough, Redbilled, (<i>Pyrhocorax pyrrhocorax</i>), Chough, Yellowbilled, (<i>Pyrhocorax graculus</i>), Finch, Tibet Snow, (<i>Montifringilla adamsi</i>), Kestrel, (<i>Falco tinnunculus</i>), Partridge, Chukor, (<i>Alectoris chukar</i>), Partridge, Snow, (<i>Lerwa lerwa</i>), Pigeon, Blue Rock, (<i>Columba livia</i>), Pigeon, Hill, (<i>Columba rupestris</i>), Pigeon, Snow, (<i>Columba leuconota</i>), Snowcock, Himalayan, (<i>Tetraogallus himalayensis</i>), Sparrow, House, (<i>Passer domesticus</i>), Vulture, Bearded, (<i>Gypaetus barbatus</i>)</p>

District	National Parks / Wildlife Sanctuaries	Flora (Trees)	Flora (Other Plants)	Fauna
Mandi	BAN:- Bandli Sanctuary NAR:- Nargu Sanctuary SHIK:- Shikari Devi Sanctuary	<i>Acacia catechu</i> (Khair), <i>Bauhinia variegata</i> (Kachnar, Kral), <i>Bombax</i> spp., <i>Bombax ceiba</i> (Semal, Simbal), <i>Cedrela</i> spp., <i>Erythrina suberosa</i> , <i>Moringa oleifera</i> , <i>Myrica esculenta</i> (Khaphal), <i>Pinus roxburghii</i> (Chil, Chir), <i>Pistacia integerrima</i> (Kakkar, Kakeran, Kakare), <i>Punica granatum</i> (Daroo), <i>Quercus dilatata</i> , <i>Quercus incana</i> (Ban, Ban oak), <i>Rhododendron arboreum</i> (Baras, Burash, Cheo), <i>Sapindus mukorossi</i> (Ritha), <i>Xanthophyllum</i> spp., <i>Abies pindrow</i> (Tosh), <i>Aesculus indica</i> (Pangar, Goon, Gum, Jungli Khanoor, Khanor), <i>Cedrela serrata</i> (Darle, Dauri, Kharak), <i>Cedrus deodara</i> (Deodar, Diar, Diyar), <i>Picea smithiana</i> (Rai, Tosh), <i>Pinus roxburghii</i> (Chil, Chir), <i>Pinus wallichiana</i> (Kail), <i>Quercus dilatata</i> , <i>Quercus incana</i> (Ban, Ban oak), <i>Quercus semecarpifolia</i> (Kharsu), <i>Toona ciliata</i> (Toon), <i>Abies pindrow</i> (Tosh), <i>Acer caesium</i> (Chrاندو, Mandar, Rikhandu), <i>Acer oblongum</i> , <i>Acer pictum</i> (Mandar, Mandlu, Rikhandlu, Rikhandu), <i>Aesculus</i> spp., <i>Bombax</i> spp., <i>Bombax ceiba</i> (Semal, Simbal), <i>Cedrela serrata</i> (Darle, Dauri, Kharak), <i>Cedrela</i> spp., <i>Cedrus deodara</i> (Deodar, Diar, Diyar), <i>Celtis</i> spp., <i>Juniperus recurva</i> , <i>Picea smithiana</i> (Rai, Tosh), <i>Pinus wallichiana</i> (Kail), <i>Quercus dilatata</i> , <i>Quercus incana</i> (Ban, Ban oak), <i>Quercus semecarpifolia</i> (Kharsu), <i>Rhododendron arboreum</i> (Baras, Burash, Cheo), <i>Salix alba</i> (Badda), <i>Sapindus mukorossi</i> (Ritha),	<i>Albatoda zeylanica</i> (Basauti, Basuti), <i>Artemisia nilagirica</i> (Charmar, Charmor, Seski), <i>Berberis aristata</i> (Kashmal, Kashmal, Kemal), <i>Berberis vulgaris</i> (Kahmal, Kemal), <i>Carissa opaca</i> (Garna, Karaunda, Karonda), <i>Murraya paniculata</i> , <i>Vitex negundo</i> (Banna), <i>Ziziphus mauritiana</i> (Ber), <i>Berberis</i> spp., <i>Ilex diplyrena</i> (Kanderu), <i>Indigofera</i> spp., <i>Prinsepia</i> spp., <i>Rosa webbiana</i> (Gulab), <i>Rubus</i> spp., <i>Strobilanthes</i> spp.,; <i>Artemisia nilagirica</i> (Charmar, Charmor, Seski), <i>Berberis aristata</i> (Kashmal, Kashmal, Kemal), <i>Dioscorea deltoidea</i> (Kins, Kunj, Calendi, Tardi), <i>Prinsepia utilis</i> (Bekal, Bhekkhal, Kangora), <i>Rosa moschata</i> (Ban gulab, Kuin, Kuja, Rubus ellipticus (Lal anchu akhi, Hinsar), <i>Spiraea</i> spp., <i>Thymus serpyllum</i> (Ban jawain, Pahari ajwain), <i>Viburnum foetens</i> (Talanj, Tirnoi),	Dove, Indian Ring, ( <i>Streptopelia decaocto</i> ), Partridge, Black, ( <i>Francolinus francolinus</i> ), Partridge, Chukor, ( <i>Alectoris chukar</i> ), Pheasant, Chir, ( <i>Catrens wallichii</i> ), Pheasant, Kalij, ( <i>Lophura leucomelana</i> ), Bulbul, Whitechecked, ( <i>Pycnonotus leucogenys</i> ), Bunting, Crested, ( <i>Melophus lanthami</i> ), Chat, Brown Rock, ( <i>Ceromela fusca</i> ), Flycatcher, Greyheaded, ( <i>Culicicapa ceylonensis</i> ), Flycatcher, Paradise, ( <i>Terpsiphone paradise</i> ), Flycatcher, Verditer, ( <i>Muscicapa thalassina</i> ), Flycatcher, Whitebrowed Blue, ( <i>Muscicapa superciliosa</i> ), Flycatcher, Whitethroated Fantail, ( <i>Rhipidura albicollis</i> ), Hawk-cuckoo, Large, ( <i>Cuculus sparverioides</i> ), Jay, Blackthroated, ( <i>Garrulus lanceolatus</i> ), Kingfisher, Whitebreasted, ( <i>Halcyon smyrnensis</i> ), Myna, Bank, ( <i>Acridotheres ginginianus</i> ), Myna, Brahminy, ( <i>Sturnus pagodarum</i> ), Myna, Common, ( <i>Acridotheres tristis</i> ), Parakeet, Blossomheaded, ( <i>Psittacula cyanocephala</i> ), Pheasant, Chir, ( <i>Catrens wallichii</i> ), Pheasant, Monal, ( <i>Lophoborus impejanus</i> ), Shrike-babbler, Redwinged, ( <i>Pteruthius flaviscapis</i> ), Thrush, Plainbacked Mountain, ( <i>Zoothera mollissima</i> ), Tit, Greenbacked, ( <i>Parus monticolus</i> ), Tit, Grey, ( <i>Parus major</i> ), Tit, Redheaded, ( <i>Aegithalos concinnus</i> ), Tit, Yellowcheeked, ( <i>Parus xanthogenys</i> ), Vulture, Bearded, ( <i>Gypaetus barbatus</i> ), Vulture, Griffon, ( <i>Gyps fulvus</i> ), Woodpecker, Scalybellied Green, ( <i>Picus squamatus</i> ), Accentor,

District	National Parks / Wildlife Sanctuaries	Flora (Trees)	Flora (Other Plants)	Fauna
				Alpine, ( <i>Prunella collaris</i> ), Chat, Pied Bush, ( <i>Saxicola caprata</i> ), Crow, House, ( <i>Corvus splendens</i> ), Dove, Little Brown, ( <i>Streptopelia senegalensis</i> ), Kestrel, ( <i>Falco tinnunculus</i> ), Pheasant, Chir, ( <i>Catreus wallichii</i> ), Pheasant, Kalij, ( <i>Lophura leucomelana</i> ), Pheasant, Koklas, ( <i>Pucrasia macrolopha</i> ), Pheasant, Monal, ( <i>Lophophorus impejanus</i> ), Raven, ( <i>Corvus corax</i> ), Redstart, Plumbeous, ( <i>Rhyacornis fuliginosus</i> ), Redstart, Whitecapped, ( <i>Chaimarrornis leucocephalus</i> ), Robin, Orangeflanked Bush, ( <i>Erethacus cyanurus</i> ), Sparrow, Cinnamon Tree, ( <i>Passer rutilans</i> ), Tit, Greenbacked, ( <i>Parus monticolus</i> ), Tit, Simla Black, ( <i>Parus rufonuchalis</i> ), Vulture, Bearded, ( <i>Gypaetus barbatus</i> ), Vulture, Griffon, ( <i>Gyps fulvus</i> ), Warbler, Yellowbrowed Leaf, ( <i>Lophylloscopus inornatus</i> ), Woodpecker, Yellowfronted Pied, ( <i>Picoides maharattensis</i> )
Shimla	CHA:- Chail Sanctuary CHU:- Churdhar Sanctuary DARA:- Daranghati Sanctuary SIM:- Simbalbaray TAL:- Talra Sanctuary	<i>Abies</i> spp., <i>Acacia</i> spp., <i>Bauhinia</i> spp., <i>Bombax</i> spp., <i>Cedrela</i> spp., <i>Cedrus deodara</i> (Deodar, Diar, Diyar), <i>Eucalyptus</i> spp., <i>Ficus</i> spp., <i>Lagerstroemia</i> spp., <i>Pereskia</i> spp., <i>Picea</i> spp., <i>Pinus roxburghii</i> (Chil, Chir), <i>Pinus wallichiana</i> (Kail), <i>Populus</i> spp., <i>Punica</i> spp., <i>Quercus</i> spp., <i>Rhododendron</i> spp., <i>Robiia pseudoacacia</i> , <i>Salix</i> spp., <i>Terminalia</i> spp., <i>Ziziphus</i> spp.; <i>Abies pindrow</i> (Tosh), <i>Betula alnoides</i> (Bhuj, Bhujipattara, Kathbhuj), <i>Juniperus</i> spp., <i>Picea smithiana</i> (Rai, Tosh), <i>Quercus dilatata</i> , <i>Quercus incana</i> (Ban, Ban oak), <i>Quercus semecarpifolia</i> (Kharsu), <i>Rhododendron</i> spp., <i>Taxus baccata</i>	<i>Berberis</i> spp., <i>Hordeum</i> spp., <i>Lantana</i> spp., <i>Lonicera</i> spp., <i>Myrsine Africana</i> , <i>Rosa</i> spp., <i>Triticum</i> spp., <i>Viburnum foetens</i> (Talanj, Tirnoi), <i>Zea</i> spp.; <i>Ainsliaea aptera</i> , <i>Anemone rivularis</i> , <i>Arundinaria falcate</i> , <i>Berberis</i> spp., <i>Cotoneaster bacillaris</i> (Banang, Renu; Ruins), <i>Deutzia compacta</i> (Bathi), <i>Fragaria vesca</i> , <i>Geranium wallichianum</i> , <i>Hedera nepalensis</i> (Kural, Grumru, Grumuru), <i>Impatiens</i> spp., <i>Jasminum officinale</i> Chambeli, Chameli, Jungli chambeli, Malti), <i>Polygonum</i> spp., <i>Prinsepia utilis</i> (Bekal, Bhekhal, Kangora), <i>Rosa</i> spp., <i>Rubus ellipticus</i> (Lal anchu akhi, Hinsar), <i>Sarcococa saligna</i> (Diun, Taliary), <i>Skimmia</i>	Barbet, Great Hill, ( <i>Megalaima virens</i> ), Blackbird, Greywinged, ( <i>Turdus boulboul</i> ), Bulbul, Black, ( <i>Hypsipetes madagascariensis</i> ), Bulbul, Whitechecked, ( <i>Pycnonotus leucogenys</i> ), Chat, Stone, ( <i>Saxicola torquata</i> ), Creeper, Himalayan Tree, ( <i>Certhia himalayana</i> ), Crow, Jungle, ( <i>Corvus macrorhynchos</i> ), Eagle, Golden, ( <i>Aquila chrysaetos</i> ), Flycatcher, Greyheaded, ( <i>Callicicapa ceylonensis</i> ), Flycatcher, Whitebrowed Blue, ( <i>Muscicapa superciliosa</i> ), Jay, Blackthroated, ( <i>Garrulus lanceolatus</i> ), Junglefowl, Red, ( <i>Gallus gallus</i> ), Kestrel, ( <i>Falco tinnunculus</i> ), Kite, Pariah,



District	National Parks / Wildlife Sanctuaries	Flora (Trees)	Flora (Other Plants)	Fauna
		(Barhmi, Barmi); <i>Abies pindrow</i> (Tosh), <i>Acer pictum</i> (Mandar, Mandlu, Rikhandlu, Rikhandu), <i>Aesculus inidca</i> (Pangar, Goon, Gum, Jungli Khanoor, Khanor), <i>Betula alnoides</i> (Bhuj, Bhujji pattara, Kathbhoj), <i>Cedrus deodara</i> (Deodar, Diar, Diyar), <i>Fraxinus floribunda</i> (Angah, Sunnu, Sunuh), <i>Grewia</i> spp. (Biul), <i>Juglan regia</i> (Akhrot, Kor, Than), <i>Litsea umbrosa</i> (Chrindi), <i>Picea smithiana</i> (Rai, Tosh), <i>Pinus wallichiana</i> (Kail), <i>Pistacia integerrima</i> (Kakkar, Kakeran, Kakare), <i>Populus ciliata</i> (Chalauj, Chaaloon, Pahari peepal), <i>Pyrus pasbia</i> (Kainth, Shkegal, Shagal), <i>Quercus dilatata</i> , <i>Quercus incana</i> (Ban, Ban oak), <i>Quercus semecarpifolia</i> (Kharsu), <i>Rhododendron</i> spp., <i>Rhus chinensis</i> (Arkhar), <i>Acacia catechu</i> (Khair), <i>Albizia lebecke</i> (Siris), <i>Anogeissus latifolia</i> (Chaal, Chhal), <i>Bauhinia</i> spp., <i>Bombax ceiba</i> (Semal, Simbal), <i>Cassia fistula</i> (Alis, Amaltas), <i>Dalbergia sissoo</i> (Shisham, Tali), <i>Emblica officinalis</i> (Aonla, Amla), <i>Haldina cordifolia</i> , <i>Mallotus philippensis</i> , <i>Shorea robusta</i> (Sal), <i>Syzygium cumini</i> (Jamnoa, Jamun), <i>Terminalia alata</i> (Alson, Sain), <i>Terminalia bellirica</i> (Bahera, Harar), <i>Terminalia chebula</i> (Harar), Toona Ciliata (Toon); <i>Abies pindrow</i> (Tosh), <i>Acer pictum</i> (Mandar, Mandlu, Rikhandlu, Rikhandu), <i>Aesculus inidca</i> (Pangar, Goon, Gum, Jungli Khanoor, Khanor), <i>Betula utilis</i> (Bhiy, Bhoj, Bhojpatra, Bhuj), <i>Cedrus deodara</i>	<i>arborescens</i> (Gurl patta), <i>Valeriana hardwickii</i> (Tagger), <i>Viburnum grandiflorum</i> (Talanj), <i>Viola canescens</i> (Banfsha, Bankasha, Banksha), <i>Viola pilosa</i> (Banksha), <i>Vitis</i> spp., <i>Aconitum</i> spp., <i>Andropogon</i> spp., <i>Arundinaria</i> spp., <i>Asparagus</i> spp., <i>Berberis</i> spp., <i>Clematis</i> spp., <i>Cuscuta reflexa</i> (Akasbel, Amarbel), <i>Cuscuta</i> spp., <i>Cymbopogon</i> spp., <i>Deutzia staminea</i> (Batti), <i>Eleusine</i> spp., <i>Eremurus himalaicus</i> (Chukri), <i>Juniperus</i> spp., <i>Loranthus</i> spp., <i>Otostegia limbata</i> (Boo), <i>Pimpinella</i> spp., <i>Prinsepia</i> spp., <i>Rosa moschata</i> (Ban gulab, Kuin, Kuja), <i>Setaria</i> spp., <i>Smilax</i> spp., <i>Themeda anathera</i> (Alunji), <i>Viburnum grandiflorum</i> (Talanj), <i>Vitis</i> spp., <i>Berberis chitria</i> , <i>Indigofera</i> spp., <i>Parthenocissus himalayana</i> , <i>Prinsepia utilis</i> (Bekal, Bhekhal, Kangora), <i>Rubus</i> spp., <i>Rumex hastatus</i> (Amlora, Bhilmpura), <i>Strobilanthes</i> spp., <i>Viburnum</i> spp., <i>Bergenia ciliata</i> (Pathartor), <i>Desmodium</i> spp., <i>Skinimia arborescens</i> (Gurl patta),	( <i>Milvus migrans</i> ), Lapwing, Redwattled, ( <i>Vanellus indicus</i> ), Magpie, Green, ( <i>Cissa chinensis</i> , Magpie, Redbilled Blue, ( <i>Cissa erythrorhyncha</i> ), Martin, Dusky Crag, ( <i>Hirundo concolor</i> ), Myna, Common, ( <i>Acridotheres tristis</i> ), Nightjar, Franklin's, ( <i>Caprimulgus affinis</i> ), Nightjar, Indian Jungle, ( <i>Caprimulgus indicus</i> ), Owl, Great Horned or Eagle-owl, ( <i>Bubo bubo</i> ), Owl, Spotted Scops, ( <i>Otus spilocephalus</i> ), Parakeet, Alexandrine, ( <i>Pisittacula cupatria</i> ), Parakeet, Slatyheaded, ( <i>Pisittacula himalayana</i> ), Partridge, Black, ( <i>Francolinus francolinus</i> ), Partridge, Chukor, ( <i>Alectoris chukar</i> ), Partridge, Grey, ( <i>Francolinus pondicerianus</i> ), Pheasant, Chit, ( <i>Catreus wallichii</i> ), Pheasant, Kalij, ( <i>Lophura leucumelana</i> ), Pigeon, Blue Rock, ( <i>Columba livia</i> ), Redstart, Black, ( <i>Phoenicurus ochruros</i> ), Robin, Orangeflanked Bush, ( <i>Eritbacus cyanurus</i> ), Rosefinch, Whitebrowed, ( <i>Carpodacus thura</i> ), Shrike, Rufousbacked, ( <i>Lanius schachl</i> ), Sibia, Blackcapped, ( <i>Heterophasia capistrata</i> ), Sparrow, House, ( <i>Passer domesticus</i> ), Thrush, Plainbacked Mountain, ( <i>Zoothera mollissima</i> ), Tit, Greenbacked, ( <i>Parus monticolus</i> ), Tit, Grey, ( <i>Parus major</i> ), Vulture, Bearded, ( <i>Gypaetus barbatus</i> ), Vulture, Griffon, ( <i>Gyps fulvus</i> ), Wagtail, Grey, ( <i>Motacilla cinerea</i> ), Wagtail, White, ( <i>Motacilla alba</i> ), Wheatear, Desert, ( <i>Oenanthe deserti</i> ), White-eye, ( <i>Zosterops palpebrosa</i> ), Woodpecker,
		(Deodar, Diar, Diyar), <i>Juglan regia</i> (Akhrot, Kor, Than), <i>Picea smithiana</i> (Rai, Tosh), <i>Pinus wallichiana</i> (Kail), <i>Prunus cornuta</i>		Brownfronted Pied, ( <i>Picoides auriceps</i> ), Woodpecker, Scalybellied Green, ( <i>Picus squamatus</i> ); Bulbul, Whitechecked, ( <i>Pycnonotus</i>

District	National Parks / Wildlife Sanctuaries	Flora (Trees)	Flora (Other Plants)	Fauna
		(Bird cherry, Jammu), <i>Quercus semecarpifolia</i> (Kharsu),		<i>leucogenys</i> ), Bullfinch, Redheaded, ( <i>Pyrrhula erythrocephala</i> ), Chat, Stone, ( <i>Saxicola torquata</i> ), Crow, Jungle, ( <i>Corvus macrorhynchos</i> ), Dove, Rufous Turtle, ( <i>Streptopelia orientalis</i> ), Forktail, Spotted, ( <i>Enicurus maculates</i> ), Greenfinch, Himalayan, ( <i>Carduelis spinoides</i> ), Grosbeak, Allied, ( <i>Coccothraustes icteroides</i> ), Grosbeak, Black- and-Yellow, ( <i>Coccothraustes melanozanthos</i> ), Kestrel, ( <i>Falco tinnunculus</i> ), Minivet, Scarlet, ( <i>Pericrocotus flammeus</i> ), Nutcracker, ( <i>Nucifraga caryocatactes</i> ), Nuthatch, Whitecheeked, ( <i>Sitta leucopsis</i> ), Oriole, Blackheaded, ( <i>Oriolus xanthornus</i> ), Pheasant, Koklas, ( <i>Pucrasia macrolopha</i> ), Pheasant, Monal, ( <i>Lophophorus impejanus</i> ), Pigeon, Wedgetailed Green, ( <i>Treron sphenura</i> ), Redstart, Black, ( <i>Phoenicurus ochruros</i> ), Rosefinch, Common, ( <i>Carpodacus erythrinus</i> ), Siva, Barthroated, ( <i>Minla strigula</i> ), Thrush, Mistle, ( <i>Turdus viscivorus</i> ), Thrush, Variegated Laughing, ( <i>Garrulax variegates</i> ), Tit, Brown Crested, ( <i>Parus dichrous</i> ), Tit, Crested Black, ( <i>Parus melanolophus</i> ), Vulture, Bearded, ( <i>Gypaetus barbatus</i> ), Vulture, Griffon, ( <i>Gyps fulvus</i> ), Wagtail, Grey, ( <i>Motacilla cinerea</i> ), Warbler, Olivaceous Leaf, ( <i>Phylloscopus griseolus</i> ), Woodpecker, Himalayan Pied, ( <i>Picoides himalayensis</i> ), Barbet, Crimonthroated, ( <i>Megalaima rubricapilla</i> ), Barbet, Great Hill, ( <i>Megalaima virens</i> ), Bluebird, Fairy, ( <i>Irena puella</i> ), Bulbul, Black, ( <i>Hypsipetes madagascariensis</i> ), Bulbul, Whitechecked, ( <i>Pycnonotus leucogenys</i> ), Chough, Yellowbilled, ( <i>Pyrrhocorax graculus</i> ), Coot, ( <i>Fulica atra</i> ), Crow, House, ( <i>Corvus splendens</i> ), Crow, Jungle, ( <i>Corvus macrorhynchos</i> ), Cuckoo, The, ( <i>Cuculus canorus</i> ), Dipper, Brown, ( <i>Cinclus pallasi</i> ), Dove, Rufous Turtle, ( <i>Streptopelia orientalis</i> ), Dove, Spotted, ( <i>Streptopelia chinesis</i> ), Drongo, Black, ( <i>Dicrurus adsimilis</i> ), Flycatcher, Whitebrowed Blue, ( <i>Muscicapa supercilaris</i> ), Hoopoe,
				<i>Upupa epops</i> ), Jay, Blackthroated, ( <i>Garrulus lanceolatus</i> ), Junglefowl, Red, ( <i>Gallus gallus</i> ), Kestrel, ( <i>Falco tinnunculus</i> ), Magpie, Redbilled Blue, ( <i>Cissa erythrorhynchos</i> ), Minivet, Scarlet, ( <i>Pericrocotus flammeus</i> ), Myna, Common, ( <i>Acridotheres tristis</i> ), Myna, Jungle, ( <i>Acridotheres fuscus</i> ), Partridge, Black, ( <i>Francolinus</i>

District	National Parks / Wildlife Sanctuaries	Flora (Trees)	Flora (Other Plants)	Fauna
				<p><i>francolinus</i>), Partridge, Chukor, (<i>Alectoris chukar</i>), Partridge, Common Hill, (<i>Arborophila torqueola</i>), Peafowl, Common, (<i>Pavo cristatus</i>), Pheasant, Kalij, (<i>Lophura leucomelana</i>), Pheasant, Koklas, (<i>Pucrasia macrolopha</i>), Redstart, Plumbeous, (<i>Rhyacornis fuliginosus</i>), Redstart, Whitecapped, (<i>Chaimarrornis leucocephalus</i>), Rosefinch, Common, (<i>Carpodacus erythrinus</i>), Shrike, Rufousbacked, (<i>Lanius schach</i>), Sibia, Blackcapped, (<i>Heterophasia capistrata</i>), Sparrow, Cinnamon Tree, (<i>Passer rutilans</i>), Sparrow, House, (<i>Passer domesticus</i>), Thrush, Streaked Laughing, (<i>Garrulax lineatus</i>), Tit, Greenbacked, (<i>Parus monticolus</i>), Tit, Redheaded, (<i>Aegithalos concinnus</i>), Tit, Simla Black, (<i>Parus rufonuchalis</i>), Tragopan, Western, (<i>Tragopan melanocephalus</i>), Tree Pie, Himalayan, (<i>Dendrocitta formosae</i>), Tree Pie, Indian, (<i>Dendrocitta vagabunda</i>), Vulture, Bearded, (<i>Gypaetus barbatus</i>), Vulture, Griffon, (<i>Gyps fulvus</i>), Wagtail, Yellow, (<i>Motacilla flava</i>), White-eye, (<i>Zosterops palpebrosa</i>), Woodpecker, Brownfronted Pied, (<i>Picoides auriceps</i>), Woodpecker, Himalayan Pied, (<i>Picoides himalayensis</i>), Woodpecker, Scalybellied Green, (<i>Picus squamatus</i>); Accentor, Alpine, (<i>Prunella collaris</i>), Junglefowl, Red, (<i>Gallus gallus</i>), Lapwing, Redwattled, (<i>Vanellus indicus</i>), Peafowl, Common, (<i>Pavo cristatus</i>), Pheasant, Kalij, (<i>Lophura leucomelana</i>), Partridge, Chukor, (<i>Alectoris chukar</i>), Pheasant, Chir, (<i>Catrenus wallichii</i>), Pheasant, Kalij, (<i>Lophura leucomelana</i>), Pheasant, Koklas, (<i>Pucrasia macrolopha</i>), Pheasant, Monal, (<i>Lophoborus impejanus</i>), Tragopan, Western, (<i>Tragopan melanocephalus</i>);</p>
Sirmaur	CHU:- Churdhar Sanctuary REN:- Renuka Sanctuary SIM:- Simbalbara Sanctuary	<p><i>Abies pindrow</i> (Tosh), <i>Betula alnoides</i> (Bhuj, Bhujji pattara, Kathbhoj), <i>Juniperus</i> spp., <i>Picea smithiana</i> (Rai, Tosh), <i>Quercus dilatata</i>, <i>Quercus incana</i> (Ban, Ban oak), <i>Quercus semecarpifolia</i> (Kharsu), <i>Rhododendron</i> spp., <i>Taxus baccata</i> (Barhmi, Barmi), <i>Acacia catechu</i> (Khair), <i>Aegle marmelos</i> (Bel, Bil), <i>Albizia lebecke</i> (Siris), <i>Azadirachta indica</i> (Neem, Darek, Drek), <i>Bauhinia variegata</i> (Kachnar, Kral), <i>Bombax ceiba</i> (Semal, Simbal), <i>Cassia fistula</i> (Alis, Amaltas), <i>Dalbergia sissoo</i> (Shisham, Tali), <i>Emblicia officinalis</i> (Aonla, Amla), <i>Ficus nemoralis</i> (Anzir, Phagoora),</p>	<p><i>Ainsliaea aptera</i>, <i>Anemone rivularis</i>, <i>Arundinaria falcate</i>, <i>Berberis</i> spp., <i>Cotoneaster bacillaris</i> (Banang, Renu; Ruins), <i>Deutzia compacta</i> (Bathi), <i>Fragaria vesca</i>, <i>Geranium wallichianum</i>, <i>Hedera nepalensis</i> (Kural, Grumru, Grumuru), <i>Impatiens</i> spp., <i>Jasminum officinale</i> (Chambeli, Chameli, Jungli chambeli, Malti), <i>Polygonum</i> spp., <i>Prinsepia utilis</i> (Bekal, Bhekhal, Kangora), <i>Rosa</i> spp., <i>Rubus ellipticus</i> (Lal anchu akhi, Hinsar), <i>Sarcococa saligna</i> (Diun, Taliary), <i>Skimmia arborecens</i> (Gurl patta), <i>Valeriana bardwickii</i> (Tagger), <i>Viburnum grandiflorum</i> (Talanj),</p>	<p>Bulbul, Whitechecked, (<i>Pycnonotus leucogenys</i>), Bullfinch, Redheaded, (<i>Pyrrhula erythrocephala</i>), Chat, Stone, (<i>Saxicola torquata</i>), Crow, Jungle, (<i>Corvus macrorhynchos</i>), Dove, Rufous Turtle, (<i>Streptopelia orientalis</i>), Forktail, Spotted, (<i>Enicurus maculatus</i>), Greenfinch, Himalayan, (<i>Carduelis spinoides</i>), Grosbeak, Allied, (<i>Coccybraustes icteroides</i>), Grosbeak, Black- and-Yellow, (<i>Coccybraustes melanozanthos</i>), Kestrel, (<i>Falco tinnunculus</i>), Minivet, Scarlet, (<i>Pericrocotus flammeus</i>), Nutcracker, (<i>Nucifraga</i></p>

District	National Parks / Wildlife Sanctuaries	Flora (Trees)	Flora (Other Plants)	Fauna
		<p><i>Ficus religiosa</i> (Peepal), <i>Grevillea robusta</i> (Grevalia), <i>Grewia optiva</i> (Betul, Beul, Dhamman), <i>Juglan regia</i> (Akhrot, Kor, Than), <i>Mangifera indica</i> (Aam, Amb), <i>Morus alba</i> (Karun, Shahtoot, Shatoot), <i>Nyctanthes arbor-tristis</i> (Harsingar), <i>Ougeinia ojeinensis</i> (Sandan), <i>Phoenix humilis</i> (Khajoor), <i>Pyrus pashia</i> (Kainth, Shkegal, Shagal), <i>Salix tetrasperma</i> (Beuns), <i>Shorea robusta</i> (Sal), <i>Syzygium cumini</i> (Jamnoa, Jamun), <i>Terminalia alata</i> (Alson, Sain), <i>Terminalia bellirica</i> (Bahera, Harar), <i>Terminalia chebula</i> (Harar), <i>Toona Ciliata</i> (Toon), <i>Acacia catechu</i> (Khair), <i>Albizia lebbbecke</i> (Siris), <i>Anogeissus latifolia</i> (Chaal, Chhal), <i>Bauhinia</i> spp., <i>Bombax ceiba</i> (Semal, Simbal), <i>Cassia fistula</i> (Alis, Amaltas), <i>Dalbergia sissoo</i> (Shisham, Tali), <i>Embblica officinalis</i> (Aonla, Amla), <i>Haldina cordifolia</i>, <i>Mallotus philippensis</i>, <i>Shorea robusta</i> (Sal), <i>Syzygium cumini</i> (Jamnoa, Jamun), <i>Terminalia alata</i> (Alson, Sain), <i>Terminalia bellirica</i> (Bahera, Harar), <i>Terminalia chebula</i> (Harar), <i>Toona Ciliata</i> (Toon)</p>	<p><i>Viola canescens</i> (Banfsha, Bankasha, Banksha), <i>Viola pilosa</i> (Banksha), <i>Vitis</i> spp.; <i>Adhatoda zeylanica</i> (Basauti, Basuti), <i>Agave americana propinquum</i> (Cobra plant), <i>Bauhinia vablii</i> (Tor, Taur), <i>Cannabis sativa</i> (Bhang), <i>Carissa opaca</i> (Garna, Karaunda, Karonda), <i>Girardinia diversifolia</i> (Bichchu Buti), <i>Jasminum humile</i> (Ban chamei, Malti, Sune, Jungli chambeli), <i>Murraya koenigii</i> (Gadhelu, Gandhelu, Gandela), <i>Rosa sericea</i> (Ban gulab), <i>Rumex</i> spp., <i>Viola canescens</i> (Banfsha, Bankasha, Banksha), <i>Adhatoda</i> spp., <i>Dendrocalamus strictus</i> (Banj), <i>Enalalopsis binata</i> (Babhar grass, Bagar), <i>Lantana camara</i> (Pardesi buti), <i>Phyllanthus</i> spp., <i>Saccharum</i> spp., <i>Ziziphus</i> spp.</p>	<p><i>caryocatactes</i>, Nuthatch, Whitecheeked, (<i>Sitta leucopsis</i>), Oriole, Blackheaded, (<i>Oriolus xanthornus</i>), Pheasant, Koklas, (<i>Pucrasia macrolopha</i>), Pheasant, Monal, (<i>Lophoborus impejanus</i>), Pigeon, Wedgetailed Green, (<i>Treron sphenura</i>), Redstart, Black, (<i>Phoenicurus ocburos</i>), Rosefinch, Common, (<i>Carpodacus erythrinus</i>), Siva, Barthroated, (<i>Minla strigula</i>), Thrush, Mistle, (<i>Turdus viscivorus</i>), Thrush, Variegated Laughing, (<i>Garrulax variegates</i>), Tit, Brown Crested, (<i>Parus dichrous</i>), Tit, Crested Black, (<i>Parus melanolephus</i>), Vulture, Bearded, (<i>Cypaetus barbatus</i>), Vulture, Griffon, (<i>Gyps fulvus</i>), Wagtail, Grey, (<i>Motacilla cinerea</i>), Warbler, Olivaceous Leaf, (<i>Phylloscopus griseolus</i>), Woodpecker, Himalayan Pied, (<i>Picoides himalayensis</i>), Babbler, Jungle, (<i>Turdoides striatus</i>), Babbler, Rustycheeked Scimitar, (<i>Pomatorhinus erythrognys</i>), Babbler, Spotted, (<i>Pellorneum ruficeps</i>), Barbet, Bluethroated, (<i>Megalaima asiatica</i>), Blackbird, (<i>Turdus merula</i>), Bulbul, Redvented, (<i>Pycnonotus cafer</i>), Bulbul, Redwhiskered, (<i>Pycnonotus jocosus</i>), Bulbul, Whitechecked, (<i>Pycnonotus leucogenys</i>), Coot, (<i>Fulica atra</i>), Dove, Spotted, (<i>Streptopelia chinensis</i>), Dove, Turtle, (<i>Streptopelia turtur</i>), Egret, Little, (<i>Egretta garzetta</i>), Flycatcher, Paradise, (<i>Terpsiphone paradise</i>), Heron, Night, (<i>Nycticorax nycticorax</i>), Heron, Pond, (<i>Ardeola grayii</i>),</p>
				<p>Junglefowl, Red, (<i>Gallus gallus</i>), Kingfisher, Common, (<i>Alcedo atthis</i>), Kingfisher, Whitebreasted, (<i>Halcyon smyrnesis</i>), Koel, (<i>Eudynamis scolopacea</i>), Lapwing, Redwattled, (<i>Vanellus indicus</i>), Magpie, Yellowbilled Blue, (<i>Cissa flavirostris</i>), Magpie-robin, (<i>Copsychus saularis</i>), Minivet, Scarlet, (<i>Pericrocotus flammeus</i>), Moorhen, (<i>Gallinula chloropus</i>), Myna, Common, (<i>Acridotheres tristis</i>), Oriole, Golden, (<i>Oriolus oriolus</i>), Owl, Scops, (<i>Otus scops</i>), Parakeet, Roseringed, (<i>Pisittacula karmeri</i>), Parakeet, Slatyheaded, (<i>Pisittacula himalayana</i>), Partridge, Black, (<i>Francolinus francolinus</i>), Pheasant, Kalij, (<i>Lophura leucomelana</i>), Redstart, Plumbeous, (<i>Rhyacornis fuliginosus</i>), Redstart, Whitecapped, (<i>Chaimarrornis leucocephalus</i>), Roller, Indian, (<i>Coracias benghalensis</i>), Sparrowhawk, Besra, (<i>Accipiter virgatus</i>),</p>

District	National Parks / Wildlife Sanctuaries	Flora (Trees)	Flora (Other Plants)	Fauna
				Stork, Painted, ( <i>Mycteria leucocephala</i> ), Thrush, Whitecrested Laughing, ( <i>Garrulax leucolophus</i> ), Tit, Grey, ( <i>Parus major</i> ), Tree Pie, Himalayan, ( <i>Dendrocitta formosae</i> ), Tree Pie, Indian, ( <i>Dendrocitta vagabunda</i> ), Wagtail, Grey, ( <i>Motacilla cinerea</i> ), Warbler, Yellowbrowed Leaf, ( <i>Lophylloscopus inornatus</i> ), Waterhen, Whitebreasted, ( <i>Amurornis phoenicurus</i> ), White-eye, ( <i>Zosterops palpebrosa</i> ), Accentor, Alpine, ( <i>Prunella collaris</i> ), Junglefowl, Red, ( <i>Gallus gallus</i> ), Lapwing, Redwattled, ( <i>Vanellus indicus</i> ), Peafowl, Common, ( <i>Pavo cristatus</i> ), Pheasant, Kalij, ( <i>Lophura leucomelana</i> ).
Solan	CHA:- Chail Sanctuary DARL:- Darlaghat Sanctuary MAJ:- Majathal Sanctuary SHIL:- Shilli Sanctuary	<i>Abies</i> spp., <i>Acacia</i> spp., <i>Bauhinia</i> spp., <i>Bombax</i> spp., <i>Cedrela</i> spp., <i>Cedrus deodara</i> (Deodar, Diar, Diyar), <i>Eucalyptus</i> spp., <i>Ficus</i> spp., <i>Lagerstroemia</i> spp., <i>Pereskia</i> spp., <i>Picea</i> spp., <i>Pinus roxburghii</i> (Chil, Chir), <i>Pinus wallichiana</i> (Kail), <i>Populus</i> spp., <i>Punica</i> spp., <i>Quercus</i> spp., <i>Rhododendron</i> spp., <i>Robiia pseudoacacia</i> , <i>Salix</i> spp., <i>Terminalia</i> spp., <i>Ziziphus</i> spp., <i>Acacia catechu</i> (Khair), <i>Aegle marmelos</i> (Bel, Bil), <i>Cassia fistula</i> (Alis, Amaltas), <i>Feronia</i> spp. (Baranasi), <i>Flacourtia</i> spp. (Kangu), <i>Lagerstroemia</i> spp., <i>Cornus capitata</i> (Thumi), <i>Litsea umbrosa</i> (Chrindi), <i>Quercus glauca</i> (Bani), <i>Quercus incana</i> (Ban, Ban oak), <i>Rhododendron arboreum</i> (Baras, Burash, Cheo), <i>Zanthoxylum armatum</i> (Timber), <i>Cedrus deodara</i> (Deodar, Diar, Diyar), <i>Quercus incana</i> (Ban, Ban oak), <i>Rhododendron arboreum</i> (Baras, Burash, Cheo),	<i>Berberis</i> spp., <i>Hordeum</i> spp., <i>hypericum oblongifolium</i> , <i>Lantana</i> spp., <i>Lonicera</i> spp., <i>Myrsine Africana</i> , <i>Rosa</i> spp., <i>Triticum</i> spp., <i>Viburnum foetens</i> (Talanj, Tirnoi), <i>Zea</i> spp.; <i>Carex nubigena</i> , <i>Carissa opaca</i> (Garna, Karaunda, Karonda), <i>Cymbopogon</i> spp., <i>Euphorbia royleana</i> (Chhoin, Chor, Thor), <i>Heteropogon montaus</i> (Makora), <i>Murraya koenigii</i> (Gadhelu, Gandhelu, Gandela), <i>Myrsine Africana</i> , <i>Berberis lycium</i> (Kashmal, Kemal), <i>Chrysopogon fulvus</i> (Dhault), <i>Cymbopogon martinii</i> (Lab), <i>Hedera nepalensis</i> (Kural, Grumru, Grumuru), <i>Heteropogon montaus</i> (Makora), <i>Murraya paniculata</i> , <i>Ranunculus</i> spp., <i>Smilax glaucophylla</i> ,	Barbet, Great Hill, ( <i>Megalaima virens</i> ), Blackbird, Greywinged, ( <i>Turdus bonlboul</i> ), Bulbul, Black, ( <i>Hypsipetes madagascariensis</i> ), Bulbul, Whitechecked, ( <i>Pyononotus leucogenys</i> ), Chat, Stone, ( <i>Saxicola torquata</i> ), Creeper, Himalayan Tree, ( <i>Certhia himalayana</i> ), Crow, Jungle, ( <i>Corvus macrorhynchos</i> ), Eagle, Golden, ( <i>Aquila chrysaetos</i> ), Flycatcher, Greyheaded, ( <i>Culicicapa ceylonensis</i> ), Flycatcher, Whitebrowed Blue, ( <i>Muscicapa supercilaris</i> ), Jay, Blackthroated, ( <i>Garrulus lanceolatus</i> ), Junglefowl, Red, ( <i>Gallus gallus</i> ), Kestrel, ( <i>Falco tinnunculus</i> ), Kite, Pariah, ( <i>Milvus migrans</i> ), Lapwing, Redwattled, ( <i>Vanellus indicus</i> ), Magpie, Green, ( <i>Cissa chinensis</i> ), Magpie, Redbilled Blue, ( <i>Cissa erythrorhyncha</i> ), Martin, Dusky Crag, ( <i>Hirundo concolor</i> ), Myna, Common, ( <i>Acridotheres tristis</i> ), Nightjar, Franklin's, ( <i>Caprimulgus affinis</i> ), Nightjar, Indian Jungle, ( <i>Caprimulgus indicus</i> ), Owl, Great Horned or Eagle-owl, ( <i>Bubo bubo</i> ), Owl, Spotted Scops, ( <i>Otus spilocephalus</i> ), Parakeet, Alexandrine, ( <i>Pisittacula eupatria</i> ), Parakeet, Slatyheaded, ( <i>Pisittacula himalayana</i> ), Partridge, Black, ( <i>Francolinus francolinus</i> ), Partridge, Chukor, ( <i>Alectoris chukar</i> ), Partridge, Grey, ( <i>Francolinus pondicerianus</i> ), Pheasant, Chir, ( <i>Catreus wallichii</i> ), Pheasant, Kalij, ( <i>Lophura leucomelana</i> ), Pigeon, Blue Rock, ( <i>Columba livia</i> ), Redstart, Black, ( <i>Phoenicurus ochruros</i> ), Robin, Orange-flanked Bush, ( <i>Eribacus cyanurus</i> ), Rosefinch, Whitebrowed, ( <i>Carpodacus thura</i> ), Shrike, Rufous-backed, ( <i>Lanius schachl</i> ), Sibia, Blackcapped, ( <i>Heterophasia capistrata</i> ), Sparrow, House, ( <i>Passer domesticus</i> ), Thrush, Plain-backed Mountain, ( <i>Zosterops mollissima</i> ), Tit, Green-backed, ( <i>Parus monticolus</i> ), Tit, Grey, ( <i>Parus major</i> ), Vulture, Bearded, ( <i>Gypaetus barbatus</i> ), Vulture, Griffon, ( <i>Gyps fulvus</i> ), Wagtail, Grey, ( <i>Motacilla cinerea</i> ), Wagtail, White, ( <i>Motacilla alba</i> ), Wheatear, Desert, ( <i>Oenanthe</i>

District	National Parks / Wildlife Sanctuaries	Flora (Trees)	Flora (Other Plants)	Fauna
				<i>deserti</i> ), White-eye, ( <i>Zosterops palpebrosa</i> ), Woodpecker, Brownfronted Pied, ( <i>Picoides auriceps</i> ), Woodpecker, Scalybellied Green, ( <i>Picus squamatus</i> ); Crow, House, ( <i>Corvus splendens</i> ), Junglefowl, Red, ( <i>Gallus gallus</i> ), Partridge, Black, ( <i>Francolinus francolinus</i> ), Partridge, Chukor, ( <i>Alectoris chukar</i> ), Partridge, Grey, ( <i>Francolinus pondicerianus</i> ), Peafowl, Common, ( <i>Pavo cristatus</i> ), Pheasant, Kalij, ( <i>Lophura leucomelana</i> ), Tree Pie, Indian, ( <i>Dendrocitta vagabunda</i> ), Junglefowl, Red, ( <i>Gallus gallus</i> ), Partridge, Black, ( <i>Francolinus francolinus</i> ), Partridge, Chukor, ( <i>Alectoris chukar</i> ), Partridge, Grey, ( <i>Francolinus pondicerianus</i> ), Peafowl, Common, ( <i>Pavo cristatus</i> ), Pheasant, Chir, ( <i>Catreus wallichii</i> ), Pheasant, Kalij, ( <i>Lophura leucomelana</i> ), Accentor, Alpine, ( <i>Prunella collaris</i> ), Babbler, Jungle, ( <i>Turdoides striatus</i> ), Flycatcher, Paradise, ( <i>Terpsiphone paradise</i> ), Myna, Common, ( <i>Acridothores tristis</i> ), Partridge, Black, ( <i>Francolinus francolinus</i> ), Partridge, Chukor, ( <i>Alectoris chukar</i> ), Peafowl, Common, ( <i>Pavo cristatus</i> ), Pheasant, Kalij, ( <i>Lophura leucomelana</i> ).

## References

- Ministry of Environment and Forest, Government of India
- State Forest & Wildlife Department of Himachal Pradesh
- Department of Fisheries, Himachal Pradesh
- Department of Environment, Science & Technology
- Himachal Pradesh State Council for Science, Technology & Environment
- India - State of Forest Report, 2009
- Landuse Statistics, Ministry of Agriculture, GoI, 2006
- State Forest Report of Himachal Pradesh, 2008,2009
- State Environment Report, Himachal Pradesh (Published in 2009)
- Indian Institute of Remote Sensing Dehradun, 2002
- Districts Statistical Abstract, 2000, 2001(H.P.)
- Annual Administrative Report of Forest Department, 2007-08
- Website: <http://hpforest.nic.in>

## CHAPTER 2 WETLANDS

### 2.1 Resource Inventory of Existing Assets of the Sector

#### Wetlands/Lakes of Himachal Pradesh

The study from remote sensing technique revealed that the wetland category of river/stream is the most dominant wetland type in the State followed by reservoirs and high altitude wetlands. The drainage system of the region includes the Chandra Bhabha or Chenab, Ravi, Beas, Sutlej and Yamuna. These rivers are perennial and are fed by snow and rainfall. The rivers change significantly from post monsoon to pre monsoon period. The river beds are of rocky composition, with deep blue water during pre monsoon to swirling water flowing from bank to bank during monsoon. They are protected by an extensive cover of natural vegetation.

Lakes are numerous in number. Because of the elevation gradient in the State, the lakes are distributed over different elevations giving each one a characteristic hydrology.

Reservoir/barrage are or legally constructed on major rivers to meet the requirement of irrigation, drinking water, and power generation. The State is known for the Govindsagar reservoir, one of its kind of gravity dam in the country.

Natural Lakes: The State is dotted with many natural lakes. Broadly, the lakes can be categorized as low altitude, mid altitude and high altitude ones. Some of the important lakes of different category are:

Low Altitude Lakes: Lying in the elevation range of less than 1000m, there are many lakes including Renuka and Macchial Lake (District Mandi).

Renuka lake is the most famous lake in HP and is a Ramsar site. About 45 km from Nahan this legendary natural lake is named after Renuka, mother of Rishi Parshuram. Macchial Lake is situated in Mandi district (6 km from the

Jogindernagar town). This lake is considered sacred and is named after Macchendra Devta or Matasya Avtar of Lord Vishnu.

Mid Altitude Lakes: Lying in the elevation range of below 3000 m, there are many lakes viz. Khajjiar Lake, Rewalsar Lake, Kuntisar lake, Sukhasar, Kumarwah Lake, Dal Lake, etc.

Khajjiar lake is located in Chamba district, about 16 kms from Dalhousie and 25 kms from Chamba. Fed by slim streams, this small lake rests in the centre of the large glade of Khajjiar. The glade and the lake are held sacred to Khajjinag - after whom the place is named. The surrounding area of the lake is 'spongy' due to dense growth of weed called 'vacha' over which dust has formed a thick layer of earth.

Rewalsar lake is located about 25 km from Mandi. Lying in a mountain hollow, the lake is held sacred to Hindu, Sikh and Buddhist communities. Shaped quite like a square and with a shoreline of 735 meters, it lies at an elevation of 1330 m amsl. The other two lakes- Kunti and Sukhasar which are located near to Rewalsar.

High Altitude Lakes: There are many high altitude lakes lying above 3000 m elevation range, mainly in Northern districts of the State. Chandertal lake is located in Mulhila range at 4000 m amsl. Some of the other high altitude lakes are Brighu lake, Suraj Tal, Nako Lake, Dhankar Lake, Dashair, Seruvalsar, Manimahesh, Ghadhasaru, Mahakali, Lama Dal etc.

Bhrigu Lake is situated at a height of 4200 m near Manali with Vashist and Gulabo as approaching points. It draws its name from Bhrigu Peak.

Nako Lake is situated at an altitude of 3635 m amsl, and is surrounded by hills in village Nako, 3-4 km from Reckong- Peo, the head-quarter of district Kinnaur. The lake is surrounded by willow and poplar trees. It is famous for its wonderful climatic conditions. The water for Nako lake comes from its bottom core.

Suraj tal is a small lake which is situated at 4833 m amsl, within a short distance from Keylong in Lahaul. This is considered as a sacred lake.

Manimahesh Lake is located in Chamba district, 32 kms from Bharmaur. Held sacred to lord Shiva, this lies in the Budhil valley at the foot of the Manimahesh ranges. The peak of Manimahesh Kailash is regarded as one of the mythical abodes of Shiva.

Man-Made Wetlands: Barrages, reservoirs, tanks/ ponds are some of the man-made wetlands found in the State of Himachal Pradesh.

Barrages: There are few barrages made on Beas and Sutlej River. The Barrage at Sundernagar is one of the most famous barrages of the State, situated at 845 m amsl on river Sutlej.

The barrage on Beas river is located at Marhi (on Manali-Rothang road, 12 km before Rohtang pass). Situated at 3255 m amsl, it is the highest barrage in the State.

Reservoirs: Govindsagar reservoir, Pandoh reservoir, Pong dam lake are some of the important reservoirs of the State. Pong dam is located in the Kangra District of Himachal Pradesh. It is one of the most efficient reservoirs in terms of power generation and controls irrigation to down stream districts of Punjab and Haryana states.

Chamera Reservoir is situated near Chowrah village, Chamba District. Chamera Reservoir is linked with Pathankot town by a 97 km long road. The river basin is laid along the Himalayas and touches the Shivalik hills on the Southern fringe. The reservoir has a water spread area of 900 ha and catchment areas of 472 km<sup>2</sup>. It has a mean depth of 43.5 m.

Pandoh reservoir is a minor irrigation project which generates power and controls floods during monsoon season.

Man-made ponds/lakes: There are few manmade village ponds/lakes, observed mainly in low elevation areas. These ponds mainly serve animal husbandry. Few small ponds in Mandi district are under lotus cultivation.

National Wetland Inventory and Assessment (NWIA) Atlas of Himachal Pradesh, 2011; prepared by Ministry of Environment and Forest of India, estimates the area of various wetland categories for Himachal Pradesh. This has been carried out using GIS layers of wetland boundary, water-spread, aquatic vegetation and turbidity. Total 170 wetlands have been mapped at 1:50,000 scale in the State. In addition, 471 small wetlands (< 2.25 ha) have also been identified. Total wetland area estimated is 98496 ha that is around 1.77 per cent of the geographical area (Table 1). The major wetland types are River/ Stream (55558 ha). The major rivers are Sutlej, Ravi, Chenab, Jhelum and Bias.

There are 13 Reservoirs/Barrages with 41,817 ha area. Total 42 high altitude lakes are mapped with 387 ha area. However, among the 471 small wetlands mapped as point feature, many are high altitude lakes. Chandratol is a famous high altitude lake of the State which is a popular tourist destination. The other wetlands are tanks/ponds, waterlogged and lakes/ponds. Graphical distribution of wetland type is shown in Figure 1. There are total 170 manmade and natural wetlands identified in the State (Table 2) and also shown in Figure 2.

Aquatic vegetation is observed in reservoirs/barrages and tanks/ponds. The aquatic vegetation in wetlands was observed only during pre monsoon (5294 ha). The open water spread area is significantly lower during pre monsoon (49245 ha) compared to post monsoon (69107 ha). The qualitative turbidity of water is mainly low to moderate in both the seasons.



**Table 1: Area Estimates of Wetlands in HP (Area in ha)**

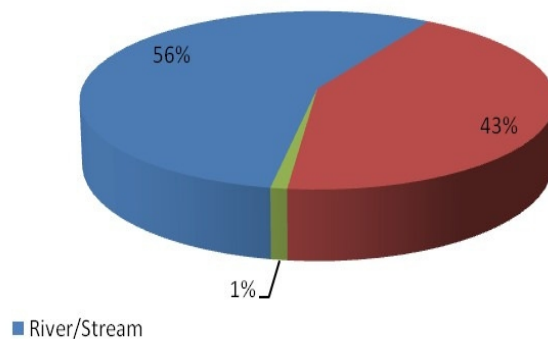
Sr. No.	Wetland Category	No. of Wetlands	Total Wetland Area	% of Wetland Area	Post-monsoon Area	Open Water Pre-monsoon Area
<b>Inland Wetlands-Normal</b>						
1	Lakes/Ponds	8	52	0.05	49	26
2	High altitude wetlands	42	387	0.39	285	128
3	Waterlogged	10	47	0.05	39	19
4	River/Stream	67	55558	56.41	27153	17063
<b>Inland Wetlands-Man-made</b>						
7	Reservoirs/Barrages	13	41817	42.46	41445	31966
8	Tanks/Ponds	27	134	0.14	106	29
9	Waterlogged	3	30	0.03	30	14
Sub-Total-Inland wetland (Natural & Man-made)		170	98025	99.52	69107	49245
Wetlands (<2.25 ha)		471	471	0.48	-	-
Grand Total		641	98496	100.00	69107	49245
Area under Aquatic Vegetation					-	5294
Area under turbidity levels						
Low					46870	33949
Moderate					22236	15296

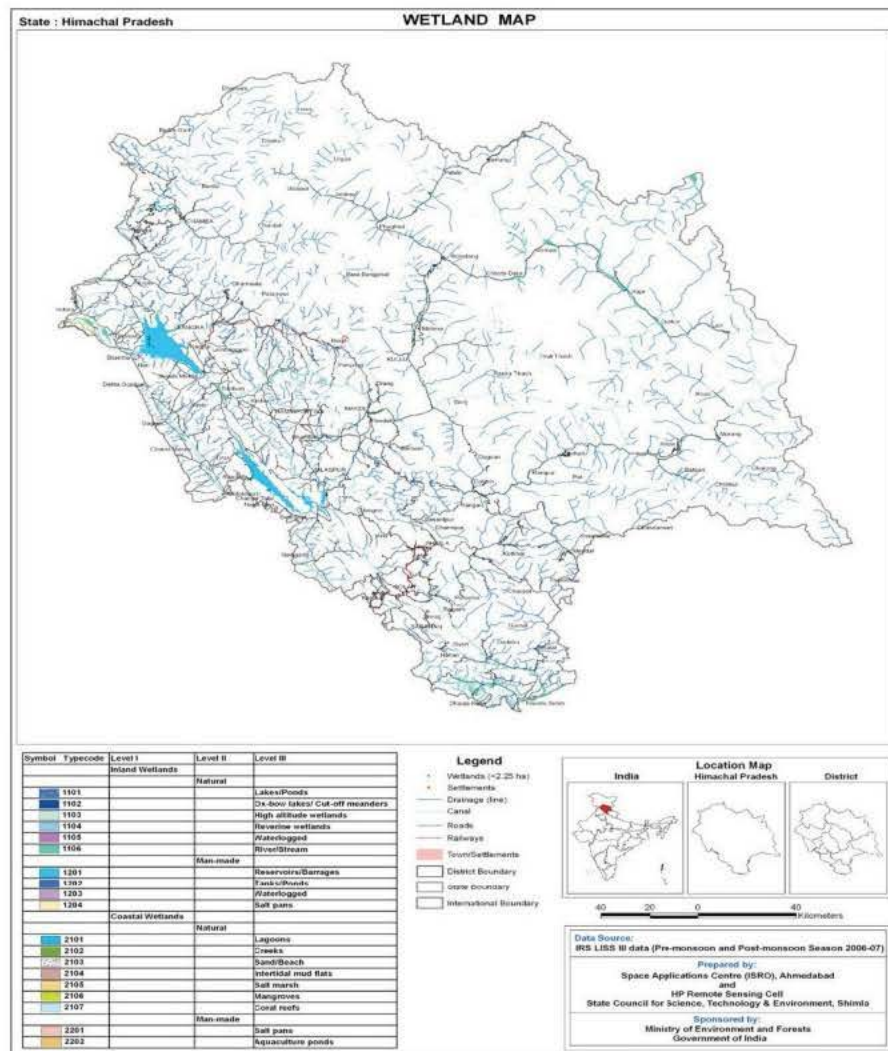
(Source: National Wetlands Inventory Atlas of Himachal Pradesh – <http://moef.nic.in/modules/others/?f=wetlands-atlas>) / Ministry of Environment and Forest, GoI.

**Table 2: Wetland distribution in Himachal Pradesh (Area in Ha)**

Wetlands	No.	Wet area (Ha)	Water Spread(Ha)	
			Post-Monsoon	Pre Monsoon
Natural wetlands	127	56044	27526	17236
Manmade	43	41981	41581	32009
Total	170	98025	69107	49245

No. of Wetlands < 2.25 ha =471

**Figure 1: Type-wise wetland distribution in Himachal Pradesh**



**Figure 2: Wetlands Sites of Himachal Pradesh**

(Source: National Wetlands Inventory Atlas of Himachal Pradesh – <http://moef.nic.in/modules/others/?f=wetlands-atlas>) / Ministry of Environment and Forest, GoI.

**2.2 In addition to the above listed common parameters, those specific to NRM sectors, covering flora, fauna and aquatic species are as follows**

**2.2.1 Inventory of habitats and existing species**

**Pong dam**

It supports 54 species of waterfowl as compared to 39 reported before creation of the dam. 367 species of birds, belonging to 56 families have been reported, the most important being the

vast variety of waterfowls. About 40 species of waterfowls were noticed to have bred during 2008-09. There are about 80 species of butterflies and 8 species of snakes.

The flora consists of more than 500 species. With increased protection and awareness about the faunal diversity, the bird count steadily registered an increase from about 70000 in 1999-2000 to about 142000 in 2004-05 before declining marginally to a figure of 111000 in 2006-07. There exist about 27 species of fish, which provide livelihood to about 2700 families living in the vicinity of the reservoir. Birds and fish are the main elements of fauna at the Pong Dam Lake. The sanctuary is an important staging area for an annual migratory waterfowl population of more than 20,000 birds comprising mainly of barheaded geese (*Anser*

*indicus*), northern lapwing (*Vanellus vanellus*), ruddy shelduck (*Tadorna ferruginea*), pintail (*Anas acuta*), common teal (*Anas crecca*), mallard (*Anas poecilorhyncha*), coot (*Fulica atra*), etc. The rednecked grebe (*Podiceps grisegena*) was recorded from this reservoir for the first time in India. This gives the area national as well as international significance for the conservation of several waterfowls. The black headed gull, great black headed gull and herring gull, species which are fairly uncommon in India away from the coast, visit the reservoir each winter, which act as an important staging area for migrants such as bar headed geese and northern lapwing while five species, namely ruddy shelduck, pintail, common teal, mallard and coot, flock during winter at the reservoir in thousands.

#### Waterside birds at Pong Dam reservoir

Species name	Status according to Whistler (1926)	After creation of the Dam
Striated babbler ( <i>Turdoides earlei</i> )	-	Common, local
Blue throat ( <i>Erithacus svecica</i> )	Common, winter visitor	Common, winter visitor
Striated marsh warbler ( <i>Megalurus palustris</i> )	-	Common, local
Red munia ( <i>Estrilda amandava</i> )	-	Common, local
Indian white wagtail ( <i>Motacilla alba</i> )	Common, winter visitor	Common, winter visitor
Large pied wagtail ( <i>M. maderaspatensis</i> )	Common, local	Common, local
Grey wagtail ( <i>M. cinerea</i> )	Common, winter visitor	Common, winter visitor
Yellow wagtail ( <i>M. flava</i> )	Occasional, straggler	Occasional, straggler
Tawny pipit ( <i>Anthus campestris</i> )	-	Occasional, winter visitor
Indian sand lark ( <i>Calandrella raytal</i> )	Common, local	Common, local
Crow pheasant ( <i>Centropus sp.</i> )	-	Common, local
Marsh harrier ( <i>Circus aeruginosus</i> )	Occasional, migratory	Common, local
Osprey ( <i>Pandion haliaetus</i> )	Occasional, summer visitor	Occasional, summer visitor
Pallas' fishing eagle ( <i>Haliaeetus leucorhynchus</i> )	Common, local	Common, local

Main Observations	Year	Remarks
Sightings of Red-necked grebe ( <i>Podiceps grisegena</i> )	1988-89 (15); 1989-90 (17) 1990-91 (10); 1991-92 (21) 1992-93 (0); 1993-94 (2) 1994-95 (6).	First sighted on 2nd December 1985
Conglomerations of Great Cormorants ( <i>Phalacrocorax carbo</i> )	1993-94 1994-95	2600 birds on one sandbar. In flight.
Sighting of Black storks ( <i>Ciconia nigra</i> )	1988-89	Birds could not be sighted during subsequent surveys.
Sighting of Greylag goose ( <i>Anser anser</i> )	1994-95	First recorded sighting of 10 birds in the area.

Main Observations	Year	Remarks
Observations on Black bellied terns ( <i>Sterna melanogaster</i> )	1988-89 (5); 1989-90 (0) 1990-91 (0); 1991-92 (5) 1992-93 (5); 1993-94 (0) 1994-95 (0).	Observations vary over the years.
Observations on gulls and terns	All over the years	One of the few water bodies attracting gulls and terns in hundreds.

Fish Diversity: A total of 27 fish species (sub-species, varieties) belonging to six families have been encountered in the Pong reservoir. Pong reservoir may be categorized as a Mystus reservoir. *M. Seenghala* has been showing constant increase during the last 10 years. Mahseer is a highly precious and sought-after fish of the Pong reservoir. It's probably the only reservoir in the country, which provides the opportunity of Mahseer angling.

Very little data on fish is available in Beas river prior to construction of the Pong Dam. *Oreinus sinuatus*, *Schizothorax richardsonii* and *Glyptosternum striatus* are the three major fish of river Beas. In 1974-75, the stocking programme started in the Pong Dam Lake. Mainly seed of minor carp and Indian major carps were introduced. *Labeo rohita*, *Catla catla*, *Catla mrigala* and *Catla carpic* are four major species which have been stocked in the reservoir with a ratio of 2:2:1:1. The fish production in the lake has been recorded highest during the years when the maximum water level was recorded.

Inventory of Fish (family wise) in Pong dam Family *Cyprinidae* comprises of following species *Barilius bendelisis*, *B.vagra*, *Cirrhinus mrigala*, *Crossocheilus latius*, *Catla catla*, *Labeo dero*, *L. bata*, *L. rohita*, *Cyprinus carpio*, *Schizothorax richardsonii*, *Tor putitora*, *Puntius ticto* and *P.sarana*,

#### Family Cobitidae

*Botia birdi*, *Naemacheilus kangrae*

#### Family Bagridae

*Mystus aor*, *M.seenghala*, *Bagarius bagarius*, *Wallago attu*

#### Family Sisoridae

*Glyptothorax pectinopterus*, *G.garhwali*

#### Family Channidae

*Channa marulius*, *C.striatus* *C.cephalus*

#### Family Mastacembelidae

##### Mastacembelus armatus

After creation of the Pong Dam, it has been noted that golden mahseer (*Tor putitora*), Snow trout (*Schizothorax richardsonii*) and *L. dero* have started declining in their earlier habitat. Similarly *S.richardsonii* is diminishing while *L. dero* is competing to retain its presence in the reservoir. The cultivation disturbs the mudflats and other waterbird habitats during the winter season. There has been an increase in reports of the severity of crop damage by the waterfowls, mainly Bar-headed geese and Brahminy ducks. Secondly, fishing done by nets often cause obstruction to the diving ducks. Poaching is not a severe threat, though a few cases have been detected by the sanctuary protection staff.

Prior to the construction and completion of the reservoir, detailed study on ecology and fisheries of River Beas had never been done. *Oreinus sinuatus*, *S. richardsonii* and *Glyptosternum striatus* are three major fish of river Beas recorded from Beas Kund to Largi- a stretch of approximately 150 km. *T. putitora*, *S richardsonii*, *L. dero* and *W. attu* from Beas river. The creation of the reservoir while on one hand has created a perennial source of water body but on the other hand has certain migratory species competing to retain their position in the ecosystem. Of these, three most important are the golden mahseer (*T. putitora*), Snow trout (*S. richardsonii*) and *L. dero*. The mahseer which had its migratory run upto Sultanpur near Kullu has disappeared in this area. The other affected species are *S.richardsonii* and *L. dero*. While the former could not establish in the

new environment, the latter is struggling to retain its progeny in the reservoir.

Chandertal wetland: The Chandertal Lake supports endangered mammalian species i.e. Snow Leopard (*Uncia uncia*), Bobak Marmot (*Marmota bobak*), mountain vole (*Alticola roylei*), Himalayan Ibex (*Capra sibirica hemalayanus*), Blue Sheep (*Pseudois nayaur*) listed in IUCN's Red List and CITES. Chandertal Lake is of special value for its endemic plant and animal communities. Large variety of species is found in the wetland, which includes Snow cock (*Tetraogallus himalayensis*), Chukor, Black ring stilt (*Himantopus mexicanus*), Brahminy duck (*Tadorna ferruginea*), Kestrel (*Falco tinnunculus*), Golden eagle (*Aquila chrysaetos*) and Chough (*Pyrrhocorax pyrrhocorax*). A large number of mammals are present in the

catchment area of the lake namely Snow Leopard, Red Fox (*Vulpes vulpes*), Wolf, Ibex, Blue Sheep / Bharal (*Pseudois nayaur*) etc. are the common mammals of the area. In addition to the mammals and birds, the region abounds in various insects during the summer season. The insect fauna consists of spiders, beetles, wingless grasshopper, butterflies and bugs. The margins of the lake abound in larvae of mayflies, stone fly and caddis fly.

Flora: The Chandertal Lake and its catchment area come under the alpine zone which is characterized by the absence of trees. The herbaceous growth is remarkable for its variety. The important species are *Potentilla*, *Ranunculus*, *Aquilegia* and *Primula* species etc. The common grasses frequently met with are *Poa* and *Agropyron*. These grasses are rich in nutritive value.

### List of Plants

1	<i>Rosularia angiosperma</i>	26	<i>Arabidopsi shimalaica</i>
2	<i>Leontopodium himalayanum</i>	27	<i>Nepeta laevigata</i>
3	<i>L.monocephalum</i>	28	<i>Saxifraga spp.</i>
4	<i>Geranium tuberaria</i>	29	<i>Aster spp</i>
5	<i>G.pratense</i>	30	<i>Polygonum paronychioides</i>
6	<i>Potentilla sericea</i>	31	<i>P.plebeium</i>
7	<i>P.plurijuga</i>	32	<i>Juncus thomsoni</i>
8	<i>Thymus linearis</i>	33	<i>Gentianella moorcroftiana</i>
9	<i>Oxytropisbumifusa</i>	34	<i>Waldheimia stoliczkaei</i>
10	<i>O.lapponica</i>	35	<i>Chaerophyllum reflexum</i>
11	<i>Astragalus rhizanthus</i>	36	<i>Epilobium spp.</i>
12	<i>A.subuliformis</i>	37	<i>Juniperus spp.</i>
13	<i>Cerastium cerastioides</i>	38	<i>Psychrogeton andryaloides</i>
14	<i>Hedysarum cachemirianum</i>	39	<i>Aconitum violaceum</i>
15	<i>Ranunculus spp.</i>	40	<i>Agrostis vinealis</i>
16	<i>Eritrichium nanum</i>	41	<i>Aster flaccidus</i>
17	<i>Rhodiola spp</i>	42	<i>Delphinium cashmerianum</i>
18	<i>Bistorta affinis</i>	43	<i>Duchesnea indica</i>
19	<i>B.vivipara</i>	44	<i>Geranium wallichianum</i>
20	<i>Artemisia spp</i>	45	<i>Jurinella macrocephala</i>
21	<i>Rheum spiciforme</i>	46	<i>Oxyria digyna</i>
22	<i>Rnebbianum</i>	47	<i>Pedicularis pectinata</i>
23	<i>Draba setosa</i>	48	<i>Poa annua</i>
24	<i>Primula spp</i>	49	<i>Polygonum viviparum</i>
25	<i>Androsace spp</i>	50	<i>Potentilla atrosanguinea</i>

## Algae

Sr. No.	Name	Class
1	<i>Caloneis bacillum</i>	Bacillariophyceae
2	<i>Chroococcus schizodermaticus</i>	Cyanophyceae
3	<i>Cosmariumdecoratum</i>	Chlorophyceae
4	<i>Cymbella laevis</i>	Bacillariophyceae
5	<i>Fragilaria pinnata</i>	Bacillariophyceae
6	<i>Microspora floccosa</i>	Chlorophyceae
7	<i>Naviculacryptocephala</i>	Bacillariophyceae
8	<i>Oedogonium figuratum</i>	Chlorophyceae
9	<i>Schizomeris leibleinii</i>	Chlorophyceae
10	<i>Zygnema kbannae</i>	Chlorophyceae

## Fauna: Mammals

Sr. No.	Common Name	Zoological Name
1	Bobak marmot	<i>Marmota bobak</i>
2	Royles mountain vole	<i>Alticola roylei</i>
3	Himalayan weasel	<i>Mustela sibirica</i>
4	Mole rat	<i>Bandicota spp.</i>
5	Himalayan Ibex	<i>Capra sibirica hemalayanus</i>
6	Wolf	<i>Canis lupus</i>
7	Lynx	<i>Felix lynx</i>
8	Snow leopard	<i>Uncia uncia</i>
9	Himalayan fox	<i>Vulpes spp.</i>

## Birds

Sr. No.	Common Name	Zoological Name
1	Hoopoe	<i>Upupa epops</i>
2	Yellow Headed Wagtail	<i>Motacilla flava</i>
3	White Wagtail	<i>Motacilla alba</i>
4	Grey Wagtail	<i>Motacilla cinerea</i>
5	Yellow billed chough	<i>Pyrrhocorax pyrrhocorax</i>
6	Red billed chough	<i>Pyrrhocorax graculus</i>
7	Raven	<i>Corvus corax</i>
8	Jungle crow	<i>Corvus macrorhynchos</i>
9	Little brown dove	<i>Streptopelia senegalensis</i>
10	Blue rock pigeon	<i>Columba livia</i>
11	Snow Pigeon	<i>Columba leuconota</i>
12	Hill Pigeon	<i>Columba rupestris</i>
13	Common rose finch	<i>Carpodacus erythrinus</i>
14	Brandts mountain finch	<i>Leucosticte brandti</i>
15	Hodgson's mountain finch	<i>Leucostictenemorica</i>
16	Horned lark	<i>Otocoris alpestris</i>
17	Black (common) redstart	<i>Phoenicurus ochruros</i>
18	Hodgson's redstart	<i>Phoenicurus hodgsoni</i>

Sr. No.	Common Name	Zoological Name
19	Short toed eagle	<i>Circetus gallicus</i>
20	Lammergeyer vulture	<i>Gypaetus barbatus</i>
21	White backed vulture	<i>Gyps bengalensis</i>
22	Common sandpiper	<i>Tringa hypoleucos</i>
23	Green sandpiper	<i>Tringa ochropus</i>
24	Green Shank	<i>Tringa nebularia</i>
25	Kentish plover	<i>Charadrius alexandrinus</i>
26	Black winged stilt	<i>Himantopus himantopus</i>
27	Common teal	<i>Anas crecca</i>
28	Blue rock thrush	<i>Monticola solitarius</i>
29	Magpie robin	<i>Copsychus saularis</i>
30	Himalayan snowcock	<i>Tetraogallus himalayensis</i>

Renuka wetland: 443 species from phylum protozoa to phylum chordata have been recorded.

Birds: 103 species of birds belonging to 38 families have been identified in the Renuka area with 66 species of resident birds

Sr. No.	Common Name	Zoological Name
1	Crimson breasted barbet	<i>Megalaima haemacephala</i>
2	Bulbul	<i>Pycnonotus cafer</i>
3	Robin	<i>Saxicoloides fulicata</i>
4	Minivet	<i>Pericrocotus flammens</i>
5	House swift	<i>Apus nipalensis</i>

## Migratory birds

Sr. No	Common Name	Zoological Name
1	Lapwing	<i>Vanellus indicus</i>
2	Egret	<i>Egretta garzetta</i>
3	Mallard	<i>Anas platyrhynchos</i>
4	Pond Heron	<i>Ardeola grayii</i>

## Fish

1	Mahseer ( <i>Tor putitora</i> )	8	<i>Labeo bata</i>
2	Baam ( <i>Mastacembelus armatus</i> )	9	Saslu ( <i>Rasbora caverii</i> )
3	Borna snakehead ( <i>Channa amphibius</i> )	10	Barred baril ( <i>Barilius barila</i> )
4	Chikli ( <i>Nemacheilus sikmaiensis</i> )	11	<i>Centropristis striatus</i>
5	Khavali ( <i>Puntius amphibius</i> )	12	<i>Centropristes cephalus</i>
6	Puntius sa rana	13	<i>Centropristes marulius</i>
7	Rohu ( <i>Labeo rohita</i> )	14	<i>Chela sp.</i>

## Flora

1	<i>Terminalia tomentosa</i>	11	<i>Salix tetrasperma</i>
2	<i>Sborea robusta</i>	12	<i>Dalbergia sissoo</i>
3	<i>Moringa pterygosperma</i>	13	<i>Anogeisus</i> sp.
4	<i>Ougeinia ojeinensis</i>	14	<i>Aegle marmelos</i>
5	<i>Cassia fistula</i>	15	<i>Murraya koenigii</i>
6	<i>Bauhinia variegata</i>	16	<i>Berberis</i> spp.
7	<i>Ficus palmata</i>	17	<i>Phragmites</i> spp
8	<i>Ficus religiosa</i>	18	<i>Typha</i> spp
9	<i>Bambusa arundinacea</i>	19	<i>Carex</i> spp
10	<i>Phoenix</i> spp.	20	<i>Hydrilla</i> spp.

## District wise distribution of Wetlands in

### HP:

There are 12 districts in the State. The geographical area of the districts varies from 1118 km<sup>2</sup> (Hamirpur) to 13835 km<sup>2</sup> (Lahaul & Spiti). The wetlands occupy as high as 10.63% of the geographical area (Bilaspur district), and as low as 0.46% (Shimla). In terms of total wetland area (% wetland area), Kangra is the leading district (34605 ha, 35.13%) and Hamirpur is the least (2182 ha, 2.22 %). District-wise wetland area estimates is given in Table 4.

**Table 4: District-wise wetland area**

Sr. No.	District	Geographical Area (km <sup>2</sup> )	Wetland Area (km <sup>2</sup> )	% of total wetland area	% of district geographical area
1	Bilaspur	1167	12407	12.60	10.63
2	Chamba	6528	4667	4.74	0.71
3	Hamirpur	1118	2182	2.22	1.95
4	Kangra	5739	34605	35.13	6.03
5	Kinnaur	6401	4990	5.07	0.78
6	Kullu	5503	2894	2.94	0.53
7	Lahaul & Spiti	13835	10766	10.93	0.78
8	Mandi	3950	3704	3.76	0.94
9	Shimla	5131	2368	2.40	0.46
10	Sirmaur	2825	9990	10.14	3.54
11	Solan	1936	2720	2.76	1.40
12	Una	1540	7203	7.31	4.68
	Total	55673	98496	100	1.77

Source: National Wetlands Inventory Atlas of Himachal Pradesh - <http://moef.nic.in/modules/others/?f=wetlands-atlases>

## Bilaspur

Bilaspur district is predominantly situated in the Sutlej River basin. It lies between 31°12'30" and 31°35'30" North latitude and between 76°23'45" and 76°55'40" East longitude. The area of the district is 1167 sq. km. It is located at an altitude of 610 meters above mean sea level.

## 2.2.2 Inventory of endangered species

**Table 3: Endangered (EN)**

Sr. No	Botanical Name	Common/Local Name
1.	<i>Aconitum deinorrhizum</i>	Mohra
2.	<i>Angelica glauca</i>	Chora
3.	<i>Betula utilis</i>	Bhojpatra/Bhoj
4.	<i>Dioscorea deltoidea</i>	Shingli mingli
5.	<i>Ephedra gerardiana</i>	Somlata
6.	<i>Fritillaria roylei</i>	Ksheer kakoli
7.	<i>Habenaria intermedia</i>	Riddhi
8.	<i>Hyoscyamus niger</i>	Khurasani ajwain
9.	<i>Juniperus polycarpus</i>	Jau. Hauber
10.	<i>Jurinea dolomiaea</i>	Dhoop
11.	<i>Meconopsis aculeata</i>	Patishan rooli
12.	<i>Nardostachys grandiflora</i>	Balchharh
13.	<i>Paris polyphylla</i>	Meethi bach. Dudh bach
14.	<i>Picrorhiza kurroa</i>	Karu, Kutki
15.	<i>Podophyllum hexandrum</i>	Bankakri
16.	<i>Polygonatum cirrhifolium</i>	Salam mishri, Maha meda
17.	<i>Rheum emodi</i>	Revandchini
18.	<i>Rheum moorcroftianum</i>	Revandchini
19.	<i>Taxus wallichiana</i>	Talishpatra
20.	<i>Zanthoxylum armatum</i>	Tirmur

Its boundaries touch Una, Hamirpur, Mandi and Solan districts. The temperature fluctuates from maximum 37°C to minimum 05°C. The principal river that passes through the district is the Sutlej River, which divides the district almost into two equal halves. Bhakra Dam is an important wetland of this district, which is the highest straight gravity dam of the world at the height of 740 ft.

Total wetland area in the district is 12407 ha that includes 33 small wetlands (<2.25 ha). Reservoir/ Barrage occupies 89.39% of wetlands. River/Stream is the second large wetland type in the district which accounts for 9.89% of the area. Details of the wetlands are given in Table 5.

The area under aquatic vegetation is 396 ha in pre monsoon. The open water spread of wetlands is significantly more in Post-monsoon (12257 ha) than in Pre-monsoon (8527 ha). The qualitative turbidity of water is low in both the seasons.

**Table 5: Area estimates of wetlands in Bilaspur (ha)**

Sr. No.	Wetland Category	Number of Wetlands	Total Wetland Area	% of Wetland Area	Open Water	
					Post-monsoon Area	Pre-monsoon Area
<b>Inland Wetlands - Natural</b>						
1	High altitude wetlands	1	42	0.34	41	18
2	Waterlogged	1	5	0.04	5	4
3	River/Stream	9	1227	9.89	1112	901
<b>Inland Wetlands -Man-made</b>						
4	Reservoirs/ Barrages	4	11090	89.39	11089	7604
5	Waterlogged	1	10	0.08	10	-
	Sub-Total	16	12374	99.73	12257	8527
	Wetlands (<2.25 ha)	33	33	0.27	-	-
	<b>Grand Total</b>	<b>49</b>	<b>12407</b>	<b>100.00</b>	<b>12257</b>	<b>8527</b>
Area under Aquatic Vegetation					-	396
Area under turbidity levels						
Low					11306	7866
Moderate					951	661

Source: National Wetlands Inventory Atlas of Himachal Pradesh – <http://moef.nic.in/modules/others/?f=wetlands-atlases>

### Important Wetland

**Gobind Sagar:** The Gobind Sagar (lies between 31°12'52" N and 31°36'29" N latitudes and 76°21'52" E and 76°46'39" E longitudes) is a reservoir over the river Sutlej, and came into existence on account of the construction of the dam at Bhakra and is named in honour of Shri Gobind Singh, the tenth Sikh Guru. One of the world's highest gravity dams, the Bhakra rises 225.5 m above its lowest foundations. This reservoir is 90 kms long and encompasses an area of 15739 ha.

As far back as 1962, the Gobind Sagar was declared a 'water fowl refuge' and even today, hosts a variety of water and shore birds. Fishing is a regular activity and 51 species and sub-species have been recorded. The varieties found, include *Labeo dero*, *Tor putitora*,

*Mystus seenghala* and mirror carp and other species.

### Chamba

Chamba is the north-western district of Himachal Pradesh, with its headquarters located in Chamba town. The district is surrounded on the north-east and east by the Ladakh area of Jammu and Kashmir State, Lahaul and Bara Bangahlaa area of Himachal Pradesh, on the south-east and south by the districts of Kangra of Himachal Pradesh and Gurudaspur of Punjab State. The Ravi River flows through this district. Chamba lies between 32°11'30" and 33°13'06" North latitude and between 75°49'00" and 77°49'30" East longitude. The area of the district is 6528 km<sup>2</sup>. The territory is wholly mountainous with altitude ranging from 610 meters to about 6400 meters above mean sea level. There are four



major wildlife sanctuaries in the district i.e. Kalatop Khajjiar, Sechu, Kugti, and Tundah. These Sanctuaries are mainly distributed in the northern part of the district.

Total wetland area in the district is 4667 ha that includes 13 small wetlands (<2.25 ha). River/stream occupies 77.80% of wetlands. Reservoir/Barrage is the second large wetland type in the district accounting for 21.23%. The

other major wetland types are High altitude lakes (0.64%). Details of wetland are given in Table 6.

The area under aquatic vegetation is very low (2 ha) and observed during pre monsoon. The open water spread of wetlands is more in Post-monsoon (3568 ha) than in Pre-monsoon (2307 ha). The qualitative turbidity of water is low to moderate in both the seasons.

**Table 6: Area estimates of wetlands in Chamba (ha)**

Sr. No.	Wetland Category	Number of Wetlands	Total Wetland Area	% of Wetland Area	Open Water	
					Post-monsoon Area	Pre-monsoon Area
Inland Wetlands – Natural						
1	Lakes/Ponds	1	2	0.04	-	-
2	High altitude wetlands	4	30	0.64	27	-
3	River/Stream	10	3631	77.80	2657	1453
Inland Wetlands -Man-made						
4	Reservoirs/Barrages	2	991	21.23	884	854
	Sub-Total	17	4654	99.72	3568	2307
	Wetlands (<2.25 ha)	13	13	0.28	-	-
	Grand Total	30	4667	100.00	3568	2307
	Area under Aquatic Vegetation				-	2
	Area under turbidity levels					
	Low				3310	1130
	Moderate				258	1177

Source: National Wetlands Inventory Atlas of Himachal Pradesh – <http://moef.nic.in/modules/others/?f=wetlands-atlases>

## Hamirpur

Hamirpur district is predominantly drained by the river Beas. It is the smallest district of the State and lies between 31°4'48" and 31°53'35" North latitude and between 76°17'50" and 76°43'42" East longitude. Its boundaries touch Una in the west and Bilaspur district of Himachal Pradesh in the south. In the west, the district shares its boundary with Mandi district and on south with Kangra district of Himachal Pradesh. Hamirpur is located in a relatively warmer region with a lower altitude as compared to the other districts of the State. The average elevation is 738 metres and it

ranges from 400 meters to 1232 meters. The maximum temperature of the district ranges from 37°C to 39°C and the minimum from 03°C to 05°C. The area of the district is 1118 sq. km.

Total wetland area in the district is 2182 ha that includes 8 small wetlands (<2.25 ha). River/stream occupies 99.63% of wetlands. The open water spread of wetlands is more in Post-monsoon (875 ha) than in Pre-monsoon (643 ha). The qualitative turbidity of water is moderate in both the seasons. Details of wetland are given in Table 7.

**Table 7: Area estimates of wetlands (ha)**

Sr. No.	Wetland Category	Number of Wetlands	Total Wetland Area	% of Wetland Area	Open Water	
					Post-monsoon Area	Pre-monsoon Area
Inland Wetlands – Natural						
1	River/Stream	6	2174	99.63	875	643
Inland Wetlands -Man-made						
	Sub-Total	6	2174	99.63	875	643
	Wetlands (<2.25 ha)	8	8	0.37	-	-
<b>Total</b>		<b>14</b>	<b>2182</b>	<b>100.00</b>	<b>875</b>	<b>643</b>
Area under turbidity levels						
Low					-	44
Moderate					875	599

Source: National Wetlands Inventory Atlas of Himachal Pradesh – <http://moef.nic.in/modules/others/?f=wetlands-atlases>

### Kangra

Kangra district lies between 31°40'00" and 32°25'00" North latitude and between 75°35'00" and 77°05'00" East longitude. The total area of the district is 5739 sq. km and it's criss-crossed by mountain ranges and enclosed valleys. It is bounded on the southwest by Una district, on the northwest by District Gurdaspur of Punjab, on the north by Lahaul & Spiti and Chamba districts of Himachal Pradesh. It is enclosed by Kullu and Mandi districts in the east while on the south it touches Hamirpur district. The Beas is the principal river which receives almost the entire drainage of the

district. The territory is wholly mountainous with an altitude ranging from 500 meters to about 5500 meters from the mean sea level.

Total wetland area in the district is 34537 ha that includes 68 small wetlands (<2.25 ha). Reservoir/ stream occupies 71.06% of wetlands. River/stream is the second large wetland type in the district which accounts for 28.63%. Details of wetland are given in Table 8.

The area under aquatic vegetation is 3731 ha in pre monsoon. The open water spread of wetlands is more in Post-monsoon (28375 ha) than in Pre-monsoon (22265 ha). The qualitative turbidity of water is low in both the seasons.

**Table 8: Area estimates of wetlands (ha)**

Sr. No.	Wetland Category	Number of Wetlands	Total Wetland Area	% of Wetland Area	Open Water	
					Post-monsoon Area	Pre-monsoon Area
Inland Wetlands – Natural						
1	Waterlogged	1	6	0.02	-	3
2	River/Stream	35	9908	28.63	3834	1941
Inland Wetlands -Man-made						
3	Reservoirs/Barrages	2	24589	71.06	24508	20307
4	Tanks/Ponds	2	14	0.04	13	-
5	Waterlogged	2	20	0.06	20	14
	Sub-Total	42	34537	99.80	28375	22265
	Wetlands (<2.25 ha)	68	68	0.20	-	-
<b>Total</b>		<b>110</b>	<b>34605</b>	<b>100.00</b>	<b>28375</b>	<b>22265</b>
Area under Aquatic Vegetation						3731
Area under turbidity levels						
Low					24648	20342
Moderate					3727	1923

Source: National Wetlands Inventory Atlas of Himachal Pradesh – <http://moef.nic.in/modules/others/?f=wetlands-atlases>

## Important Wetland

Pong Dam - Ramsar Site (2002): Pong is a recently created reservoir on the Beas River in the plains of Sansarpur Terrace, district Kangra (between 31°52'14" N and 32°07'31" N latitudes and 75°53'04" E and 76°13'36" E longitudes). Located at an elevation of 450 m amsl, it has a length of 41.80 km, width of 13.73 km and sprawls over an area of 24532 hectares. The dam is an important source of electricity and irrigation. There is some submerged vegetation in the reservoir, but because of the pronounced seasonal changes in the water level, the shoreline does not support extensive areas of emergent vegetation. The surrounding hill sides have mixed deciduous and pine (*Pinus roxburghii*) forests.

Zoological Survey of India has recorded 447 faunal species in the wetland area. 220 bird species (i.e. Bar headed geese, Northern lapwing, Pintail, Common teal, Mallard and Coot) belonging to 54 families have been recorded. The Black headed gull, Great black headed gull and herring gull which are fairly uncommon in India away from the coast, visit the reservoir each winter.

A total of 27 fish species belonging to six families have been encountered in the Pong reservoir. Mahseer (*Tor putitora*) is a highly precious and sought - after fish of the Pong reservoir.

## Kinnaur

Kinnaur district has an area of 6401 sq. km. The district coordinates ranges from 31°05'55" to 32°05'20" North latitude and 77°45'00" and 79°00'50" East longitude. Lahaul and Spiti district of Himachal Pradesh bounds Kinnaur on the north and on the east by the Tibetan territory, on the south by Shimla district and Uttarkashi district of Uttarakhand and on the west by Shimla district. Sutlej, the principal river of the district arises in the Himalayas and has plenty water throughout the year, as it is the only perennial river of the district.

Total wetland area in the district is 4990 ha that includes 43 small wetlands (<2.25 ha). River/stream occupies 97.37% of wetlands. The open water spread of wetlands is more in

Post-monsoon (1426 ha) than in Pre- monsoon (1312 ha). The qualitative turbidity of water is moderate in both the seasons. Details of wetland are given in Table 9.

**Table 9: Area estimates of wetlands (ha)**

Sr. No.	Wetland Category	Number of Wetlands	Total Wetland Area	% of Wetland Area	Post-monsoon Area	Open Water Pre- monsoon Area
<b>Inland Wetlands – Natural</b>						
1	High altitude wetlands	7	47	0.94	15	-
2	Waterlogged	1	8	0.16	8	-
3	River/Stream	1	4859	97.37	1378	1302
<b>Inland Wetlands -Man-made</b>						
4	Reservoirs/Barrages	2	5	0.10	-	-
5	Tanks/Ponds	5	28	0.56	25	10
Sub-Total		16	4947	99.14	1426	1312
Wetlands (<2.25 ha)		43	43	0.86	-	-
Total		59	4990	100.00	1426	1312
<b>Area under turbidity levels</b>						
Low					40	12
Moderate					1386	1300

Source: National Wetlands Inventory Atlas of Himachal Pradesh – <http://moef.nic.in/modules/others/?f=wetlands-atlases>

## Kullu

Kullu forms a transitional zone between the lesser and greater Himalayas and presents a typical rugged mountainous terrain with moderate to high relief. The altitude varies from 1300 meters to over 6000 meters from the mean sea level. The central coordinates of Kullu district are 31°58'00" North latitude and 77°06'04" East longitude. The area of the district is 5503 sq. km. On the North and Northeast, it is bounded by Lahaul & Spiti and Kangra districts, on the east and southeast by Kinnaur, and Shimla district and in the Southwest by Mandi District. The Sutlej and the Beas are the principal rivers of the district and these two rivers receive the entire drainage of the district.

Total wetland area in the district is 2894 ha that includes 65 small wetlands (<2.25 ha). River/stream occupies 94.96% of wetlands. Tanks/ponds are the second large wetland type in the district accounting for 1.87%. The other major wetland types are High altitude lakes. There are 7 large ones that were mapped with 27 ha area (0.93%). Details of wetland are given in Table 10.

The open water spread of wetlands is more in Pre- monsoon (2015 ha) than in Post-monsoon (1907 ha). The qualitative turbidity of water is moderate in both the seasons.

**Table 10: Area estimates of wetlands in Kullu (ha)**

Sr. No.	Wetland Category	Number of Total Wetlands	Total Wetland Area	% of Wetland Area	Post-monsoon Area	Open Water Pre- monsoon Area
Inland Wetlands – Natural						
1	High altitude wetlands	7	27	0.93	11	-
2	River/Stream	2	2748	94.96	1855	2013
Inland Wetlands -Man-made						
3	Tanks/Ponds	12	54	1.87	41	2
	Sub-Total	21	2829	97.75	1907	2015
	Wetlands (<2.25 ha)	65	65	2.25	-	-
	<b>Total</b>	<b>86</b>	<b>2894</b>	<b>100.00</b>	<b>1907</b>	<b>2015</b>
Area under turbidity levels						
	Low				52	2
	Moderate				1855	2013

Source: National Wetlands Inventory Atlas of Himachal Pradesh – <http://moef.nic.in/modules/others/?f=wetlands-atlases>

## Lahaul & Spiti

The location of the district is between north latitude 31°04'47" to 32°59'57" and east longitude 76°46'29" and 78°41'34". The geographical area of the district is 13835 sq. km. Lahaul & Spiti is bounded between Thiro Nallah in the west to Samdu in the east, Baralacha pass and its Parallel ranges in the north to Bhaha Parvati Hamta, Rothang and Kuji and the Sach pass in the south. It touches Tibet on its eastern border and north to it lies Ladakh, on the western and southern side. It borders with Chamba and Kullu districts and on the south-eastern side is the Kinnaur district.

The wetlands are associated with the main river of Lahaul valley, Chandra river, which originate from Chandra Tal near Baralacha, the other river is the Bhaga river which originates from Suraj Tal opposite Baralacha and meets Chandra river at Tandi and finally joins with Chenab river.

Total wetland area in the district is 10766 ha that includes 87 small wetlands (<2.25 ha). River/stream occupies 96.30% of wetlands. High altitude lakes are the second large wetland type in the district. This district has maximum number of large high altitude lakes (16) accounting for 1.71%. Chandertal is the most

famous high altitude lake in the district. The other major wetland types are Tanks/Ponds (0.07%). Details of wetland are given in Table 11.

significantly more in Post-monsoon (4406 ha) than in Pre- monsoon (2376 ha). The qualitative turbidity of water is low to moderate in both the seasons.

The open water spread of wetlands is

**Table 11: Area estimates of wetlands in Lahaul & Spiti (ha)**

Sr. No.	Wetland Category	Number of Wetlands	Total Wetland Area	% of Wetland Area	Post-monsoon Area	Open Water Pre- monsoon Area
<b>Inland Wetlands – Natural</b>						
1	High altitude wetlands	16	184	1.71	160	95
2	Waterlogged	2	8	0.07	7	-
3	River/Stream	4	10368	96.30	4128	2213
<b>Inland Wetlands -Man-made</b>						
4	Reservoirs/Barrages	1	111	1.03	111	68
5	Tanks/Ponds	2	8	0.07	-	-
	Sub-Total	25	10679	99.19	4406	2376
	Wetlands (<2.25 ha)	87	87	0.81	-	-
	<b>Total</b>	<b>112</b>	<b>10766</b>	<b>100.00</b>	<b>4406</b>	<b>2376</b>
<b>Area under turbidity levels</b>						
	Low				2315	163
	Moderate				2091	2213

Source: National Wetlands Inventory Atlas of Himachal Pradesh – <http://moef.nic.in/modules/others/?f=wetlands-atlases>

## Important Wetland

Chandertal Lake: The Chandertal Lake with its deep blue icy water, surrounded by snow and acres of scree, constitute an important high altitude cold desert wetland of western Himalayas. Their latitudinal and longitudinal position are 32°29' N and 77°36' E respectively and is situated at an altitude of 4270 metres.

This natural lake is about one km in length, half km in breadth at its widest part and has a circumference of 2.5 kms. The total area of the wetland is about 49 ha. The lake owes its name either to the fact that it is the source of the river Chandra, or by virtue of its crescent moon like shape. The mountain peaks with snow caps and slopes around the valley rise up to 3000 metres to 6300 metres. The mountain ranges are called Moulkila and Chandrabhaga. This crystal clear blue water lake lies in a broad grassy plain, which in ancient times was a glacier. Thus, the Chandertal wetland is covered by glacial type of soil, which is not fully developed. The lake has been formed due to blockades of rock basin by scree and para glacial deposits and the glaciers are the main source of inflow. There is also a regular outflow of water that keeps on varying depending upon the season. Chandertal wetland helps in the reduction of floods in downstream as water moves into wetland faster than it moves out of downstream part of the channel.

The region of Chandertal is characterized by oxygen deficiency, low atmospheric pressure, intense radiation, excessive coldness, and aridity and revitalizing climate. The average snowfall recorded is 75cm. The winters are extremely cold with mercury dipping down to -37°C to -40°C. The lake begins to freeze in the month of October and by December it is completely frozen. The turbidity is also very low, and free from eutrophication. About 65% of the catchment area is a degraded forest due to glacial action. Herbs and grasses cover rest of the 35% of the area. From June to September, shepherds from Kangra, Mandi and Kullu can be seen with their herds of sheep at Chandra pastures.

The Chandertal Lake and its catchment area fall in the Alpine zone that is characterized by the absence of trees. Since the lake is free from any human activity in the immediate vicinity, it is free from eutrophication. However, many algal species have been reported viz. *Caloneis bacillum*, *Chroococcus schizodermaticus*, *Cosmarium decoratum*, *Cymbella laevis*, *Fragilaria pinnata*, *Microspora floccosa*, *Navicula cryptocephala*, *Oedogonium figuratum*, *Schizomeris leibleinii* and *Zygnema khannae*.

The clean water of the lake with small marshy patches around attracts many migratory birds. Important species noted are: Snow cock, Chukar, Black winged stilt, Brahminy duck, Golden eagle, Hoopoe, Yellow Headed Wagtail, Jungle crow, Blue rock pigeon, Common rose finch, Black redstart, Short toed Eagle, Common Sandpiper, Teal, Magpie Robin, etc. The important wildlife species found in the region are Marmota Bobak, Snow leopard, Red fox, Snow wolf, Capra ibex, Blue sheep & Lynx.

The herbaceous growth in the catchment area is remarkable for its variety. The important species are *Potentilla*, *Ranunculus*, *Aquilegia*, *Primula*, *Aconitum*, *Aster*, *Astragalus*, *Bistorta affinis*, *Delphinium*, *Geranium*, *Oxyria*, *Potentilla*, *Polygonum*, *Ranunculus*, *Rosularia*, *Stellaria* and *Thymus* species. The common grasses frequently encountered are *Poa* and *Agropyron*. These grasses have rich nutritive value.

Some of the common herbaceous species found in the grasses found near the lake are *Geranium pratense*, *Jurinea macrocephala*, *Duchesnea indica*, *Potentilla atrosanguinea*, *Oxyria digyna* and, *Bistorta affinis* Mandi.

The location of the district is between north latitude 31° 13' 50" to 32° 04' 30" and east longitude 76° 37' 20" and 77° 23' 15". The geographical area of the district is 3950 km<sup>2</sup>. Kangra binds the district on the northwest,

Hamirpur and Bilaspur district in the west, Solan district in the south, Shimla district on south – west and Kullu district in the east. Beas and Sutlej are the main rivers, which pass through the district. There are three lakes in the district that are popular from religious and tourist points of view. The Rewalsar Lake is situated at southwest of Mandi Township at a height of 1300 meters from the mean sea level. It is very deep and oligotrophic in nature. Parashar Lake is small in size and located about 36 km. away from Mandi Township in the northeast direction. The Kamrunag Lake is

located at an altitude of 3150 meters from the mean sea level.

Total wetland area in the district is 3704 ha that includes 4 small wetlands (<2.25 ha). River/stream occupies 93.90% of wetlands. Reservoir/Barrage is the second large wetland type in the district which accounts for 5.21%. Details of wetland are given in Table 12.

The open water spread of wetlands is more in Pre- monsoon (2139 ha) than in Post-monsoon (2300 ha). The qualitative turbidity of water is moderate in both the seasons.

**Table 12: Area estimates of wetlands in Mandi (ha)**

Sr. No.	Wetland Category	Number of Wetlands	Total Wetland Area	% of Wetland Area	Open Water	
					Post- monsoon Area	Pre- monsoon Area
Inland Wetlands – Natural						
1	Lakes / Ponds	1	4	0.11	3	2
2	Waterlogged	2	7	0.19	7	6
3	River/Stream	8	3478	93.90	2100	1985
Inland Wetlands -Man-made						
4	Reservoirs/Barrages	2	193	5.21	172	137
5	Tanks/Ponds	4	18	0.49	18	9
Sub-Total		17	3700	99.89	2300	2139
Wetlands (<2.25 ha)		4	4	0.11	-	-
<b>Total</b>		<b>21</b>	<b>3704</b>	<b>100.00</b>	<b>2300</b>	<b>2139</b>
Area under turbidity levels						
Low					198	254
Moderate					2103	1885

Source: National Wetlands Inventory Atlas of Himachal Pradesh – <http://moef.nic.in/modules/others/?f=wetlands-atlases>

### Important Wetland

Parashar lake: It is a mid altitude lake located in Mandi district about 40 kilometres from Mandi town (31°25'55" N latitude and 77°09'00" E longitude) at an altitude of 2600 amsl. The lake is held sacred to the sage Prashar, who is supposed to have meditated here. It is an oval lake of around 3 ha area, with crystal clear water. There is a small floating circular island with dense reeds, which shifts positions annually. The dimensions of this floating island as deciphered by LISS III data is: Area: 450 m<sup>2</sup>, Perimeter: 76.0 m and Diameter: 23.6 m

This lake is set in sub alpine pastureland with evergreen meadows with a large number of rare and medicinal herbs. The lake view undergoes spectacular changes during different seasons

from lush green during rainy, to pale gold hue in autumn and snow white during winter. It has maintained its serenity and is not yet polluted. The lake is abundant with fish that have been introduced.

### Shimla

Shimla is a hill station and lies in between north latitude 30°45'00" to 31°44'00" and east longitude 77°00'00" and 78°19'00". The geographical area of the district is 5131 sq. km. It is bounded by Mandi and Kullu district of Himachal Pradesh in the north, Kinnaur in the east, and by Solan district in the west. Shimla district is covered by the catchment area of the rivers Sutlej, Pabbar and Giri. Sutlej, the principal river of the district rises from

Mansarover Lake in the eastern peaks of Himalayas.

Total wetland area in the district is 2368 ha that includes 13 small wetlands (<2.25 ha). River/stream occupies 97.04% of wetlands. High Altitude Lakes is the second largest wetland type in the district. Seven such lakes

were mapped accounting for 2.41%. Details of wetland are given in Table 13.

The open water spread of wetlands is more in Post- monsoon (1517 ha) than in Pre-monsoon (1440 ha). The qualitative turbidity of water is moderate in both the seasons.

**Table 13: Area estimates of wetlands in Shimla (ha)**

Sr. No.	Wetland Category	Number of Wetlands	Total Wetland Area	% of Wetland Area	Open Water	
					Post - monsoon Area	Pre - monsoon Area
Inland Wetlands - Natural						
1	High altitude wetlands	7	57	2.41	31	15
2	River/Stream	4	2298	97.04	1486	1425
	Sub -Total	11	2355	99.45	1517	1440
	Wetlands (<2.25 ha)	13	13	0.55	-	-
	Total	24	2368	100.00	1517	1440
Area under turbidity levels						
	Low				31	277
	Moderate				1486	1163

Source: National Wetlands Inventory Atlas of Himachal Pradesh – <http://moef.nic.in/modules/others/?f=wetlands-atlases>

### Sirmaur

The district lies in the outer Himalayan range, commonly called as Shivaliks. The district coordinates are extended from north latitude 30°22'30" to 31°01'20" and east longitude 77°10'12" and 77°49'40". The area of the district is 2825 sq. km. Sirmaur is bounded by Shimla district in the north, the river Tons and Yamuna in the east, district Ambala of Haryana in the south and west and northwest by Solan district of Himachal Pradesh. The river Giri is the major river in the district.

Total wetland area in the district is 9990 ha that includes 30 small wetlands (<2.25 ha). River/stream occupies 97.33% of wetlands. Reservoir/Barrage is the second largest wetland type in the district accounting for 1.89%. Details of wetland are given in Table 14.

The area under aquatic vegetation is 7 ha in pre monsoon. The open water spread of wetlands is significantly more in Post-monsoon (5795 ha) than in Pre-monsoon (1750 ha). The qualitative turbidity of water is moderate in both the seasons.



**Table 14: Area estimates of wetlands in Sirmaur (ha)**

Sr. No.	Wetland Category	Number of Wetlands	Total Wetland Area	% of Wetland Area	Post - monsoon Area	Open Water Pre - monsoon Area
<b>Inland Wetlands – Natural</b>						
1	Lakes/Ponds	4	40	0.40	40	20
2	Waterlogged	1	8	0.08	7	3
3	River/Stream	14	9723	97.33	5716	1691
<b>Inland Wetlands - Manmade</b>						
4	Reservoirs/Barrages	3	189	1.89	32	36
Sub -Total		22	9960	99.70	5795	1750
Wetlands (<2.25 ha)		30	30	0.30	-	-
Total		52	9990	100.00	5795	1750
Area under Aquatic Vegetation						7
Area under turbidity levels						
					78	711
Moderate					5716	1039

Source: National Wetlands Inventory Atlas of Himachal Pradesh – <http://moef.nic.in/modules/others/?f=wetlands-atlases>

### Important Wetland

**Renuka Lake:** Renuka lake, with a circumference of 321 m, is the largest natural lake in Himachal Pradesh, situated 37 km from Nahan in district Sirmaur. The lake is located between 30°36'44" N and 30°36'42" N latitudes and 77°26'59" E and 77°27'58" E longitudes. The area of the wetland as derived from remote sensing data is 29 ha.

Renuka wetland besides having religious significance also harbors variety of flora and fauna. It was declared a Wildlife Sanctuary under the Wildlife Protection Act, 1972. It is located at an altitude of 660 m above msl.

The Renuka Lake is surrounded by lush green forests supporting a variety of animal and bird life. The forests support trees like *Anogeissus*, *Leucaena*, *Terminalia*, *Khair*, *Shisham*, *Carrissa*, *Cordia* and a variety of climbers. The fauna of the area include Leopard, Sambar, Spotted Deer, Barking deer, Jackal, Hare, Jungle cat,

Civet, Porcupine, Blue jay, Black Partridge, Hill Crow, Bulbul, Common Coots, Green Pigeons. The threatened Kaleej pheasant and the more common Red jungle fowl are also found here.

There has been great concern about the ecological deterioration, habitat degradation and eutrophication of the wetland due to silting, high levels of organic pollution, habitat degradation and dumping of non-biodegradable materials by pilgrims and tourists. This has not only resulted in habitat deterioration, shrinkage of the aquatic life, but also the terrestrial fauna of Renuka Sanctuary as this is the only perennial source of water for wild animals. Number of check dams and desiltation tanks were constructed on various streams to minimize the silt deposition in the wetland.

## Solan

It lies between 30°05' 00" and 31°15'00" North latitude and between 76°42'00" and 77°20'00" East longitude. The area of the district is 1936 sq. km. The district is bounded by Shimla district in the north and Ropar district of Punjab and Ambala district of Haryana in the south, Sirmaur district in the east and by Bilaspur district in the west, Mandi district touches the boundary of Solan in the north-east. Major rivers of this district are Sutlej, Yamuna and Ghaggar.

Total wetland area in the district is 2720 ha that includes 61 small wetlands (<2.25 ha). River/stream occupies 97.10% of wetlands. Details of wetland are given in Table 15.

The open water spread of wetlands is more in Post- monsoon (1400 ha) than in Pre-monsoon (1040 ha). The qualitative turbidity of water is moderate in both the seasons.

**Table 15: Area estimates of wetlands in Solan (ha)**

Sr. No.	Wetland Category	Number of Wetlands	Total Wetland Area	% of Wetland Area	Open Water	
					Post- monsoon Area	Pre- monsoon Area
<b>Inland Wetlands – Natural</b>						
1	Lakes / Ponds	2	6	0.22	6	4
2	Waterlogged	1	2	0.07	2	1
3	River/Stream	12	2641	97.10	1385	1035
<b>Inland Wetlands -Man-made</b>						
4	Reservoirs/Barrages	1	7	0.26	7	-
	Sub-Total	1	3	0.11	-	-
	Wetlands (<2.25 ha)	17	2659	97.76	1400	1040
	<b>Total</b>	<b>61</b>	<b>61</b>	<b>2.24</b>	<b>-</b>	<b>-</b>
	Area under Aquatic Vegetation					7
	Area under turbidity levels					
	Low				137	159
	Moderate				1264	881

Source: National Wetlands Inventory Atlas of Himachal Pradesh – <http://moef.nic.in/modules/others/?f=wetlands-atlases>

## Una

Una district is in the southwestern part of Himachal Pradesh. Kangra binds it in the north, Hamirpur in the east, and Bilaspur district in the south and Hoshiarpur district of Punjab in the west. It lies between 31°02'00" and 31°50'00" North latitude and between 71°55'00" and 76°28'00" East longitude. The geographical area of the district is 1540 sq. km. Two important rivers of the district, namely Beas River binds it on the north and the river Sutlej in the east.

wetlands. River/stream is the second largest wetland type in the district accounting for 34.75%. Details of wetlands are given in Table 16.

The area under aquatic vegetation is 1158 ha in pre monsoon. The open water spread of wetlands is significantly more in Post-monsoon (5281 ha) than in Pre-monsoon (3431 ha). The qualitative turbidity of water is low in both the seasons.

Total wetland area in the district is 7203 ha that includes 46 small wetlands (<2.25 ha). Reservoir/ Barrage occupies 64.45% of

**Table 16: Area estimates of wetlands in Una (ha)**

Sr. No.	Wetland Category	Number of Wetlands	Total Wetland Area	% of Wetland Area	Open Water	
					Post- monsoon Area	Pre- monsoon Area
<b>Inland Wetlands – Natural</b>						
1	Waterlogged	1	3	0.04	3	2
2	River/Stream	11	2503	34.75	627	461
<b>Inland Wetlands -Man-made</b>						
3	Reservoirs/Barrages	1	4642	64.45	4642	2960
4	Tanks / Ponds	1	9	0.12	9	8
	Sub-Total	14	7157	99.36	5281	3431
	Wetlands (<2.25 ha)	46	46	0.64	-	-
	<b>Total</b>	<b>60</b>	<b>7203</b>	<b>100.00</b>	<b>5281</b>	<b>3431</b>
	Area under Aquatic Vegetation					1158
	Area under turbidity levels					
	Low				4755	2989
	Moderate				524	442

Source: National Wetlands Inventory Atlas of Himachal Pradesh – <http://moef.nic.in/modules/others/?f=wetlands-atlases>

### 2.3 Patterns of Planning and Development in the Sector

The Central Government is responsible for overall coordination of wetland conservation programmes and initiatives at international and national levels. The Central Government is responsible for the following:

- Providing financial assistance for implementation of the approved items of the programme;
- Providing technical expertise and know-how including training of personnel;
- Issue of detailed guidelines covering all aspects of management; and
- Evaluation of the interventions made.

Himachal Pradesh State Council for Science, Technology and Environment came into existence in 1985. Conservation of Wetlands and Biodiversity is included as part of “Science & Technology” for the HPSCSTE. Furthermore, the Department of Environment & Scientific Technologies was set up in April, 2007 with an objective to improve the effectiveness of environmental management, protect vulnerable ecosystems and enhance sustainability of development. Vide notification No. GAD (CC)-5-2/71 dated 15-10-2008, the name of the Department has been changed to Department of Environment, Science and

Technology. The mandate of DEST interalia is “ To deal with all the matters relating to Biodiversity, Biosphere, Mitigation and Management of Natural Disasters, Protection and Conservation of the Wetlands, Grass-lands etc”

Department of Forests and Wildlife is responsible for management of protected areas including the wetlands in the State. The Department has prepared Wetland Management Plans for selected wetlands. Department of Tourism also makes development interventions in and around selected wetlands and manages water sports complex. Bakhra Beas Management Board manages Pong reservoir and dam. Fisheries Department promotes fisheries, enforces rules related to fishing and regulates fishing contracts.

In 2010, Ministry of Environment and Forests notified rules for conservation and management of wetlands, namely Wetlands (Conservation and Management) Rules, 2010. The rules set regulatory framework for conservation of wetlands enlisting some of the activities which are prohibited and others which need to be regulated. Categorization of wetlands has also been proposed on the basis of significance of

the functions performed and for determining the extent and level of regulation. The Rules have been framed for protected wetlands, set restrictions on activities within wetlands and has made provisions for setting Central Wetlands Management Authority. The Rules defined process of identification of wetlands under different categories. The Rules also identifies overlapping provisions and enforcement of regulated activities. Wetlands, at the Government of India level are part of the Ministry of Environment and Forests while in Himachal Pradesh, wetlands are being managed by the Department of Environment, Science and Technology.

## 2.4 Technology Adopted in the Sector along with any Changes in Technology

Conservation and restoration of wetlands not only involve the buffering of wetlands from direct human pressures, but also maintaining all other important natural processes which are directly linked to supporting wetlands in maintaining the fragile ecosystem. Measures like controlling soil erosion, reducing pressure on wetland resources and most importantly changing the attitude of people in using wetlands are important for conservation and restoration. Some technological options including biological measures are given below.

- Pollution abatement practices to reduce the non-point source of pollution through source reduction and waste minimization.
- (i) Afforestation with native species in the areas around the wetland to control the entry of silt from runoff.
- (ii) The shorelines of the lakes may be lined with bricks or stones to control shoreline erosion.
- Creation of Constructed wetlands for the purpose of storm water management & pollutant removal from surface water flows.
- (i) Infiltration trenches for reducing the storm water sediment loads to downstream areas by temporarily storing the runoff.
- (ii) Rotation of crops rather than monocultures to reduce the need for Nitrogen & assist with pest control & help in aeration of soil.
- (iii) Rainwater Harvesting is one of the key steps to be adopted in urban communities where most of the area is been metalled either by the roads or by the concrete buildings, to improve the ground water recharge, and there by reduce the pressure on wetlands to meet the urban water resources demands.
- (iv) Along with rain water harvesting, storm water management helps in reducing the pressure on wetlands. In urban areas rainwater is diverted to sewage drain which is expensive to treat and use it for any utilities. Investment can be made to have a separate drain for storm water where the rainwater harvested in each and every individual unit is connected. It will be then cost effective to treat and used for non-potable utilities of water in industries, gardening, etc.
- Dredging of sediments in the wetlands will improve the soil permeability, water holding capacity and also improve ground water recharge. However, the long term solution lies in controlling soil erosion due to agricultural practices, mining activities and other anthropogenic activities. Thus, prevention of silt is better than de-silting or dredging which involves huge economic costs.
- Waste water, solid and semi solid waste entering into the lake from external sources must be stopped before any restoration work is implemented.

- Alien and invasive species like water hyacinth and other vegetation present in the lake, causing eutrophication, must be removed manually or mechanically. Weed infestation can also be controlled by biological means e.g. introduction of *Pila globosa*, Chinese grass carp, etc. that feed on many aquatic plants.

Constructed engineered wetlands: Constructed wetlands are complex, integrated systems in which water, plants, animals, micro-organisms and the environment interact to improve water quality. The objective of constructing wetlands is to duplicate the processes occurring in natural wetlands. Constructed wetlands mimic nature by mechanically filtering, chemically transforming & biologically removing potential pollutants in the wastewater stream. These are shallow pools constructed on non-wetland sites as part of the storm water collection & treatment system.

Historically, concrete and steel was used as erosion control material. Use of concrete and steel in the form of concrete structures and steel piling etc. is called hard engineering. However there is an increase in awareness on the urgency to maintain the much needed ecological balance. It is imperative that any development effort should go hand in hand with ecological equilibrium so as to sustain it and a return to natural living has been accepted as a safe way to solve many environmental problems. This method is called soft engineering. The ultimate objective of natural erosion control measures is to establish a dense network of root system and vegetative cover to the desired degree of growth in the shortest possible time. Slowing the flow of water down the slope accomplishes two things. The transport capacity of the thin sheet flow is reduced, thereby minimising the displacement of dislodged soil particles, and more rainfall infiltrates the soil, providing desirable moisture to newly planted seedlings.

Geo-spatial tools for wetland Management: Remotely sensed multispectral data with ground

measurements of cover, density, biomass, or leaf area, vegetation condition measured at sample points could be extrapolated across a large geographical region. This information is valuable in determining trends, confirming field reports, assessing the efficacy of control measures, providing early warnings before a developing problem reaches a critical state, and general strategic planning. Remote sensing provides a critical tool for monitoring the status of infestations as well as detecting impediments to waterborne transportation caused by aquatic plant infestations. Sensors especially like ASTER, IKONOS, QUICKBIRD and LISS IV MX can be employed in the mapping of *Eichhornia*.

Soil erosion control: Carrying out of soil stabilization works in the erosion prone areas by constructing engineering structures along with vegetative spurs to reduce the silt of lake and prevent and improve the general habitat of the wetland. It is observed that the extent of silt deposition is heavy on the shallower end of the lake. As the slopes are very steep, and stablization actions taken in the past like construction of check wall, contour bending and plantation on slopes have been inadequate, therefore, use of new technology in soil stabilisation needs to be taken up. The slopes can be stabilized with the use of geo textiles followed by plantation of native grass species in the first year, followed by plantation of trees and shrubs in later years. This is a very effective way of stabilizing steep slopes that are prone to erosion.

Bioremediation: Bioremediation is the cheapest and most sustainable control method for weed eradication the chemical and mechanical control measures are expensive and hampered by reinfestation from its long-lived seeds. Bioremediation would serve as the best method for locations where water hyacinth continues to grow at greater than acceptable levels. It has proved to be an adequate control method in several instances in developing countries. There are various natural enemies of water hyacinth

reported from different parts of the world. Using currently available agents, it usually reduces extent of the infestation, climate, water quality, and other control options. In conjugation with other available tools like herbicides application, physical removal, manipulation of flows, and reductions of nutrient, input is expected to increase the pace of eradication of the weed from the aquatic ecosystem.

## 2.5 Stakeholder Involvement in Environment Preservation and Restoration

The main stakeholders who are directly or indirectly affecting or affected by the wetland are fishermen, farmers, Bhakra Beas Management Board, Tourism Department, Fisheries Department, Residents of the Watershed, Water Sports Complex and VDC's.

**Fishermen:** There are about thousands of fishermen who depend on the lake for their livelihood. There are organized Fishermen Cooperative Societies regulated by the State Fisheries Department. Their dependency for livelihood on the reservoir is high as earnings come from sale of fish catch. As the quality of fish is good, it fetches high price in the market. The fishermen expressed willingness to accept compensation for not fishing during the winter months. They are also willing to develop fish ponds and seedlings. The management on the other hand is willing to compensate the fishermen with repair of boats, procurement of proper fishing nets, as well as other awards and rewards if the fishermen cooperate with conservation priorities of the Fisheries Department.

Prior to the impoundment of the river Beas, a subsistence fishery of inconsequential nature existed in the river and adjoining streams and the average catch hardly exceeded 2-4 kgs per fishermen per day, but with the formulation of the reservoir, a lucrative fishery started attracting large number of fishermen and the oustees who had no other viable means of

livelihood. The commercial fishing in the reservoir was initiated soon after its emergence. The total catch during the first year of fishing operation was 98 tonnes and increased progressively attaining a peak of 779 tonnes (1987-88), fluctuating within a narrow range of 443-596 tonnes. The catches of mahseer in the reservoir have shown remarkable consistency during the past 10 years and landing have fluctuated between 50-81 tonnes. The highest catches of mahseer were recorded during 1997-98. The fisheries department initiated training courses for operating gears the deeper waters for fishermen. This, however, inspired large number of oustees of various communities to adopt fishing as a profession. Besides direct employment to over 1789 fishermen, the fishing activities provide indirect job to over 1000 families engaged in helping fishermen, carrying/transportation, packing of fish, weaving and mending of gears, marketing etc.

The fishermen in the area are well organized. Presently there are 14 fishermen cooperative societies functioning in the reservoir. There are about 1400 active fishermen recruited from 4000 oustees settled near the reservoir. This accounts for about 30.4% of the total population of reservoir fishermen.

**Farmers:** Large tracts along the shoreline are farmed for food grains during the draw down phase of the reservoir. However, farmers consider it their right to farm land. Some of the farmers are oustees of the dam. As the encroachment on land is illegal, the Forest department is unwilling to engage with the stakeholder, farmers too are not willing as any engagement would result in loss of crop produces that fetches good price in the market. Since it would be a direct loss to their income.

**Water sports complex:** The water sports complex organizes training programmes in water sports regularly. These activities cause significant disturbance to the lake. Sensitization of the group in relation to extent of disturbance, better practices vis-à-vis camp management, waste management etc is required. Orientation

programme should include a module on environment and its conservation.

**Bhakra Beas Management Board:** The Bhakra Beas Management Board (BBMB) is the primary stakeholder of Pong Dam and its reservoir. Being the key stakeholder in management of the area much before the Pong Dam Wildlife Sanctuary was established, BBMB interfaces with other stakeholders. Since its historical presence, BBMB carries out developmental and eco-developmental activities through village level societies and is not only a stakeholder but also a key player in the management of the area.

**Fisheries Department:** The H.P. Fisheries Act, 1976, empowers the Fishery Department to regulate and enforce rules related to fishing and development of fisheries as per the mandate. Economic dependency of fisheries department is high through issue of contracts.

**Hydro-power Companies:** There has been a spurt in hydropower development in the State. Both small and large projects have been undertaken. Micro and mini- hydel projects directly affect the hydrology and therefore the ecology of small streams that in turn affect the larger streams/ khuds. The khuds draining into the Pong reservoir are directly affected due to this.

**Communities in the watershed:** This group is directly associated although not in an obvious manner. The larger catchment of Beas has an impact on Pong reservoir. There is no direct engagement as the extent of impact is not yet realised. Pong being a large lake has been able to retain the pollution load. However, there has been a drastic change in Pong's fisheries. An in depth analysis is required to check the pollution and silt load and their affect on the Pong lake.

**Pong Dam wetland:** Most of the villagers do not know about the existence of a protected area in their vicinity. However, the fishermen and those who cultivate in the draw-down area

are aware of the Pong Dam Bird Sanctuary because the wildlife guards tell them not to harm the birds. The cultivation disturbs the mudflats and other water bird habitats during the winter season. There has been an increase in reports of the severity of crop damage by the waterfowls, mainly Bar-headed geese and Brahminy ducks. Secondly, fishing done by nets often cause obstruction to the diving ducks.

**Capacity Building of Community Organizations in Biodiversity Monitoring in HP:** The Council implemented this project to involve local people in biodiversity assessment and monitoring under AUSAID funded project. Under the project, Mehli village in the outskirts of Shimla was identified to monitor the biodiversity trends through village community. A biodiversity mapping and monitoring manual of the area for use by the local communities has been prepared.

The State may undertake measures for capacity building in the area of Lake Conservation by deputing the concerned officers to MoEF sponsored programmes on capacity building (e.g. 2 years M.Tech and short term programmes being offered by AHEC, IIT Roorkee) or any other State Level programmes.

The State Governments proposing to participate in the National Lake Conservation Programme (NLCP) must ensure availability of a 3-tier Institutional Mechanism as given below, for proper & timely implementation of the approved projects and its post implementation maintenance/ sustenance:

- (i) The State Govt. must identify a nodal department in the State for all interactions with MoEF, receipt & disbursement of funds, physical & financial monitoring of Project implementation. Lake Development Authority (LDA) or Lake Conservation Authority (LCA) if already existing at State level shall be the nodal department/ agency.

- (ii) A Project Implementation Unit (PIU) with requisite expert manpower may undertake/oversee the Project Implementation ensuring no time & cost overruns.
- (iii) The agency owning the lake (Municipal Council/Corporation/local body) may undertake the O&M of the lake and be equipped with dedicated human resources. In case of multiple agency structure, the concerned District Collector/Commissioner is authorized to take the Operation & Maintenance (O&M) responsibility.

Solid Waste Management: The HP State Council for Science, Technology & Environment has undertaken number of initiatives under Solid Waste Management Programme like Secretariat waste management scheme, Waste survey and assessment in towns, installation of Micro waste recycling units in schools, Bio conversion plant at Solan and organising Teacher training workshops. Under the NORAD project, 14 Micro Waste Recycling Units have been installed in School. The Council is also disseminating other Waste Recycling/Treatment Technologies.

## **2.6 Critical Environment Issues / Hotspots Associated with the Sector**

Wetlands are dependent on and are affected by the condition of their watersheds, immediate surroundings as well as certain features downstream, e.g., change in species composition of birds or fish downstream may affect the ecosystem of the wetland as these organisms move in the locally/ regionally dispersing floral seeds etc, and at times pathogens. Major environmental and social issues and problems related to wetlands in Himachal Pradesh are given below.

1. Shrinking of wetland area due to change in land use, human & livestock activities: Anthropogenic activities, unplanned urban and

agricultural development, industries, road construction, impoundment, resource extraction and dredge disposal is leading to continuous shrinking of wetland area. Encroachment because of unclear land tenure and lack of property rights of the wetlands and surrounding areas is the major reason for shrinkage of the wetland area. All these activities exert biotic pressure on micro-habitats and riparian forests.

2. Deforestation / removal of vegetation/ grazing in the catchment is leading to soil erosion and siltation of the wetland: The vegetation in the catchment of the wetland varies from wooded/ forested area to herbaceous meadows depending on altitude and climatic conditions. Continuous deforestation both legal & illegal in the catchment is leading to declining forest cover and productivity of forests and support lands. Furthermore, uncontrolled grazing in meadows & pasture land is leading to increased pressure and reduced water holding capacity of forests and other lands. This is causing continuous soil erosion & siltation, for e.g. the draw down areas of Pong reservoir is occupied by nomadic graziers and gujjars during March-June. Besides this stray cattle also graze in the fringe area. As per wetland management plan of Pong Dam Lake, Department of Wildlife & Forest GoHP, about 20000 grazing cattle and live stock (of which 6000 belong to nomadic graziers) graze in the core area. Similarly, migratory graziers who pass through the Chandra valley with huge flocks of sheep and goats graze the meadows. The combined effect of the visitors and graziers contribute to increased siltation and organic influx into the wetland. However, the increase in siltation and organic influx load to the Chandertal wetland in Chandra valley needs to be assessed and compared with the baseline data before anthropogenic activities are started and/ or any other high altitude wetland with no human interference



In Pong Dam wetland area, high incidences of grazing poses serious threat to the biodiversity of the area. A large number of cattle graze on the basic core zone of the reservoir after the water recedes to the minimum water level. The natural habitat linked to migratory resident birds is thus destroyed by the hoofs of the cattle. Thus, the growth of the grasses, mollusks, pila, snails etc. is checked due to destruction of the habitat which is in turn linked to the decline in habitat of majority of the migratory birds. The status of Biodiversity in Pong Sanctuary area before the high incidence of grazing and the existing status is required to be known to estimate the biodiversity loss in relation to the habitat destruction so that conservation measures be suggested accordingly.

In the catchment area of wetlands, the blasting of the hard rocks, deforestation of the area, throwing of muck in the water stream, cement concreting etc. in the Hydel projects have caused air, water and noise pollution. These have badly affected the flora and fauna of the area. Siltation besides shortening the life of reservoir also adversely affects the water quality and quantity which adversely impacts wetlands. EIA studies are needed to assess the effects on the flora and fauna of the area as well as on water quality.

3. Agricultural-Horticultural activities in the wetlands buffer zone and fringe areas: Shift in land use and agricultural production patterns in the catchment, buffer zone and fringe areas are leading to adverse impacts on wetlands in Himachal Pradesh. Shoreline of lakes/wetlands are farmed during the draw down phase e.g. Pong Wetland. Although, there is a shift in landuse and agriculture production in the catchment but the adverse impacts, if any, are to be identified and categorized depending upon their nature, composition and mode of action before suggesting the conservation measures.

4. Unrestricted dumping of sewage, solid wastes and toxic chemicals from households,

tourists destination, industries and agriculture leads to pollution and eutrophication of wetlands, silting and weed infestation: Infrastructure development and poor management of waste (municipal solid waste, construction and demolition waste and waste water) in the catchment and in the vicinity of wetlands leads to water pollution and increased influx of organic waste which leads to water pollution & eutrophication. Dumping of dung of horse and ponies near wetlands frequented by tourists (e.g. Khajjiar) also contributes to water pollution & eutrophication. Increased runoff in the degraded catchment areas of wetlands leads to siltation and weed growth, water pollution & eutrophication. Littering of non-biodegradable materials by pilgrims and tourists increase pollution load in the wetland.

5. Increased health risk in the surrounding area of wetland due to pollution: Deteriorating water quality due to pollution has also led to the spawning of mosquitoes in the absence of predators, such as *Gambusia affinis* & killifish, which prey on mosquito larvae. This poses a major health risk in the vicinity of wetland.

6. Depletion of wetland's flora and fauna due to congestion, pollution/dredging/desilting introduced and invasive plant species: Congestion of natural outdoor recreational sites is leading to depletion of wetland flora & fauna. *Eichhornia crassipes* (Water Hyacinth), *Azolla* and *Salvinia molesta* clog waterways and compete with native vegetation, leading to loss of wetland's area, and depletion of wetland's flora and fauna. Further, natural species also assume weedy proportions e.g. *Typha*, *Trapa*, *Thalia*, *Echinodorus*, etc. Removal of natural vegetation spurs spread of alien and invasive species e.g. *Lantana*, *Adhatoda*, etc. This leads to reduction of area under palatable grasses used by wild grazing animals that also have to compete with domesticated cattle and livestock in the same area. Indiscriminate introduction of new species of fish for commercial exploitation, over harvesting of particular species and fishing methods are leading to depletion of wetland's

fauna. Commercial fisheries leads to change in composition of fisheries for instance increase in the carnivorous fish. Several fish species have disappeared due to over exploitation and introduction of carps.

The fertilizers and insecticide i.e. the chemicals such as CAN, Urea, 12-32-16, DAP, Super-Phosphate etc. and insecticide pollute water of the reservoir wetland and this deteriorates aquatic flora and fauna. The polluted water keeps away the migratory birds due to non-suitable habitat. Desilting & dredging of wetlands further leads to disturbance of ecology of wetland and depletion of wetland's flora & fauna.

7. Change in natural flow/hydrology and water dynamics of the reservoir/wetland: Construction of a large number of reservoirs, canals and dams; diversion of streams and rivers to provide for irrigation lead to reduced flow into wetlands. Further, release of impounded water by dam/reservoir depends on the management authority. Small hydropower projects and other infrastructure development projects requiring water diversion also change the hydrology of the wetland.

8. Uncontrolled/ Unregulated tourism in the buffer zone leads to disturbance to ecology and critical habitat: Tourists feed fish and turtles with bread, biscuits, wheat, flour, grains, nuts etc., thereby changing the behavior and ecology of the wetland. Movement of high speed motorized boats of tourists, allied activities of water sports like training programmes and fishing vessels, poor camp management and waste disposal also add to the disturbance of the ecology of the wetlands. The change in the behavior and ecology of wetlands needs to be strengthened by scientific backing so that mitigations measures are suggested accordingly.

9. Poor enforcement of regulated activities due to jurisdiction issues on account of unclear land tenure: Some of the uncontrolled activities

include poaching of avifauna, illegal harvesting of crops and commercial fishing e.g. introduction of fish seeds/ varieties and commercial activities without permission of Chief Wildlife Warden, Department of Forests and Wildlife, Government of Himachal Pradesh. Further, remote and inaccessible areas, lack of trained enforcement staff, lack of enforcement infrastructure and lack of coordination leads to poor enforcement of the rules.

10. Change in natural flow/hydrology and water dynamics of the reservoir/wetland: Small hydropower projects and other infrastructure development projects require water diversion. Changes in hydrological regime leads to variation in ecology of the small stream/khud which in turn affects large streams and rivers and its aquatic flora, fauna and fisheries.

11. Uncontrolled/ unregulated tourism in the buffer zone leads to disturbance of ecology and critical habitat: Movement of high speed motorised boats of tourists, allied activities of water sports like training programmes and fishing vessels further lead to pollution leading to disturbance of ecology & critical habitats. Poor camp management and waste disposal also add to the disturbances.

## **2.7 Environment Initiatives taken by the Sector to Address Critical Environment Issues**

### **Chandertal Wetland**

- Awareness camps with the participation of local people in the surrounding area of Chandertal wetland have been started. Resource material i.e. posters, brochures have been produced for distribution amongst various stakeholders.
- Constructed garbage disposal pits for disposing waste generated by the tourism activities.

- Putting signboards carrying the message on Environment conservation in the Chandertal area.
- Organised awareness camps for the local people and tourists.
- Initiated Catchment treatment measures.
- Evaluation of the comprehensive MAP by Wadia Institute of Himalayan Geology, Dehradun
- Water Quality assessment of Renuka lake by the Punjab University & State Pollution Control Board.

**Renuka Wetland:** Awareness camps are organized during the Renuka fair. Resource material i.e. posters, brochures have been produced for distribution amongst the local people and tourists. Awareness campaigns regarding Biological Diversity Act, 2002, celebration of International Biodiversity Day is being done by the State Biodiversity Board.

The State Biodiversity Board engages with stakeholders on various themes and uses a diverse approach, some of which are enlisted below:

- 1 Slogan Writing Competition on the theme “Agriculture and Biodiversity”
- 2 Essay Writing Competition on “Agriculture and Biodiversity”
- 3 Through Eco-clubs established all over the State
- 4 Live-Phone-in discussion through All India Radio, Shimla, H.P
- 5 Live-Phone-in discussion through Doordarshan Station, Shimla, H.P
- 6 Exhibition on Biodiversity on the theme “Agriculture and Biodiversity
- 7 Painting Competition on Biodiversity
- 8 Quiz competition on Biodiversity to the +1&+2 students of Shimla
- 9 Lecture on biodiversity, its importance and conservation needs delivered to students of Govt. Sr. Secondary School, Kasumpti, Shimla

Besides, the Board prepares Information, Education and Communication (IEC) materials to engage stakeholders on various issues. For generating awareness of the general stakeholders of biodiversity, following IEC materials are compiled /developed:

- 1 Himachal Pradesh Mein Jaivividhata Ki Stithi Avam Pehal.
- 2 Biodiversity Status and Initiatives in Himachal Pradesh
- 3 Himachal Pradesh Mein Jaivividhata, Sambandhit Samasyanyaein Avam Sanrakashan Hetu Sujhav
- 4 Pradesh Mein Panchayat starr per Jaivividhata Prabandhan Samitiyon Ka Gathan

The H.P State Biodiversity Board has selected ten Panchayats for preparation of Biodiversity Registers on pilot basis in the 10 districts of the State as given below.

S. No.	Panchayats
1	Gram Panchayat, Naina Tikker, Tehsil Pachad, District Sirmour, H.P.
2	Gram Panchayat, Saho, Tehsil & District Chamba, H.P.
3	Gram Panchayat, Garli, Tehsil Dehra, District Kangra, H.P.
4	Gram Panchayat, Toong, Tehsil Banjar, District Kullu, H.P.
5	Gram Panchayat, Kafnu, Tehsil Nichar, District Kinnaur, H.P.
6	Gram Panchayat Khatnol, Tehsil Sunni, District Shimla, H.P.
7	Gram Panchayat, Sarahan, Tehsil Chaupal, District Shimla, H.P.
8	Gram Panchayat, Churag, Tehsil Karsog, District Mandi, H.P.
	Gram Panchayat, Darlaghat, Tehsil Arki, District Solan, H.P.
10	Gram Panchayat, Jukhala, Tehsil Sadar, District Bilaspur, H.P.

### National Wetland Inventory and Assessment 2011 (State Wetland Inventory Atlas)

A National Wetland Atlas and State Wetland Atlases have been prepared by the Space Applications Centre (SAC) of Indian Space Research Organisation (ISRO), Ahmedabad, 2011.

**Wetland Plans:** The Wildlife wing of H.P. Forest Department has prepared Wetland Management Plan for Pong Dam lake, Renuka lake and Khajjiar wetland.

## 2.8 Environment Related Studies Carried out in the Sector

Pong dam wetland: In Pong Dam Lake regular winter migratory bird surveys are being conducted since 1985. This has resulted in inventory of annual data for waterfowl at the reservoir. Surveys for understanding human-waterfowl conflict are conducted. Semi-structured interviews have been conducted, mainly on the right bank of the Beas river where the concentration of water birds is maximum. The consistency of survey efforts provides useful information for biological as well as social monitoring of this Protected Area. The villages of Jawali, Dhameta, Dada-Siba, Nagrota-Surian, Haripur, Guglara, Harsar, and Nandpur have been intensively covered to study impact of local communities on the waterbird diversity. The emerging trends in conflict situations are providing a basis for planning an eco- developmental programme.

*Source: Pong dam Lake: Information Sheet on Ramsar Wetlands*

**Chandertal:** Zoological Survey of India has carried out faunal survey of Chandertal area. Department of Geology of Punjab University has done geological study of the area. University of Newcastle upon Tyne Himalayan Expedition 1989, University of Newcastle has also covered the ecological features of the Chandertal wetland. Map of Chandertal and its

catchment on 1:1000 scales with contour interval of 1m has been prepared

Source: Chandertal Wetland: Information Sheet on Ramsar Wetlands.

In Renuka wetland following research has been undertaken:-

- Identification of Fauna of Renuka wetland by Zoological Survey of India
- Hydro-biological study by H.P. University, Shimla.
- Formulation of a comprehensive Management Action Plan by HP State Council for Science, Technology and Environment.
- Evaluation of the comprehensive MAP by Wadia Institute of Himalayan Geology, Dehradun
- Water Quality assessment of Renuka lake by the Punjab University & State Pollution Control Board.

## 2.9 Environment Monitoring (key parameters such as Air and Water Pollution) carried out for activities related to the sector

Himachal Pradesh Pollution Control Board monitors water quality of lakes, which is given in Table 17.

**Table 17: Water quality of Lakes Wetland in HP (Year 2006)**

Location	Temp	DO	pH	Conductivity Micromaho/	COD Mg/l	BOD Mg/l	Nitrate Mg/l	FC MPN/100ml	TC MPN/100ml	TSS Mg/l
Gobindsagar lake at Bilaspur, HP.	12	8.8	8.06	221	7.0	0.5	0.2	9.0	469.0	1598.0
Pongdam lake at Pong village, HP	24	8.4	7.95	211	4.0	0.8	0.2	4.0	31.0	7.2
Renuka lake, 35 km from Patna Sahib North, HP	21	6.8	8.17	585	19.6	2.3	1.5	10.0	22.0	30.0

## 2.10 Institutional Mechanisms within the Sector to Address Identified Environment Issues

Ministry of Environment and Forests, New Delhi, Government of India has designated State Council for Science, Technology and Environment as a Coordinating Agency for the Conservation and Management of Chandertal and Renuka Wetlands. The Renuka Vikas Board, a body constituted under the chairmanship of the local Deputy Commissioner looks after the management of the lake. Pong Dam Wetland is managed by the Wildlife Wing, Himachal Pradesh Forest Department. Identification of Wetlands under NWCP has been done by MoEF.

In 2010, Ministry of Environment and Forests notified rules for conservation and management of wetlands, namely Wetlands (Conservation and Management) Rules, 2010. The rules set regulatory framework for conservation of wetlands enlists some of the activities which are prohibited and others which need to be regulated. Categorization of wetlands has also been proposed on the basis of significance of the functions performed and for determining the extent and level of regulation. The Rules have been framed for protected wetlands, set restrictions on activities within wetlands and has made provisions for setting Central Wetlands Management Authority. The Rules defined process of identification of wetlands under different categories. The Rules also identified overlapping provisions and enforcement of regulated activities. Wetlands, at the Government of India level are part of the Ministry of Environment and Forests while in Himachal Pradesh, wetlands are being managed by the Department of Environment, Science and Technology.

Institutional Framework to oversee the implementation of NWCP: At the Central Government Level, National Wetlands Committee, Expert Group on Wetlands and

Research Advisory Committee on Wetlands are in place. At the State level, two Institutional structures are required for implementation of NWCP.

- State Steering Committee (SSC): SSC is chaired by Chief Secretary or Additional Chief Secretary or Principal Secretary (Forests) of the State to oversee the programme. This committee has wide representation from various line departments of the State and Central Government, scientists with requisite expertise, representatives of research institutions and representative of Union Ministry of Environment & Forests. This committee critically examines the MAPs, regularly reviews conservation activities and makes appropriate recommendations to the Central Government and other financial agencies as appropriate.
- State Wetland Conservation Authority- States have been advised to constitute the Authority having expertise in wetlands, for effective execution of Scheme in their respective State.

Department of Forest & Wildlife: - Department of Forests and Wildlife is responsible for management of protected areas including the wetlands in the State. The Department has prepared Wetland Management Plans for select wetlands. The Pong dam wetland is being managed by the Forest Department under centrally assisted Intensive Management Plan for the improvement and creation of suitable habitats, and nesting and roosting sites for several species of birds. The Government of Himachal Pradesh has also undertaken ecological improvement and restoration of Renuka and Riwalsar wetlands for conservation and propagation of their biotic resources.

Department of Environment, Scientific & Technologies: - The Department of Environment & Scientific Technologies was set up in April, 2007 with an objective to improve

the effectiveness of environmental management, protect vulnerable ecosystems and enhance sustainability of development. Vide notification no. GAD (CC)-5-2/71 dated 15-10-2008 the name of the Department has been changed to Department of Environment, Science and Technology. The mandate of DEST inter alia is “To deal with all matters relating to Bio- diversity, Biosphere, Mitigation and Management of Natural Disasters, Protection and Conservation of the Wetlands, Grass-lands etc”

HP State Science, Technology and Environment (HPSCTE): - The Council was established at Shimla by Govt. of Himachal Pradesh on January 3, 1986 under the country wide programme of the Department of Science & Technology, Govt. of India to promote Science & Technology in the State.

The State Council for Science, Technology & Environment, Himachal Pradesh, is the nodal agency for Conservation of Wetlands and Biodiversity is included as part of “Science & Technology” for the HPSCSTE and creation of Environment Awareness in the State.

The State Biodiversity Board of Himachal Pradesh. The Government of H.P has constituted the H.P State Biodiversity Board vide notification no. STE-A(3)-1/2004 dated 12.05.2008 under the Chairmanship of the Chief Secretary, to the Govt. of H.P for implementation of the Biological Diversity Act, 2002 in the State. The Board is located in the State Council for Science, Technology and Environment. Further, Biodiversity Management Committees have been constituted under the State Biodiversity Board.

The H.P State Biodiversity Board has constituted Biodiversity Management Committees at the following Panchayats in five districts of the State as given below:

Department of Tourism also makes development interventions in and around select wetlands and manages water sports complex.

Bakhra Beas Management Board manages Pong reservoir and dam. Fisheries Department promotes fisheries, enforces rules related to fishing and regulates fishing contracts.

S. No.	Panchayats
1	Gram Panchayat, Naina Tikker, Tehsil Pachad, District Sirmour, H.P.
2	Gram Panchayat, Toong, Tehsil Banjar, District Kullu, H.P.
3	Gram Panchayat Khatnol, Tehsil Sunni, District Shimla, H.P.
4	Gram Panchayat, Churag, Tehsil Karsog, District Mandi, H.P.
5	Gram Panchayat, Darlaghat, Tehsil Arki, District Solan, H.P.

Organograms of different agencies along with description is given below.

### ***A. Department of Forest & Wildlife***

The Department of Forest & Wildlife is the department ( Wildlife wing) for carrying out all activities connected with Wetlands in the State of Himachal Pradesh. The Wildlife wing is headed by Principal Chief Conservator of Forests ( Wildlife). S/ he is assisted by 3 Conservator of Forests ( Wildlife). The Department of Forest & Wildlife has 36 Divisions and 6 Wildlife & 2 National Park. The existing institutional framework of Department of Forest & Wildlife is shown in Figure 3 and responsibilities of the officers are described below:-

#### **1. Addl. Pr.CCF (Finance & Planning)**

He/She is assisted by Chief Conservator of Forests (Forest Protection and Fire Control) and Conservator of Forests (Planning & Finance) and is responsible for all planning and budgeting issues.

#### **2. Addl. Pr.CCF (Admn. & HRD)**

He/She is assisted by Chief Conservator of Forests (Training and Establishment), Chief Conservator of Forests (Monitoring &

Evaluation) and Conservator of Forests (MIS & Public Governances) and is responsible for all HRD issues at policy level, Matters relating to CEC/Court cases and controlling officer for CCF (Training & Establishment) & CCF (M&E).

### **3. Addl. Pr.CCF (CAT & Plantations)**

He/She is assisted by Chief Conservator of Forests (Soil Conservation), Chief Conservator of Forests (Ecotourism & Plantations), Conservator of Forests (CAT Plans), Conservator of Forests (Ecotourism & Plantations) and Director of SLUB and is responsible for all soil & water conservation, Land resource management, Controlling officer for Director (State Land use Board) and Eco-tourism Policy, public-private enterprises, Ecotourism website, consultancies, out-sourcing and conferences related to Eco-tourism Issues relating to EIA and ES related matters.

### **4. Addl. Pr.CCF (Management)**

He/She is assisted by Chief Conservator of Forests (PFM), Chief Conservator of Forests (WP & Settlement), Chief Conservator of Forests (Sale & Audit), Conservator of Forests (Policy & Law) and is responsible for all Co-ordination with various agencies on forest management matters, Policy & rules for PFM, Preparation & Monitoring of working plan implementation and all working & settlement issues.

### **5. Chief Conservator of Forests (FCA & Project)**

He/She responsible for mining related issues, Land transfer cases matters, Monitoring reports relating to Mid Hill, projects and nodal officer of forest clearances cases, FCA 1980.

### **6. Chief Conservator of Forests (Faunal Diversity & PA Network)**

He/She is responsible for Identification, evaluation

& management of sites of specific scientific interest (SSSI); qualitative & quantitative survey of protected areas and SSSI; research in protected areas & SSSA; National and State wildlife policies; Wildlife Act and rules/biodiversity act & rules; International conventions and protocols on wildlife, protected areas and SSSI, etc.

### **7. Chief Conservator of Forests (Floral Diversity, NTFF & Management)**

He/She is assisted by Conservator of Forest (Research & Silva) and is responsible for Conservation and propagation of NTFP on governmental and private lands; No timber forest products and all related matters; National and State Medicinal Plant Boards; Co-ordination with outside institutions and research organizations on NTFP and medicinal plants and Invasive alien plant species & their management.

### **8. Chief Project Director, Mid Himalayan Watershed Development Project**

He/She is assisted by 2 Regional project directors and is responsible for proper administration of the affairs and funds of the projects and efficient implementation including management of procurement and disbursement activities, consolidation of annual works programmes and budgets, preparation and production of annual progress reports and financial statements and monitoring/evaluation of the project.

### ***B. H.P. State Council for Science, Technology & Environment***

The H.P. State Council for Science, Technology & Environment, Himachal Pradesh, is the nodal

agency for the promotion of Science & Technology and creation of Environment Awareness in the State. The State Council for Science, Technology & Environment is also the department for carrying out some activities connected with Wetlands in the State. The council is headed by Principle Secretary (S & T)- cum- Chairman (EC). He/She is assisted by Member Secretary, Joint Member Secretary and other officers. The existing administrative framework of State Council for Science, Technology & Environment is shown in Figure 5 and responsibilities of the officers are described below:-

1. Principle Secretary (S & T)-cum- Chairman (EC)- Principle Secretary (S & T)-cum- Chairman (EC) is overall in charge of the Council/ Department.
2. Member Secretary - Administrative in-charge of the office of the council
3. Joint Member Secretary - Drawing and disbursing officer of the State Council and assist the member secretary.
4. Principle Scientific Officer: - looking after the execution of programmes related to Science popularization, Ecology & Environment, Technology dissemination-Remote Sensing related.
5. Senior Scientific Officer: - looking after the execution of programmes related to Science popularization, Ecology & Environment, Technology dissemination-Remote Sensing related.
6. Scientific Officer: - Assisting the Principal and Sr. Scientific officers in execution of the activities/ programmes being co-ordinated and carrying out the activities independently in the council.
7. Project Officer: - Environmental Planning
8. Environment Engineer: - Environmental Planning

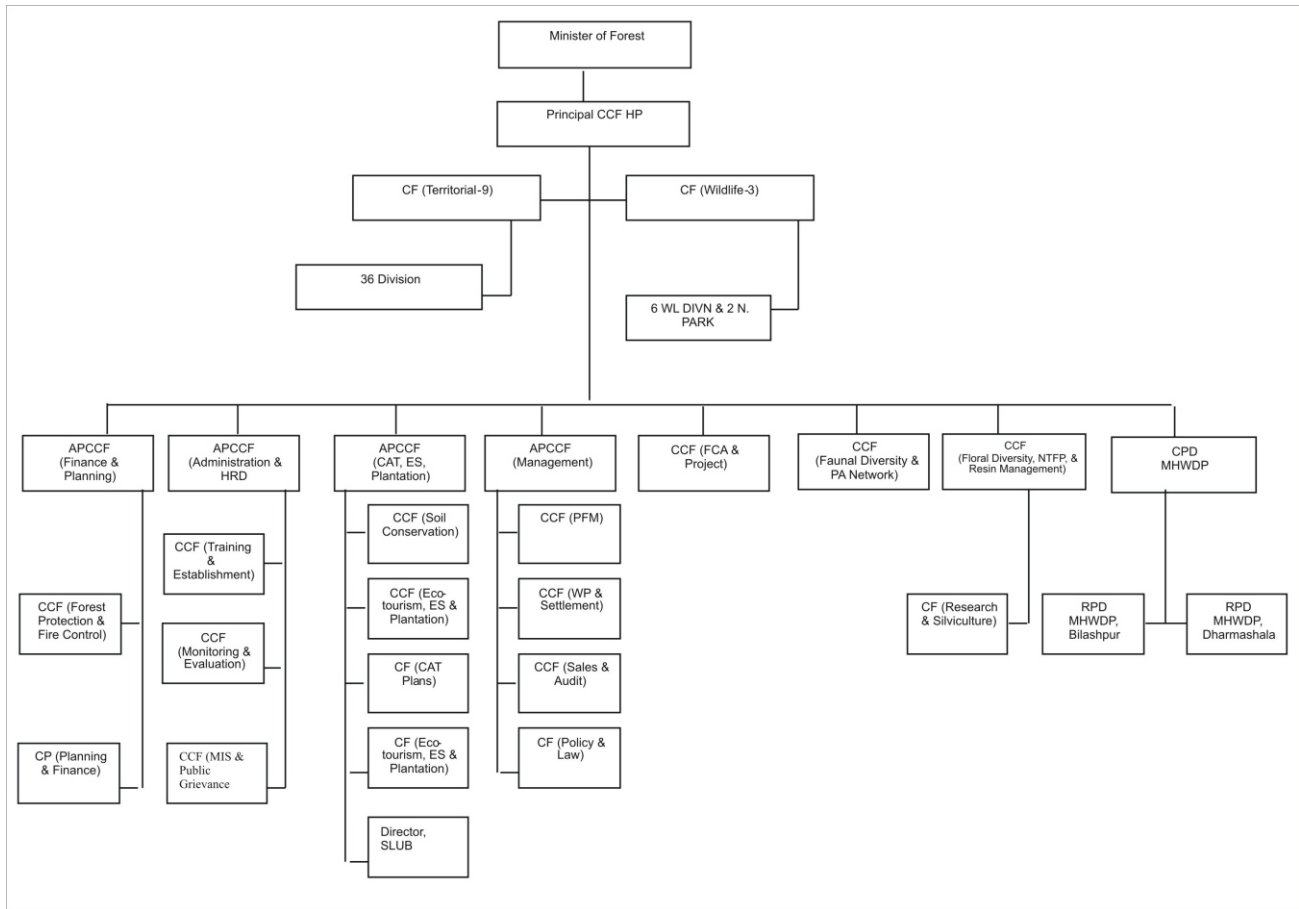
### ***C. Department of Environment, Science & Technology***

Besides Department of Forest & Wildlife and State Council for Science, Technology & Environment, the Department of Environment, Science & Technology is also the department for carrying out some activities connected with wetlands in the State of Himachal Pradesh. The Department of Environment & Scientific Technologies was set up in April, 2007 with objectives to improve the effectiveness of environmental management, protect vulnerable ecosystems and enhance sustainability of development. The Department of Environment, Science & Technology has 3 divisions i.e. Environment Division, Science & Technology Division and Biotechnology Division. The department is headed by Director. S/he is assisted by Additional Director, Senior Environment Officer, Project Officer and Environment Engineer in Environment Division. The existing administrative framework of Department of Environment, Science & Technology is shown in Figure 4.

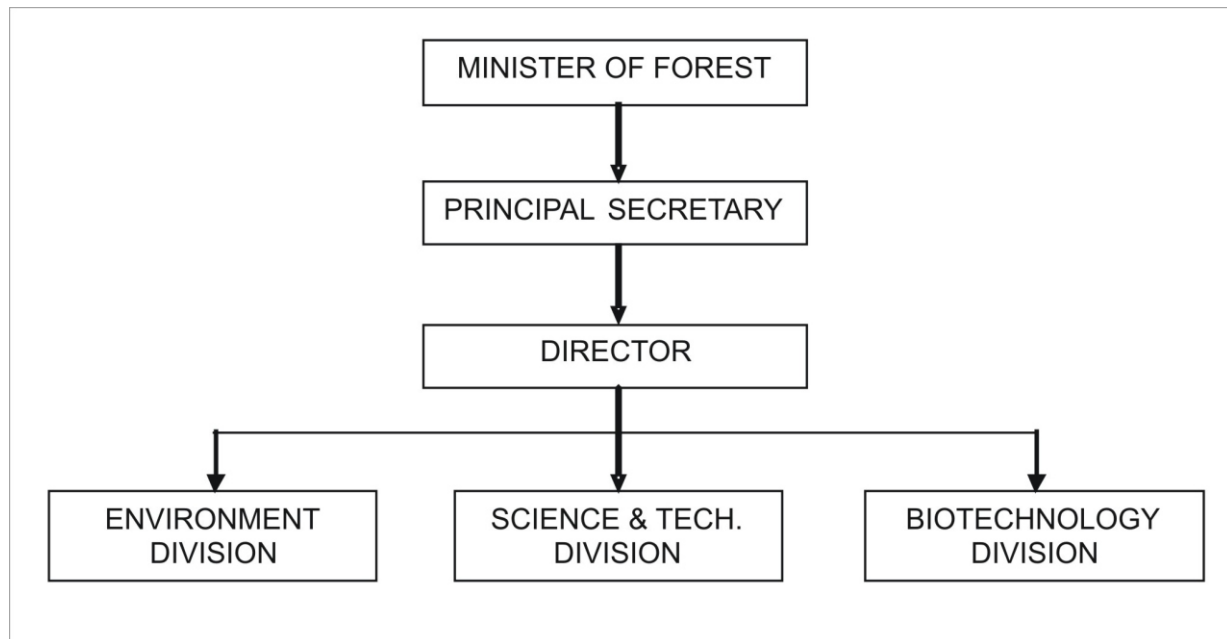
Therefore, based on the above institutional structure, gaps have been identified within the existing institutional framework which is described in Institutional Mechanism report. Furthermore, institutional responsibilities to implement actions identified and approved by the nodal department and line departments have also been described in Institutional Mechanism Report.

In order to address environmental issues identified in concerned sectoral guidelines, a number of innervations are required from the nodal department with identified line departments.





**Figure 3: Organogram of Forest Department, Himachal Pradesh**



**Figure 4: Organogram of Department of Environment, Science & Technology, Himachal Pradesh**

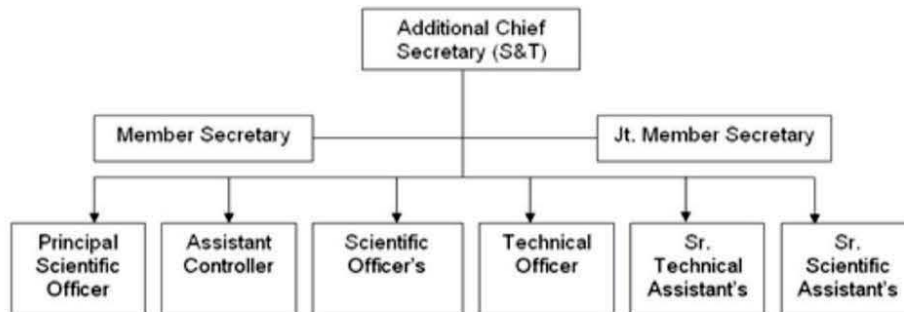


Figure 5: Organogram of H.P. State Council for Science, Technology & Environment

**2.11 Data / Documentation Pertaining to Addressing Demographic Issues in the Context of the Sectors, such as Population changes; Requirements of Population and Changing Lifestyles; Migratory Population Including Tourists; Transhumants; Transit Labour Population; Pressures Felt by Communities due to Degraded Environment Conditions**

Documentation related to wetlands of the State is given below.

**Pong Dam lake:** Pong dam reservoir provides sustenance to about 64 villages for fishing, grazing, agriculture, fuelwood, fodder and tourism etc. Thus the reservoir not only supports a wide variety of flora and fauna but also through its unique ecosystem provides livelihoods to the villages in the vicinity. The Cat fish (*Mystus seenghala*) has been showing constant increase during the last 10 years, therefore Pong reservoir may be categorized as a cat fish reservoir.

Prior to the impoundment of the river Beas, a subsistence fishery of inconsequential nature existed in the river and adjoining streams and the average catch hardly exceeded 2-4 kgs per fishermen per day, but with the formulation of the reservoir, a lucrative fishery started attracting large number of fishermen and the

oustees who had no other viable means of livelihood. The commercial fishing in the reservoir was initiated soon after its emergence. The total catch during the first year of fishing operation was 98 tonnes and increased progressively attaining a peak of 779 tonnes (1987-88), fluctuating within a narrow range of 443-596 tonnes. The catches of mahseer in the reservoir have shown remarkable consistency and landing have fluctuated between 50-81 tonnes. The highest catches of mahseer were recorded during 1997-98. The Fisheries Department initiated training courses for operating gears in the deeper waters for fishermen. This, however, inspired large number of oustees of various communities to adopt fishing as a profession. Besides direct employment to over 1789 fishermen, the fishing activities provide indirect job to over 1000 families engaged in helping fishermen, carrying/transportation, packing of fish, weaving and mending of gears, marketing etc.

The fishermen in the area are well organized. There are 14 fishermen cooperative societies functioning in the reservoir. There are about 1400 active fishermen recruited from 4000 oustees settled near the reservoir. This accounts for about 30.4% of the total population of reservoir fishermen.

**Chandertal wetland:** There is no permanent human settlement in the catchment area of Chandertal wetland. However, from July to September the migratory grazers erect temporary shelters. There are no commercial units in the vicinity of the wetland. Since the

whole area is devoid of vegetation and human settlement, no area in the vicinity of the lake is used for agriculture. About 65% of catchment area is highly degraded due to glacial action and seasonal grazing by migratory grazers. Rest 35% of the area is covered by herbs and grasses.

The anthropogenic interference with the lake ecosystem is seasonal (summer) through visits by trekkers and tourists from Batal, Kunzam or Baralacha pass routes. During the tourist season, a large number of visitors pollute the water quality of the lake by leaving garbage after camping. This adds toxicity to the fish and aquatic fauna as the camping spot on the alpine meadow at the northern end drains into the lake.

The nomadic herdsmen pass through the Chandra valley with huge flocks of sheep and goats that graze the meadows. The whole Chandertal and its catchment area are grazed heavily by migratory grazers every year. The combined effect of the visitors and herdsmen contribute to increased siltation and organic influx into the lake.

This lake remains closed from October to June due to heavy snowfall in the area. A large numbers of tourist visit this wetland every year from July to September.

**Renuka Wetland:** A temple of Renukaji exists along the edge of the wetland. An annual fair is held at the site of the lake and thousands of pilgrims visit this area during this time. Local people are symbolically attached to this lake and treat it as a sacred place.

There are six villages in close proximity of the lake with population of 2700 and cattle population of 3407. Local community fulfills their needs of fuel and fodder from the surrounding area.

There is massive landslide on the northern side of the lake. This coupled with the construction of roads in the area have caused heavy siltation on the northern side of the lake.

## 2.12 Information on Human Resource Management issues (which may have relevance to environment management) in the sector such as: manpower, vocational training, awareness levels, etc.

Status of Manpower in Forest Department: The Forest Department is the nodal department for carrying out all activities connected with forestry and Wildlife in the State of Himachal Pradesh.

The department is headed by Principal Chief Conservator of Forests. The officers of the rank of Additional Principal CCF, Chief Conservator of Forests, Conservator of Forests, Divisional Forest Officers, Assistant Conservator of Forests, Range Forest Officers, Deputy Range Officers and Forest Guards work in the department at various levels. Officers are assisted by staff in discharging their functions.

The existing status of human resource management in Himachal Pradesh is given below:

**Table 18: Cadre Position of the IFS, HPFS and other Officers**

Sl. No.	Name of post	Sanctioned posts	In position
1	PCCF	2	1
2	Addl.PCCFs	4	4
3	CCFS	11	11
4	CFs	17	18
5	DCFs	31	27
	Other on Deputation, Training Reserve & Leave Reserve/	41	44
6	Junior		
7	HPFS Officers	160	151
8	XEN (Forests)	2	2
9	SDO (Forests)	5	5
10	Forest Statistician	1	-
11	FMO	1	-
12	Registrars	3	3
13	Supdt (Gazetted)	23	23
14	Dy. Controllar (F&A)	1	1
	Section Officer	1	1
15	(F&A)		
16	Private Secretary	1	1

**Table 19: Staff Position of Field, Technical, Ministerial & Class- IV cadre**

S No.	Name of Post	Sanctioned	Existing	S No.	Name of Post	Sanctioned	Existing
1	Animal Attendant	26	26	55	Plumber	8	8
2	Beldar	8	8	56	Proof Reader	1	1
3	Boatman	5	5	57	Restorer	1	1
4	Book Binder	2	2	58	Sawmill Operator	1	1
5	Camel Cart Driver	1	1	59	Senior Auditor	2	2
6	Carpenter	6	6	60	Soil Surveyor Assistant	1	1
7	Chowkidar	462	452	61	Sr. Assistant	223	218
8	Cinema Operator	1	1	62	Sr. Lab. Technician	1	0
9	Clerk/Sr / Jr.Assistant	445	330	63	Sr. Photographer	1	1
10	Compositor	4	5	64	Sr.Scale S.grapher	23	15
11	Computer	4	1	65	Statistical Assistant	3	3
12	Conductor	3	3	66	Steno Typist	13	0
13	Daftri	10	10	67	Supdt. Gr. II	122	118
14	Dak Runner	21	21	68	Surveyor	5	5
15	Dandidar	1	2	69	Sweeper	58	64
16	Darkroom Assistant	1	1	70	Taroos	7	1
17	Demarcation Daroga	22	1	71	Taxidermist	1	0
18	Depot Watcher	3	1	72	Technical Assistant	1	1
19	Deputy Ranger	801	801	73	Timber Watcher	5	5
20	Distributor	1	1	74	Tractor Operator	1	0
21	Dispenser	1	1	75	Truck Cleaner	4	2
22	Draftsman	9	7	76	Vet. Pharmacist	3	3
23	Driver (Truck/Bus/ van)	82	82	77	Workshop Mechanic	1	1
24	Electric Mechanic	1	1				
25	Electrician	3	4				
26	Enclosure Cleaner	2	2				
27	Forest Guard	2581	2488				
28	Forest Rangers	296	200				
29	Forest Worker	3041	3041				
30	Gate Keeper	4	4				
31	Gestetner Operator	1	1				
32	Head Draftsman	13	13				
33	Inker	1	3				
34	Jamadar	30	30				
35	Junior Draftsman	11	11				
36	Junior Engineer	7	7				
37	Junior Photographer	1	1				
38	Junior Translator	1	1				
39	Kanungo	33	28				
40	Khalasi	2	2				
41	Line Man	1	0				
42	Machine Man	1	1				
43	Malie's	280	278				
44	Masson	1	1				
45	Muleman/Sais	19	19				
46	Naib Tehsildar	8	8				
47	Operator/Mechanic	1	1				
48	P.T.I.	1	1				
49	Packer	1	1				
50	Park Cleaner	1	1				
51	Patwari	68	48				
52	Peon	565	565				
53	Personal Assistant	6	6				
54	Photographer-cum- Artist	1	0				

**Table 20: Forestry Administrative Units As On 31.03.2008**

Offices	Divisions		Ranges		Blocks		Beats	
	(T)	(F)	(T)	(F)	(T)	(F)	(T)	(F)
<b>Principal Chief Conservator of Forests, H P</b>								
CCF (M & E), Sunder Nagar	-	-	-	-	-	-	-	-
CF (Research)	-	-	-	-	-	-	-	-
DCF (Hqrs)	-	-	-	-	-	-	-	-
CF Bilaspur	4	-	19	-	58	-	226	-
CF Chamba	5	-	18	-	57	-	201	-
CF Dharamshala	5	-	23	-	83	-	335	-
CF Kullu	4	-	16	1	43	-	139	-
CF Mandi	5	-	24	-	77	-	294	-
CF Nahan	5	-	22	-	69	-	270	-
CF Rampur	5	1	18	-	52	-	172	-
CF Shimla	4	-	22	1	63	2	230	-
<b>Addl. Principal Chief Conservator of Forests (APD)</b>								
CCF (Administration & HRD)	-	-	-	-	-	-	-	-
CCF (Planning & Finance)	-	-	-	-	-	-	-	-
CF (MIS & PG)	-	1	-	3	-	-	-	-
<b>Addl. Principal Chief Conservator of Forests (Projects)</b>								
CCF (WP), Mandi	-	4	-	-	-	-	-	-
CCF (FCA)	-	-	-	-	-	-	-	-
CF (Projects)	-	2	-	-	-	-	-	-
<b>Addl. Principal Chief Conservator of Forests (CAT Plan)</b>								
CCF (SC & LRM)	-	2	-	-	-	-	-	-
CF (CAT Plan)	-	-	-	-	-	-	-	-
<b>Addl. Principal Chief Conservator of Forests (PFM&amp;FDA), Hamirpur</b>								
CCF (FM, Industry & Law)	-	-	-	-	-	-	-	-
CCF (PS & Audit)	-	-	-	-	-	-	-	-
CF (Policy & Law)	-	-	-	-	-	-	-	-
<b>Chief Project Director (MHWDP)</b>								
Regional Project Director, Bilaspur	-	5	-	-	-	-	-	-
Regional Project Director, D/Shala	-	6	-	-	-	-	-	-
<b>Principal Chief Conservator of Forests (Wildlife) Shimla</b>								
CCF (Eco-Tourism & NTFP)	-	-	-	-	-	-	-	-
CF (Eco-Tourism)	-	-	-	-	-	-	-	-
CCF (Protected Area & Bio-diversity)	-	-	-	-	-	-	-	-
DCF (Hqrs.)	-	-	-	-	-	-	-	-
CF WL, Dharamshala	2	-	5	1	10	-	32	-
CF WL Shimla	3	-	13	-	26	-	60	-
CF GHNP, Shamshi	1	-	8	-	22	-	57	-
<b>Total :</b>	<b>43</b>	<b>21</b>	<b>188</b>	<b>6</b>	<b>560</b>	<b>2</b>	<b>2016</b>	<b>-</b>

(T)- Territorial (F) – Functional (U)

**Table 21: Forestry Personnel in position as on 31-03-2008**

Sl. No.	Employees	Number
1	Indian Forest Services Officers	103
2	State Forest Services Officers	161
3	Other Technical/ Professional Officers	36
4	Forest Rangers	295
5	Deputy Rangers	801
6	Forest Guards	2581
7	Other Technical Staff	248
8	Ministerial and Class-IV Employees	5296
	<b>Total</b>	<b>9389</b>

Human resource and training level: While the officers and staff are trained in forestry and/ or wildlife management, they lack training in wetland management. Regular training for wetland management of the staff should be incorporated in department's training curriculum.

Assessment of the organogram of DEST (given in figure 4) indicates that the current profile and strength of existing staff is inadequate to address the DEST mandate " To deal with all matters relating to Bio- diversity, Biosphere,

Mitigation and Management of Natural Disasters, Protection and Conservation of the Wetlands, Grasslands etc.

Assessment of Department of Forests and Wildlife's organogram (Figure 3) indicates that though the department is mandated and tasked for protection of protected areas, but the current strength of staff and profile is inadequate to address the department's mandate for conservation and management of protected wetlands including wetlands of international significance namely Ramsar sites.

Assessment of the organogram of HP State Science, Technology & Environment (given in Figure 5) indicates that Conservation of Wetlands and Biodiversity is included as part of "Science & Technology" and creation of Environment Awareness in the State as mandate for the Council. However, current profile and strength of existing staff is inadequate to address the Council's mandate.

Therefore, based on the above institutional structure, gaps have been identified within the existing institutional framework of the concerned departments and are described in Institutional Mechanism report. Furthermore, institutional responsibilities to implement actions identified and approved by line departments have also been described in Institutional Mechanism Report.

The proposed institutional structure and training needs assessment and areas for training for the officers and staff training in wetland management have been done and given in. Regular training for wetland management of the staff has also been suggested for respective department's training curriculum in Institutional Mechanism Report.

### **2.13 Regulatory analysis to identify any regulations that have environment implications (negative or positive), and compliance with the same**

Wetlands and cross sectoral policy and regulatory framework at State level shows the intent of the State Government to address environmental issues related to the sector. A list of policies, plans, programmes, projects is given below:-

- National Water Policy 2002 and State Water Policy
- National Environment Policy (NEP), 2006
- Wetlands (Conservation and Management) Rules, 2010
- National Wetlands Conservation Programme
- Guidelines for National Lake Conservation Plan
- State Urbanisation Policy, 2009
- EIA notification September 14, 2006 and subsequent amendments
- The Indian Forest Act, 1927
- Forest (Conservation) Act, 1980
- HP Forest Sector Policy & Strategy 2005
- National Biosphere Reserve Programme.
- National Afforestation Programme
- Integrated Development of Wildlife Habitat.
- Catchment Area Treatment Plans
- State Tourism Policy, 1991
- Revised Policy on Development of Ecotourism in Himachal Pradesh, 2005
- Water (Prevention and Control of Pollution) Act 1974, Amended -1988

- Environment (Protection) Act, 1986
- Himachal Pradesh Non-Biodegradable Garbage (Control) Act, 1995
- Himachal Pradesh Non-Biodegradable Garbage (Control) Rule, 1996
- The Biological Diversity Act, 2002 and Biodiversity Rules, 2004
- Wildlife Protection Act, 1972 and amendments
- National Biodiversity Action Plan, 2008
- Himachal Pradesh Fisheries Act, 1976
- Himachal Pradesh Fisheries Rules, 1979
- Himachal Pradesh Fisheries (Fourth Amendment) Rules
- Himachal Pradesh State Council for Science, Technology & Environment
- India State of Forest Report, 2011
- Landuse Statistics, Ministry of Agriculture, GoI, 2006.
- State Forest Report of Himachal Pradesh, 2008, 2009.
- State Environment Report, Himachal Pradesh (Published in 2009)
- Indian Institute of Remote Sensing, Dehradun, 2002
- Districts Statistical Abstract, 2000, 2001
- Annual Administrative Report of Forest Department, 2007-08
- Website: <http://hpforest.nic.in/>

**2.14 Inventory of flora, fauna, aquatic species, inventory of habitats, existing species, endangered species, exotic species, inventory of migratory species and information on biodiversity losses have been given in the above sections. Further, a detailed list of avifauna and plants found in PAs is given in baseline of Forests and Wildlife (section 1.12)**

### **References:**

- Ministry of Environment and Forest, Government of India.
- State Forest & Wildlife Department of Himachal Pradesh.
- Department of Fisheries, Himachal Pradesh.
- Department of Environment, Science & Technology

## CHAPTER 3 FISHERIES

### 3.1 Resource inventory of existing assets of the sector

Himachal Pradesh has the privilege of having vast network of fisheries resources in the form of snow fed perennial rivers and streams besides man-made reservoirs, other impoundments, viz. lakes, soil water conservation in the form of check dams, kuhls and village ponds etc. While these resources are means of food with rich proteins in the form of fish, it also provides source of earning livelihood to thousands of people. The running water scheme initiated in the State has provided an adequate answer to many of the problems of pond fish culturists. In view of plenty of water flowing in the form of streams, kuhls vis-a-vis availability of mirror carps and trout seed in the State, the scheme of running water fish culture is getting popular among the fish farmers of the State. The pond culture is also getting big impetus in view of availability of fish seed, initiation of several extension and training schemes.

Himachal Pradesh is blessed with some of the finest rivers viz. Sutlej, Beas and Chenab originating from the permanent glaciers and spring-beds. The rivers and their branches are bestowed with exotic trout, mahseer, snow trout, loaches, indigenous lesser barilas and mirror carps. Besides, there are many natural lakes located in the higher reaches, man made impoundments harbouring more than 78 species of fish belonging to family of *Sisoridae*, *Belonidae*, *Ophiocephalidae* and *Mastacembelidae* and series of ponds dotted especially in sub-mountainous region. Fisheries in Himachal Pradesh are artisanal in character

involving roughly 12,500 families of fishermen and engaging from localized subsistence fishing to highly mobile and intensive fishing. The activities are mainly 'capture' in character where the fishermen operate varied types of fishing devices in open waters.

According to State Agriculture Plan, Himachal Pradesh, the State has 42000 ha of surface water area under reservoirs, 3000 km rivers, 725 ha of high altitude lakes, about 675 ha of surface water area under community, dugout and impoundment ponds. Fisheries serve as a source of direct livelihoods to about 7000 families. The State produced 6887 tonnes of fish in 2006-07 out of which 58.47 per cent was accounted by the rivers' fish production. Also, it was spread across most of the districts. The fish production increased to 7333 tonnes during 2007-08.

Inventory of habitats and existing species: Fish fauna of Himachal Pradesh rivers and streams principally belong to the families of *Salmonidae*, *Cyprinidae*, *Psilorhynchida*, *Homopteridae*, *Cobitidae* and *Sisoridae*. *Salmonidae* is represented by brown and rainbow trout while the mahseer by golden and deep bodied mahseer. Lesser barils are represented by *Barilius barilus*, *Barilius bendelisis*, *Barilius vagra* and *Barilius bola*. Minor carps are represented by *Labeo dero*, *Semiplotus semiplotus*, *Crossocheilus latius*, *Garra gotyla*, Snow trouts are *Danio devario*, and loaches are represented by *Botia birdi*, *Nemacheilus botia*, *N. pectinopterus* and *G. kashmirensis*. A List of fish found in the State is given in Table 1.

**Table 1: List of Fish found in HP**

1. <i>Notopterus lecepede</i>	43. <i>Botia dario</i>
2. <i>Notopterus notopterus</i>	44. <i>B. birdi</i>
3. <i>Salmo gairdeneri gairdenerii</i>	45. <i>B. lobachata</i>
4. <i>S. trutta fario</i>	46. <i>B. rostrata</i>
5. <i>Barilius barila</i>	47. <i>Nemacheilus botia</i>



6. <i>B. bendelisis</i>	48. <i>N. botia aures</i>
7. <i>B. barna</i>	49. <i>N. corica</i>
8. <i>B. vagra vagra</i>	50. <i>N. kangrae</i>
9. <i>B. sbarca</i>	51. <i>N. nilgiriensis</i>
10. <i>Raimas bola</i>	52. <i>N. rypicola</i>
11. <i>Danio devario</i>	53. <i>N. montanus</i>
12. <i>D. rerio</i>	54. <i>N. punjabensis</i>
13. <i>Esomus daniricus</i>	55. <i>N. stoliczkae</i>
14. <i>Rasbora danconius</i>	56. <i>Amblyceps mangois</i>
15. <i>Salmophasia bacaila</i>	57. <i>Mystus (Mystus) bleekeri</i>
16. <i>Hypothalmichthys molitrix</i>	58. <i>M. vittatus</i>
17. <i>Cyprinus carpio communis</i>	59. <i>Wallago attu</i>
18. <i>C. carpio specularis</i>	60. <i>Clupisoma garua</i>
19. <i>Carrasius auratus</i>	61. <i>Bagarius bagarius</i>
20. <i>Catla catla</i>	62. <i>Glyptothorax brevipinnis</i>
21. <i>Cirrhinus mrigala</i>	63. <i>G. garhwali</i>
22. <i>C. reba</i>	64. <i>Glyptothorax conirostris</i>
23. <i>Labeo boga</i>	65. <i>G. pectinopterus</i>
24. <i>L. calbasu</i>	66. <i>G. stoliczkae</i>
25. <i>L. dero</i>	67. <i>G. gracilis</i>
26. <i>L. dyocbeilus</i>	68. <i>G. horai</i>
27. <i>L. bata</i>	69. <i>G. kashmirensis</i>
28. <i>L. pangusia</i>	70. <i>G. telchitta</i>
29. <i>L. robita</i>	71. <i>Pseudocheneis sulcatus</i>
30. <i>Osteobromas cotio cotio</i>	72. <i>Glyptosternum reticulatum</i>
31. <i>Puntius chola</i>	73. <i>Glyptosternum sp.</i>
32. <i>P. chonchonius</i>	74. <i>Xenentodon regan</i>
33. <i>P. sarana sarana</i>	75. <i>Xenentodon cancila</i>
34. <i>P. ticto ticto</i>	76. <i>Channa striatus</i>
35. <i>P. wagenii</i>	77. <i>C. marulius</i>
36. <i>Tor sp.</i>	78. <i>C. punctatus</i>
37. <i>Tor putitora</i>	79. <i>C. orientalis</i>
38. <i>Tor tor</i>	80. <i>Nandus nandus</i>
39. <i>Crossocheilus latius punjabensis</i>	81. <i>Chanda baculis</i>
40. <i>Crossocheilus latius latius</i>	82. <i>Mastacembelus armatus</i>
41. <i>Garra gotyla</i>	83. <i>Mastacembelus scopell</i>
42. <i>Schizothorax richardsonii</i>	

Source: Himachal Pradesh State Biodiversity Strategy & Action Plan 2003

### 3.1.1 Trout & Carp Fish farms in Himachal Pradesh

Fish farms are the foundation stones of Fisheries' development in Inland Fisheries Sector. The seed produced at these seed production centres is either used for replenishing the harvested fish stock of open waters i.e. rivers or reservoirs or is further reared under semi-controlled conditions in growing ponds and sold for Table purposes. Himachal Pradesh has approximately 3000 kms of riverine length and four reservoirs namely Gobind sagar, Maharana Partap sagar, Pandoh and Chamera constructed on Sutlej, Beas, and

Ravi rivers respectively. The upper zones of rivers inhabited indigenous Schizothoracids and exotic Salmonids (trout) while the zones interspersing the semi-plain and plain areas are home to the mighty mahseer, Indian Major Carps and the much sought after catfish such as Singhara (*Mystus seenghala*) Malhee (*Wallago attu*) and Soal (*Channa species*). There are in all 12 fish seed farms under the control of Himachal Pradesh Fisheries Department out of which 6 are trout farms and another 6 are carp farms ( Table-2). The carp farms at Gagret and Nalagarh have been leased out to private entrepreneurs for fish and seed production.

**Table 2: Trout and Carp farms under the control of Fisheries Department, Himachal Pradesh**

Sl. No.	Trout farms	Carp farms
1	Patlikuhl (Kullu)	Deoli (Bilaspur)
2	Barot (Mandi)	Alsu (Mandi)
3	Holi (Chamba)	Kangra (Kangra)
4	Dhamwari (Shimla)	Sultanpur (Chamba)
5	Sangla (Kinnaur)	

**A) Status of trout fish farms:** The present status of trout farms in terms of fish and fish seed production, their development and future prospective is as under:

**1. Patlikuhl:** This farm was established in 1909 and is situated at National Highway-21 between Kullu and Manali on 26.4 bighas of land. The farm has the following infrastructure:

- a) Raceways 14 [13 (15x2x1.5m) and 4 (45X2.8X1.5)]
- b) Hatcheries (Bathar and Patlikuhl)
- c) Office Building 1
- d) Feed mill 1

**Availability of water:** The water to this farm is being drawn through H.D.P. pipes from a perennial tributary of river Beas named as Sujan or Sanjoin nala. The quantum of water available is sufficient for the available raceways. Hatchery at Patlikuhl is under renovation and is being provided assured water supply system, capacity of farm, hatchery, feed mill and extent of utilization. The fish farm has a fish production capacity of 10 tonnes and the production level attained during previous years has been over and above the capacity.

**2. Barot Trout Farm:** This farm was established in 1959 and is situated on the left banks of Uhl and Lambadug rivers near the barrage of Shanon Hydro- electric power project at Barot in Jogindernagar tehsil of Mandi district. The farm has the following infrastructure:

- Water storage tank 1 (7.6x4.9x1.78m)
- Fish ponds 3 (7.6x2.4x1.9m)
- Raceways 6 (15x2x4.5m)
- Hatchery 4 (30x2x1.5m)

**Water availability:** The farm had a problem of inadequate water supply. The two old water supply systems are under renovation while a new water supply system from Lambadug river with 150 lps capacity has been setup at the farm.

**Farm:** In absence of dependable water supply, the farm was hardly able to be assigned any fish production capacity. Even maintenance of brood fish was found to be difficult. With the augmentation of water supply, its fish production capacity has been achieved to be 5 t/ annum.

**Hatchery:** Hatchery has 6 incubation troughs with 4 trays. With utmost care it may only be possible to incubate about 1, 20, 000 - 1,30,000 eggs here. There are six start feed tanks capable of holding about 1, 00,000 hatchlings. The farm has a scope for expansion in its fish & fish seed production capacity by 5 t and 1 lakh ova respectively.

**3. Trout Farm Sangla:** This farm was established in 1965. Kinnaur district has a small trout farm at Sangla on the left bank of river Baspa. The farm has a total area of 1.5 acre.

**Water quality:** The water is being drawn to the farm from Hubra khad, which is a tributary of river Baspa, through 5-inch diameter GI pipe. It is estimated that the total availability of waters to the tune of 40lt/ sec. There are two spring water sources outside the farm which are supplying about 5 lt/sec water to the farm and this is the water which is being used for rearing the live stock at present.

**Infrastructure available:**

- Raceways 14 (size varies from 7x1.5x1m to 15x2x1.30m)
- Nursery tanks 16
- Office-cum-store 1
- Hatchery
- Feed store 1

Capacity of the Farm, Hatchery and level of its utilization level: There are plenty of raceways at the farm, but water supply is a limiting factor. In order to utilize all the infrastructure available, an additional water supply system from Rukti khad is under construction at the farm. After its completion, the farm shall have a production capacity of 5 tonnes.

**Hatchery:** Hatchery at the farm is under remodeling process.

**4. Bathar Hatchery:** This farm was established in 1996. This hatchery is located at a distance of about 5 km from Patlikuhl. It has an ova incubation capacity of 2,00,000 but the rearing space available for the hatchlings is hardly sufficient. With utmost care about 60,000-70,000 hatchlings can only be reared up to 1 g size. The capacity utilization has been over and above the capacity.

**Patlikuhl Hatchery:** This hatchery has 8 nursery tanks of size 2x2x0.5m made of fiberglass.

**Feed mill:** The feed mill caters to the feed requirements of trout farms functioning under the Fisheries Department as well as farms in the private sector. The mill has a production capacity of 300 kgs per hour. The annual production of feed is approximately 50 tonnes.

**Building Infrastructure: Patlikuhl:**

- 1. Office 1
- 2. Feed-mill ingredient stores 3
- 3. Hatchery 1
- 4. Laboratory 1

- 5. Store 1

**Bathar**

- 1. Hatchery 1
- 2. Type-I 1
- 3. Type-II 1
- 4. Store 1

Scope for the expansion of activities includes: Re-construction of hatchery at Patlikuhl; expansion of hatchery building and inside infrastructure at Bathar; upgradation of fish feed mill; construction of Angling lake at Patlikuhl. Fish buyers face difficulty in the procurement of ice, as there is a small ice plant at Kullu in the entire district. A small ice plant is proposed to be set up in the farm complex to overcome this barrier.

**5. Holi Trout Farm:** This farm was established in 2000. This farm has been constructed in Bharmaur tribal area at Holi in Chamba district to facilitate the propagation of trout in open waters of Ravi and its tributaries besides initiation of trout farming in rural areas for the generation of employment avenues to the tribal people. The farm has a land area of 6 bighas.

**Water availability:** Water for the farm is being drawn from two sources: a) spring source and from Kee- nala from a distance of about 2 km from the farm. The spring source provides approximately one lit./ sec water while the pipeline from nala brings about 50lt/sec.

**Infrastructure available at the farm:**

- Raceways 4 (15x2x1m)
- Nurseries 10
- Hatchery 1

Capacity of farm, Hatchery and its utilization level attained

**Farm:** By making improvements in the water supply system, the farm has now 2 tonnes of fish production capacity.

**Nurseries:** Ten cement concrete nurseries have been constructed at the farm. 40,000 trout fingerlings can be reared here up to 5 g size.

**Hatchery:** The hatchery has 6 incubation troughs with three trays each. It is possible to incubate about 1, 00, 000 trout ova in the hatchery.

**Scope for expansion of activities:** The quantum of water available is a limiting factor for the expansion in activities at the farm as spring source has 1lt/ sec of water. Water supply system from Kee nala is approximately of 2 km length and located in the landslide prone areas.

**6. Trout Farm Dhamwari:** This farm was established in 2005. It is located on 0.6 ha land in Rohru tehsil of Shimla district at Dhamwari. The farm has been recently constructed.

**Water availability:** Water to the farm is being drawn from Khanyara khad at the rate of 150lt/sec through G.I. pipe. There is hardly any shortage of water to the farm and if needed, the quantum of water being drawn can be increased by laying an additional pipe line.

**Infrastructure available at the farm:**

- Raceways 11 (3) (15x2.17x1.5m) (8) (15x2x4.5m)
- Hatchery building 1 (Containing 4 start feed tanks, two nursery tanks and 6 hatching troughs with 24 trays)

Capacity of the farm and hatchery and its utilization level

**Farm:** The construction works at the farm are nearing completion. It shall have a fish production capacity of 5 tonnes.

**Hatchery:** The hatchery has an installed capacity of 1 lakhs ova & 50000 fingerlings.

**A. Status of carp fish farms**

At present there are 6 carp farms under the control of Fisheries Department. The carp farms at Gagret and Nalagarh have been leased out to private entrepreneurs for fish and seed production. But these two are now with fisheries department with effect from Nov. 2011.

**1. Deoli Farm:** This farm was established in 1960. It is situated on 4.4 hectares of Government land in Deoli village of Bilaspur district. Following infrastructure exists in the farm:

- Nursery ponds 14 (30x10xm)
- Rectangular pond 1 (100x60x2m)
- Triangular pond 1 (1 ha.)

**Water availability:** There is no dearth of water in this farm and it can be drawn as per requirement from the small rivulet flowing by the side of the farm.

**Capacity of the farm and level of its utilization:**

The farm is producing common carp (*Cyprinus carpio*) fish seed besides experiments on the breeding of fresh water ornamental fish species. The common carp is the ideal fish for this farm keeping in view the quantum of seed produced. The available nursery area has the capacity to rear about 15 million carp spawn per annum. The two biggest ponds of 0.6 and 1 hectare each are available for the maintenance of brood fish and raising of fish for sale. Gold fish (*Carassius carassius*) is also being maintained at this farm for sale to the aquaria owners.

**2. Alsu Farm:** This farm was established in 1960. It is situated at Alsu village of Sundernagar tehsil of Mandi district and has a land area of 20 bighas. The farm has the following infrastructure:

- Nursery ponds 12 (75x50x5feet)
- Storage pond 1 (20x20x10 feet)
- Marketing pond 1 (375x80x12 feet)

**Water availability:** Water to the farm is being drawn through a kuhl from Alsu nala but the local people never allow drawing water to the farm as per requirement. During lean season or say summers there remains acute shortage of water at the farm which is a problem.

**Capacity of the farm and its present level of utilization:** Indian major carps (Rohu & Mrigal) and Grass carp are being reared at this farm.

Perhaps, it is the only carp farm in the entire Himachal Pradesh where Indian major carps especially mrigal and Rohu are being successfully bred. This has been a regular feature since 1998 onwards. The farm has attained major carp seed production level of 20,00,000 spawn per year. Its production level is being increased to 5 million seed per annum by setting up Chinese hatchery & increase in rearing space. Grass carp fish is assisting in the control of aquatic weeds and this has not responded for artificial breeding so far.

**3. Kangra farm:** This farm was established in 1965. It is located in Kangra and has an area of 0.48 ha, out of which water area is 0.28 ha. The farm has the following infrastructure:

- Nursery ponds 3 (1272 sq m)
- Rearing ponds 5 (618 sq m)
- Brood stock ponds 2 (1199 sq m)

**Water availability:** There is a small pond having an area of 42 sq m, which acts as a water source during monsoon and early part of winter. When this pond overflows, it supplies water to some other ponds. During lean seasons, the subsoil water ponds are supplied water through an electric pump from this pond, meaning thereby that all the ponds at the farm except the nursery area are dependant for water on the subsoil water table.

**Constraints:** Except three nursery ponds, all the ponds get sub-soil water and there is hardly any scope of increase in their productivity as the entire manure or nutrients if added would not be able to react with bottom soil or pond water and are likely to get leached. This results in stunted growth in fish.

**4. Sultanpur Farm:** In Chamba this farm was established in 2000. It is situated on 32 bighas of marshy land of Sultanpur in Chamba district. The main objective of setting up this farm was to provide quality fish seed to the fish farmers in Chamba, besides production of fish for Table purpose and stocking of Chamera reservoir. The farm has the following infrastructure:

• Nursery ponds	8 (18x13x1m)
• Sump well	1
• Office building	1
• Aquarium house	1
• Angler lodge (UC)	1

**Water availability:** It is the subsoil water, which is being used for fish and fish seed rearing at the farm. A sump-well has also been constructed recently. Perusal of the water temperature record reveals that the temperature ranges between 8 to 38 degree Celsius, lowest during January and maximum during the month of July. The farm being at a low area receives entire run off water from the catchments and this water accumulates in major portion of the farmland.

**Capacity of the farm and extent of its utilization:** The water logged nature of the

farmland has made the productivity control difficult in the ponds. The pond bottoms are peaty and can be neither dried nor completely netted out during fish and fish seed harvesting. The total rearing space available is 0.18 ha. It has been estimated that, it could have been possible to rear 15-20 lakhs carp spawn in 6 ponds (2 to be left as brood fish ponds) and thereby raise 5 lakhs fry if best practices are adopted.

### 3.1.2 Angling in Himachal Waters

The streams of Himachal Pradesh fall under two categories; General water and Trout waters, with estimated length of 600 and 2400 kms respectively. The major State's streams include-Beas, Sutlej, Ravi, Tirthan, Sainj, Uhl, Baspa, Pabbar, Lambadug, Giri, Rana, Nugal Gai, Baner, Bata, etc. The major fish available in these streams are Trout, Mahseer, Nemacheilus spp, Barilius sp, Schizothoracids, Crossocheilus sp. Glyptothorax spp. etc. Fishing in these streams is regularised under the State Fisheries Act. In trout water, licences only for rod and line fishing are permitted while in general water both rod and line as well as cast netting is allowed. The Department of Fisheries has identified the following stretches as potential fishing sports for trout and mahseer.

#### 1. Trout Waters

Name of the River	Stretch	Stream length in (Kms.)
Beas	Katrain to Manali	18
Tirthan	Largi to Nagni	20
Sainj	Largi to Ropa	22
Lambadug	Barit to Lohardi	6
Uhl	Barot to Kothikhad	10
Ravi	Holi to Main bridge	5

Source: Directorate of Fisheries

#### 2. Mahseer waters

Name of river	Stretch	Stream length in (kms.)
Beas	Seri mulag-Confluence of Binwa to Beas.	5
Beas	Harsipattan- confluence of Kunha tributary of Beas.	10
Beas	Chambapattan	5
Beas	Kuran	5
Beas	Dehra Gopipur	10
Beas	Baner	5
Giri	Bata	-

Source: Himachal Pradesh State Biodiversity Strategy & Action Plan 2003

### 3.1.3 Status of Fish Ponds

The Area wise breakup of community fish ponds constructed is given in Table 3. The data shows that majority of the Ponds i.e. 29 (90.63%) out of 32 are less than 0.5 ha. in area. Table 3, shows that 10 ponds were constructed during 2003-04 and 14 ponds were constructed in 2004-05. Only 8 Ponds were constructed in 2002-03.

**Table 3: Area and year wise distribution of sampled fish ponds**

Category of ponds	Area of Ponds (Ha)	Ponds		Construction Year		
		Nos.	%	2002-03	2003-04	2004-05
Type-I	Less than 0.5	29	90.63	7	10	12
Type-II	0.5 to 1.00	2	6.25	1	0	1
Type-III	Above 1.00	1	3.12	0	0	1
Total Sample		32	100	8	10	14

Source: Evaluation Study on Community Fish Pond Report

#### 3.1.3.1 Construction of Fish Ponds

Type of construction of all ponds in Mandi, Sirmour and Una districts are kutcha (excavated) in nature. Kangra district is having 5 kutcha ponds out of total 7 ponds. Bilaspur and Chamba district each have 2 kutcha ponds. Shimla district is having 2 pucca ponds out of a total of 3 ponds. The 4 semi-pucca ponds have also been found constructed in Chamba, Kangra and Solan district. Majority of ponds i.e. 22 (68.75%) out of 32 are kutcha ponds, 6 (18.75%) are pucca ponds and 4 (12.50%) ponds are semi-pucca. A district wise detail of types of construction of fish ponds is given in Table 4.

**Table 4: Types of Construction of fish ponds**

Name of the District	No. of sampled fish ponds	Types of Ponds					
		Kutcha		Pucca		Other (Semi pucca)	
		No.	%	No.	%	No.	%
Bilaspur	3	2	66.67	1	33.33	-	-
Chamba	3	2	66.67	-	-	1	33.33
Hamirpur	2	1	50.00	1	50.00	-	-
Kangra	7	5	71.42	1	14.28	1	14.28
Kullu	1	-	-	1	100.00	-	-
Mandi	4	4	100.00	-	-	-	-
Sirmour	3	3	100.00	-	-	-	-
Shimla	3	1	33.33	2	66.67	-	-
Solan	3	1	33.33	-	-	2	66.67
Una	3	3	100.00	-	-	-	-
<b>Total</b>	<b>32</b>	<b>22</b>	<b>68.75</b>	<b>6</b>	<b>18.75</b>	<b>4</b>	<b>12.50</b>

Source: Evaluation Study on Community Fish Pond Report

### 3.1.3.2 Source of Water Supply to Fish Ponds

The assessment of the source of water supply to sampled fish ponds was ascertained. It is evident from Table 5, that all ponds of Chamba districts

### 3.1.3.3 Status of Functional and Non-Functional Fish Ponds

District wise status of fish ponds was ascertained to know the actual number of functional and non-functional ponds. Functional ponds comprise two categories i.e. all weather ponds and seasonal ponds. It is evident from Table 6 that all ponds of Bilaspur, Sirmour, Kullu and Una districts are all weather ponds except one seasonal pond in Bilaspur. All the 3 ponds of Chamba district are non functional. Kangra district is having 4 functional and 3 non functional ponds. Percentage of non are dependent on rain water mostly. 3 ponds of Kangra district are rain water based while 3 are fed by natural drain. All the ponds in Una and Kullu districts and 2 ponds each in Bilaspur and Sirmour district are having natural drains. One pond each in Hamirpur, Kangra and Sirmour districts is having artificial drain. It may be concluded that majority of ponds i.e. 15 (46.88%) out of 32 are rain water based, 14 (43.75%) are having natural drain and only 3 (9.37%) are based on artificial drain.

**Table 5: Source of water supply to Fish Ponds**

Name of the District	No. of sampled fish ponds	Source of water supply					
		Natural drain		Artificial drain		Rain water	
		No.	%	No.	%	No.	%
Bilaspur	3	2	66.67	0	-	1	33.33
Chamba	3	0	-	0	-	3	100.00
Hamirpur	2	0	-	1	50.00	1	50.00
Kangra	7	3	42.86	1	14.28	3	42.86
Kullu	1	1	100.00	0	-	0	-
Mandi	4	1	25.00	0	-	3	75.00
Sirmour	3	2	66.67	1	33.33	0	-
Shimla	3	1	33.33	0	-	2	66.67
Solan	3	1	33.33	0	-	2	66.67
Una	3	3	100.00	0	-	0	-
<b>Total</b>	<b>32</b>	<b>14</b>		<b>3</b>	<b>9.37</b>	<b>15</b>	<b>46.88</b>

Source: Evaluation Study on Community Fish Pond Report

functional ponds is on the higher side in Mandi (75.00%), Shimla (66.67%) and Solan (66.67%) districts. It may be concluded that majority of ponds i.e. 18 (56.25%) out of 32 are functional while 14 (43.75%) ponds are non functional.

**Table 6: Status of Functional and Non-Functional Fish Ponds**

Name of the District	No. of sampled Fish Ponds	Status of Ponds					
		All Weather		Seasonal		Non-Functional	
		No.	%	No.	%	No.	%
Bilaspur	3	2	66.67	1	33.33	-	-
Chamba	3	-	-	-	-	3	100.00
Hamirpur	2	1	50.00	-	-	1	50.00
Kangra	7	4	57.14	-	-	3	42.86
Kullu	1	1	100.00	-	-	-	-
Mandi	4	1	25.00	-	-	3	75.00
Sirmour	3	3	100.00	-	-	-	-
Shimla	3	1	33.33	-	-	2	66.67
Solan	3	1	33.33	-	-	2	66.67
Una	3	3	100.00	-	-	-	-

Source: Evaluation Study on Community Fish Pond Report

### 3.1.3.4 Reasons for Non-functionality of Ponds

It has been observed from Table 7, that 7 out of 14 (50%) ponds are non-functional due to non-availability/ lack of water supply in ponds, besides other reasons, as some ponds are having more than one reason for failure. About 7 (50%) are perceived to be non functional due to leakage of water. Two ponds have been damaged due to rain / flood and lack of proper training/ lack of responsibility. Three ponds are non-functional due to other reasons like non-completion/ non introduction of fish seed.

**Table 7: Reasons for Non-functionality of Ponds**

Name of Districts	District Wise Non functional Ponds														
	i) Non-availability/ lack of water supply in pond	ii) Salinity of water	iii) Damage due to rain/flood	iv) Leakage of water	v) Siltation	vi) Presence of Doka fish	vii) Fault in design of pond	viii) Non-availability of quality seed	ix) Lack of proper training	x) Lack of responsibility	xi) Marketing problem	xii) Non co-operation from Department	xiii) Considered to avail subsidy under the scheme.	xiv) Other (Specify)	Incomplete/ Seed not introduced
Bilaspur	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chamba	3	-	-	2	-	-	-	-	-	-	-	-	-	-	1
Hamirpur	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Kangra	3	3	-	1	-	-	-	-	-	-	-	-	-	-	-
Kullu	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mandi	3	1	-	-	-	-	-	-	-	-	-	-	-	-	2
Sirmaur	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Shimla	2	1	-	2	1	-	-	-	1	1	-	-	-	-	-
Solan	2	2	-	-	2	-	-	-	-	-	-	-	-	-	-
Una	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	14	7	0	2	7	0	0	0	0	1	1	0	0	0	3

**3.1.3.5 Public Perception about Non Functionality of Ponds**

Public also perceives more than one reason regarding non functionality of ponds. According to this perception, 7 out of 14 ponds are non-functional due to non availability of sustainable source of water and 6 ponds are non functional due to low rains. Two ponds in Chamba and

one pond in Hamirpur are non-functional due to poor construction quality. One pond in Shimla is non-functional due to lack of repair. One pond in Chamba and two ponds in Mandi are non-functional due to other reasons like panchayat not taking responsibility / non-completion of ponds, etc (Table-8).

**Table 8: Public Perception about Non Functionality of Ponds**

Name of the District	No. of Non-Functional Ponds	Public Perception about Non Functionality of Ponds				
		No proper source of water	Poor Construction quality	Low rains	No repairs done	Non responsibility of Panchayat/ non-completion of ponds
Bilaspur	-	-	-	-	-	-
Chamba	3	-	2	-	-	1
Hamirpur	1	-	1	-	-	-
Kangra	3	3	-	3	-	-
Kullu	-	-	-	-	-	-
Mandi	3	1	-	-	-	2
Sirmaur	-	-	-	-	-	-
Shimla	2	1	-	-	1	-
Solan	2	2	-	2	-	-
Una	-	-	-	-	-	-
Total	14	7	3	6	1	3

Source: An Evaluation Study of Community Fish Ponds, Himachal Pradesh



### 3.1.3.6 Maintenance of Fish Ponds

District wise maintenance status of fish ponds was ascertained to know the actual number of ponds maintained by the Panchayat and / or through individuals on lease basis. It is clear from Table 9, that all ponds in Chamba and Solan districts are maintained by the Panchayat

itself while all the ponds in Bilaspur, Kullu and Sirmour districts are maintained by Panchayat through individuals on lease basis. In all, 17 (53.12%) ponds are maintained by Panchayat and 15 (46.88%) ponds are maintained by Panchayat through individuals on lease basis.

**Table 9: Maintenance of Fish Ponds**

Name of the District	No. of sampled Fish Ponds	Maintenance of FishPonds			
		By Panchayat		By Panchayat through individual on lease basis	
		No.	%	No.	%
Bilaspur	3	-	-	3	100.00
Chamba	3	3	100.00	-	-
Hamirpur	2	1	50.00	1	50.00
Kangra	7	5	71.43	2	28.57
Kullu	1	-	-	1	100.00
Mandi	4	2	50.00	2	50.00
Sirmaur	3	-	-	3	100.00
Shimla	3	2	66.67	1	33.33
Solan	3	3	100.00	-	-
Una	3	1	33.33	2	66.67
<b>Total</b>	<b>32</b>	<b>17</b>	<b>53.12</b>	<b>15</b>	<b>46.88</b>

*Source: Evaluation Study on Community Fish Pond Report*

### 3.1.3.7 Source of procurement of Fish Seed: The

procurement of fish seeds for all functional ponds of Bilaspur, Hamirpur, Kullu, Mandi and Shimla districts have been done from Government source only. Procurement of fish seed for all the ponds of Sirmaur district and one pond each in Kangra, Solan and Una has

been done from private source. It may be concluded that procurement of fish seed for majority of ponds i.e. 12 (66.67%) out of 18 has been done from Government source and for remaining 6 (33.33%) ponds from private source as shown in Table 10.

**Table 10: Source of procurement of Fish Seed**

Name of the District	No. of sampled Fish Ponds	Govt. Source		Private Source	
		No.	%	No.	%
Bilaspur	3	3	100	-	-
Chamba	-	-	-	-	-
Hamirpur	1	1	100	-	-
Kangra	4	3	75	1	25
Kullu	1	1	100	-	-
Mandi	1	1	100	-	-
Sirmaur	3	-	-	3	100
Shimla	1	1	100	-	-
Solan	1	-	-	1	100
Una	3	2	66.67	1	33.33
Total	18	12	66.67	6	33.33

### 3.1.3.8 Average Cost of production and annual return from the pond

The seed cost, feed cost, manuring cost, labour cost and other operational cost per pond is ` 2098, 4385, 1200, 2250 and 250 respectively. Total Average Cost of Production per pond is ` 10183 ( Table 11). It is evident from Table 10 that the average annual turnout is 510 kgs and

average price of fish is ` 38/kgs. Total turnout is ` 19380 which has been calculated by multiplying the average annual turnout with average price of fish. Net revenue has been estimated to be `9197 which has been calculated by deducting the total average cost from total turnout. This shows that community fish pond venture is profitable and it has helped local farmers in additional income generation.

**Table 11 Average Cost of production / pond**

Sl. No.	Cost of Production	Rupees	Sl. No.	Return Profile	
1	Seed cost	2098	1	Average annual out turn (kg)	510
2	Feed cost	4385	2	Average price of fish (₹/kg)	38
3	Manuring cost	1200	3	Total out turn (₹)	19380
4	Labour cost	2250	4	Total average cost (₹)	10183
5	Other operational cost	250	5	Net Revenue (₹)	9197
6	Total average cost	10183			

### 3.1.4 Introduction of new species

Started over a century ago, numerous exotic aquatic species have been introduced in the State's waters. Even though the introduction was always to bring in something useful for raising the unit area production of aquatic species, some introductions were hardly ever

backed up by a scientific assessment of the possible consequences to the indigenous fauna in particular, and aquatic ecology in general. The detrimental effects of such introductions soon became apparent but until recently were insufficient to cause wide spread concerns. However, with the development and spread of aquaculture and an increasing public awareness

of the environment, fear of the import of introductions of fish species has grown. This has led the formation of a working group to suggest a code of practices on the introduction and transfer of inland aquatic species under the aegis of F.A.O. report. A total of 1354 introductions of 237 species of fish into 140 countries have been recorded. The purpose for these introductions in aquaculture, sport, is for the improvement of wild stock, accidental entry, ornamental, control of unwanted organisms and dietary preferences.

The effect of introductions of fish on the environment and indigenous fisheries are frequently surprising, especially as the new species may adopt a niche that differs completely from that occupied in its native range. In India over 300 fish species, some of them predatory have been introduced to cater to various demands. The important food species introduced were Golden carp (*Carrassius carrassius*), Tinch (*Tinca tinca*), common carp (*Cyprinus carpio*), Grass carp (*Ctenopharyngodon idella*), Silver carp (*Hypophthalmichthys molitrix*) Brown trout (*Salmo trutta fario*), and Rainbow trout (*Salmo gairdneri gairdneri*). For mosquito control *Gambusia affinis* and guppy *Poecilia reticulata* were introduced. There have been some unauthorized introductions such as big head (*Aristichthys nobilis*), African catfish (*Clarius gariepinus*), Nile tilapia (*Oreochromis niloticus*), Red piranha (*Serrasalmus nattereri*) and Tilapia (*Oreochromis* sp.)

In Himachal Pradesh, a number of fish species have either been transferred from the plains or imported from other hill States. Trout (both rainbow and brown), were introduced in Himachal waters during the first decade of the twentieth century. Eyed ova were imported from Kashmir and stocked in Kullu, Chamba, Mandi, Kangra and Pabar valleys. Both the species, however, established well in Himachal water and played a positive role in development of recreational fishery in the State. Mirror carp, a variety of common carp (German strain) was

brought from Bhowali hatchery (U.P.) and transplanted first in Pucca Tank, Nahan. Though established in the shortest possible time, the fish gained notoriety in view of its habit of rooting around in the bottom and reputation of muddying the water it inhabited. In view of prolific breeding, the fish, off late, has become a menace in some of the State's lakes viz. Rewalsar, Parashar, Dal lake, etc. Carp introduction has increased the production level of Gobind Sagar reservoir but the fish is often blamed for reduction of Indian major carp's population in the water body in view of its competition for food with *Catla catla*. Competition is not limited to trophic interactions but also to such other ecological limiting factors as breeding space, feeding grounds, etc. Prolific breeding rate and aggressive behavior on the part of the introduced species also affects the abundance and distribution pattern of the native fish.

### 3.1.5 District wise status of fisheries

Bilaspur: Bilaspur district with its net work of rivers and streams has vast potential for the development of riverine fisheries. These rivers and streams are rich in fish fauna. Gobind Sagar Lake with an area of 16,000 hectares and various other khads provide vast breeding place for fish in the district. This lake has great potential for developing pisciculture. Important fishing grounds along the river Sutlej are Bilaspur, Dehar, Auhar, Berighat, Serimatla and Gah. Besides Govind Sagar, fishing is also carried out along Sir Khad, Alikhad, Gambhar and Gambhrola streams. Fishing is allowed only under a license which can be obtained for a period of a year or month or a week.

For the ousters of dam and other weaker sections, a scheme was launched for encouraging them to adopt fishing as a profession. About 1500 families living on the side of the Govind Sagar are engaged in fishing activity. In order to improve the quality of fish products, improved variety seeds have been released into the Gobind Sagar. Mostly the fish

found in Gobind Sagar are Katla, Rohu, Mirgal, Singhara, Silver Carp, Mahashir, Gid, Bata, Grass Carp, Kalwasu etc. The production of fish from the Govind Sagar was 4243 metric tonnes during the years from 1997-98 to 2000-2001 and valued at `9.30 Crores. The State Government got `139.63 lakhs in the form of royalty. Indian major carp and gold fish are being produced successfully.

A mirror carp hatchery was set up at Deoli 14 kms. on the bank of Ali Khad by the State Government. Besides, mirror Carp fingerlings are exported to other places out side Himachal Pradesh. The main function of this hatchery is to keep up a constant supply of fingerlings to Gobind Sagar Lake and other streams as well as to the farmers for development of pond fisheries. Fish seedlings are released into Gobind Sagar from this farm directly from nursery ponds and breeding tanks through common releasing channels into Ali Khad which ultimately feeds Gobind Sagar. This method of releasing the fingerlings into lakes and rivers reduce the mortality which would have occurred in transportation.

**Chamba:** A small quantity of fish is caught in the Ravi river near Chamba by the occupational fishermen, after obtaining a license from the District Fishery Officer, Chamba district. During the year 1998-99, 304 licenses were issued to the fishermen in the district and the total fish production was 229 metric tonnes, whose approximate value was ` 91.58 lakhs. The khads and nallahs of Bhattiyat tehsil yield some fish catch. At Sarol Tank, fish is kept for breeding purposes and for distribution. The species of fish found in the district are Tor putitora (Mahsir), Labeo dero (Gid), Labeo dyocheilus (Kunil), Barilius bendelisis (Patha), Gara lamta (Kurta) and Oreinus sinuatus (Himalayan Barbal).

**Hamirpur:** Hamirpur district has limited inland sources of water like river, rivulets, ponds and tanks. Main river of the district is Beas, which runs along the boundary of district Kangra and

covers about 45 kms. of length of running water in the district from Sachuhi to Chamukhas. Two rivulets namely Kunah khad (37 kms.) and Man khad (40 kms.) are the main tributaries of the Beas. The fisheries of district Hamirpur comprise natural fish fauna, inhabiting in the river and its two main tributaries and other streams, which are Tor putitora (Mahseer), Gulguli, Gid kalbans, Bam, Sal, Malhi, Singhara, Singhi, Kunhi and Mori. The major schemes under fisheries in order to uplift the economic conditions of the people in the district relate to management and development of riverine fisheries and pond fisheries. These schemes aim at increasing the output of better quality of fish in the rural areas of the district.

The local Panchayats also auction the panchayat ponds to the fishermen which are a source of revenue. During the year 1998-99, there were 219 registered fishermen in the district with a fish catch of 318 metric tonnes.

**Kangra:** Kangra district is traversed by 500 – 600 kms. of rivers and streams which form major riverine fisheries resources for the rural masses and fishermen. These fishermen get licences at very nominal rates and in return catch fish throughout the year barring two months from 15th June to 15th August which is recognized as the breeding season of the fish. Kangra district has about 400 hectares in the shape of rural ponds. The fish breeding farm is situated in Kangra town to meet the demand of the fish seed. There is about 40-50 kms. river stretches in river Boher, Neryal and Binwa where the propagation of trout fish seed is done. A National fish seed farm has been established in the village Meelavan in Indora tehsil of the district.

There is a vast man-made lake in the district known as Pong Reservoir which has been formed by constructing a dam on river Beas in the year 1974. It has a total area of 24,629 hectares. The Pong reservoir is predominantly a catch fish reservoir. The success of the reservoir

is mainly attributed to strict observance of fishing rules and initiation of number of fishermen welfare scheme. The number of Co-operative Societies operating in this reservoir was 13 during the year of 1997-98. The fishermen belong to the weaker sections of the society. They have been benefitted by forming co-operative society

**Kinnaur:** There is a vast network of perennial rivers, streams and khads in the district which offer a great scope for the development of fish culture. The Fisheries Department has established a Trout Farm at Sangla in 1961-62 for incubating the trout eggs which were brought here from Barot Fish farm in Mandi district. During the year 1999-2000, the production of fish was 17.5 metric tonnes valuing 17.5 lacs. The registered fishermen and licence holders were 39 in the district.

The State Government and the Government of India had not only increased substantially the subsidy component being paid to the beneficiaries under the on going 'Fish Farming Development schemes, but also initiated a number of new schemes. The beneficiary now is entitled for financial assistance of `40,000/- per hectare for pond construction, 20,000/- per hectare for pond renovation, ` 6000/- per hectare for the first year inputs, `4,000/- per unit under running water fish culture, ` 16,000/- per hectare under integrated fish farming, `12,500/- for purchase of aerator and pumps and `5.00 lacs for setting fish feed unit etc.

**Kullu:** Most of the habitation in Kullu district is found in the interior valleys having rivers, streams and nallahs which provide ample scope for development of pisciculture in the district. The main source of these rivers/streams and nallahs are perennial snow covered peaks of inner Himalayas. The crystal clear water of these rivers containing lots of minerals is most favourable for the growth of fisheries. The most favoured fish is trout which was introduced in this district as way back in 1909. Since then this variety of fish has spread to larger areas in the main river Beas and its tributaries. During the

year 2000-2001, the production of trout fish has increased by 34% and 21% increases in reservoir fish.

A hatchery was set up at Chhaki Nallah near Naggar at Mahili. Other farms at Sujjain Nallah and Patli Kuhl were also established in the years 1941 and 1943 respectively. These cold water hatcheries of Kullu proved as models not only for the State but for the country as a whole. Ova fisheries are being supplied to other States like Uttar Pradesh, Sikkim, Arunachal Pradesh etc. In addition to trout, Himalayan Barbel and Gurgoli are also found in the river waters of this area.

During the year 1999-2000, there were 212 registered fishermen in the district and the total fish production was 1,699 quintals, whose approximate value was Rupees 84.94 lakhs.

**Mandi:** Mandi district is extensively criss-crossed by perennial streams and khads which provide congenial conditions for development of fisheries. Fishing is allowed under the license system and 614 licenses to fishermen were issued in the district during the year 1998-99. A sum of `178 lakhs has been received from the sale of 414 metric tonnes of fish during the same period. The riverine fishery falls broadly under two categories of trout water and other waters. Exotic trout fish was introduced in the district from Kullu. These species are found in Uhl, Lambadag and Tirthan. The fisheries resources of the rivers are very rich and Mahasheer fish is found in river Sutlej near Dehar and Barbustor, Labeo diplostomus (Gid) Labeo dyocheulous (Kuni) and Oreingus sinuatus (Himalayan Barbel) are found in both the rivers of Beas and Sutlej and their tributaries. A trout hatchery is maintained and is well stocked at Barot on river Uhl. Pandoh, Mandi, Kunkatar, Sandhol, Dehar, Barot, Puin Bridge, Kamand, Bali Chowki and Mangalore are famous for trout fishing. Barot trout farm has a capacity of 20000 fingerlings and attracts 300 to 400 anglers in a year. Efforts are being made to propagate pisciculture in Pandoh reservoir, which is also suitable for propagation

of trout fish. The Sundarnagar barrage has been found suitable for the propagation of mirror carp fish.

**Shimla:** There is a vast network of perennial rivers, streams and khads in the district and there is great scope for the development of fish culture. The main fisheries activities in the district may be divided into three categories namely (i) development of sport fisheries (ii) conservation of riverine fisheries & (iii) development of pond fisheries in rural areas. The Pabbar River provides good trout fishery which is an attraction to the tourists and foreign anglers. For the development of trouts in Pabbar, a trout farm was established at Chirgaon with annual capacity to produce 0.5 lakh trout ova. *Schizothorax*, *Tor putitora*, *Salmo trutta fario*, *Salmo gairdinerri* and weedy fish. Fishing in these waters is regulated by fishery legislation under the Himachal Pradesh Fisheries Act, 1976. During the year 1998-1999, total production of fish was 269 metric tonnes in the district and there were 321 registered fishermen associated with this profession. As many as 52 cases of illegal and unauthorised fishing were detected and a sum of ` 6,310 was received from them as fine for unauthorised fishing.

**Sirmaur:** Sirmaur district has been extensively criss- crossed by the rivers and the streams and most of them have perennial water flow. Fishing in the rivers and the streams has been an old activity in the district. It is stated that the rivers Yamuna and Giri were known for their abundance of fish though the other streams were also not far behind. The fishing grounds in Yamuna River are Naoghat and Ganguwal in Paonta Sahib Tehsil where Mullee, Mahseer and Gid varieties of fish are available. Mirror carp was introduced in the pucca tank of Nahan for the first time in 1955 and which has considerably spread. With the result, Himachal Pradesh is one of the big suppliers of this fish to the rest of the country. This variety of fish has been extended to other districts also where the fingerlings have been distributed.

The major attempt for fishing activity in the district has been the management of riverine fisheries resources extending over 250 kms. River/stream length of Yamuna river is 35 kms, the Giri river 90 kms., the Bata river 30 kms. and other rivulets and seasonal rivulets 100 kms. Through effective enforcement of legislation, restricting fishing to the maximum sustained yield only has been achieved. The fishing in Renuka Lake and certain areas in Yamuna River have been prohibited under the Fishing Act. Around 700 to 800 fishermen earn their livelihood by fishing. During 1999-2000, there were 737 registered fishermen in the district who had estimated a yield of 804 metric tonnes of fish of the value of about `18, 400, 000/-. The Fisheries Department had detected 94 offences of unauthorized fishing and received a sum of `15, 055/- as fines from them during the year 1999-2000. There are about 50 hectares of watersheds scattered all over the district. Some of the panchayats took up fish culture in about 15 hectares of water sheds, but due to lack of personal interest, benefits have been insignificant. However, with the multiplication of water supply schemes in the villages and construction of irrigational canals and channels and also adoption of policy by the Government to subsidize pisciculture by individuals to augment their earnings, the development of fisheries appears to be indeed brightening.

**Solan:** About 12,000 fishermen families in the State depend directly or indirectly on this occupation and earn their livelihood by fishing. During 2000-2001, a new trout farm at Holi was commissioned and over 50,000 trout seed produced at this farm was stocked in river Ravi and its tributaries. With the successful implementation of the Indo Norwegian Trout Farming project, Patli Kuhal, number of new trout farming units has been established in the private sector not only in Kullu but in Mandi, Chamba and Shimla also. In 2001, 34% increase in the trout production and 21% in reservoir fish production has been witnessed in the State. During 2000-2001, about 4450 tonnes of fish and 23 million fish seed was produced upto December, 2000 and 9000

licensed fishermen were registered. The existing fishery resources of the Solan district are in the shape of village ponds, hilly streams, khuds, marshes and reservoirs. There is no major river, pond or lake in the district, hence, very little scope has been left for natural fish. There is a hatchery and fish breeding farm at Jagat Khana near Nalagarh. The Fisheries Department provides subsidy for development and running of pond fisheries. The FFDA programme is also being implemented. The rivulets and streams which flow in the district are Gambhar, Giri, Chikni and Kuni. The fishermen are provided with the fish seedlings from the Gobind Sagar. Though the farm is providing fish seedlings but it is unable cope up with the full demand. In order to meet this exigency, 20 nursery tanks and one hatchery is coming up; on completion it will provide and distribute twenty lakhs fish seedlings of Indian major carp fish.

At the end of year 1999-2000, there were 259 licensed fishermen registered in the district. 179 MT of fish was produced at the approximate value of ` 71, 45, 000/- during that year. Number of fishing offences detected was 25 and compensation of ` 4320/- was realised from the offenders. The scientific studies indicate that there are approximately 98 species of endemic and exotic species thriving in the waters of the district. These species include Indian major and minor carps, cat fish, Cobitidae and Mahseer.

**Una:** Una is a foothill district and is not drained by the perennial rivers/khads. The natural fishing grounds inside the district are almost absent. The natural fisheries resources of this district comprise a portion of Govind Sagar reservoir falling in the district. Lunkar Khad spread from Dumkhar to Bhakra from where considerable fish production is achieved. There are about 130 seasonal and perennial ponds measuring about 65 hectares in the district.

The Fish Farming Development Agency is providing the facilities of seed production, rearing and distribution. Fisheries Co-operative

Societies i.e. Lathiani, Kutlehar and Mandi are engaged in fishing from Govind Sagar. For providing some remunerative employment to the Scheduled Castes, educated unemployed, small and marginal farmers, the Government of Himachal Pradesh has started some intensive programme for development of fish culture in the State. The Fishery Department has provided gillnets, boats and tents to the fishermen for the development of the fisheries in the district.

### 3.1.6 Convenience fisheries of Himachal Pradesh

The State is blessed with 3 major man-made reservoirs with mean water spread of 26000 ha. The cumulative fish production from these water bodies during 2002-03 was 1580 mt., valued over 4.6 Crores and provided livelihood to over 2200 fishermen families. The fish species found are described in Table 12.

**Table 12: Fish Varieties**

Species	Local Name
<b>Family Notopteridae</b>	
<i>Notopterus chitala</i>	Pari
<i>N. notopterus</i>	Moh
<b>Family Cyprinidae</b>	
<i>Oxygaster bacailia</i>	Parrand
<i>O. clupeoides</i>	Tuk
<i>O.gora</i>	Bunchi
<i>Barilius barila</i>	--
<i>B.bendelisis chedra</i>	Patha
<i>B.modestus</i>	Chilwa
<i>B.vagra</i>	Lohari
<i>B.sbakra</i>	Chilwa
<i>Danio devario</i>	Parrandah
<i>D. rerio</i>	Kangi
<i>Esomus danricus</i>	Makni
<i>Rasbora daniconius</i>	Chindolachal
<i>Amblypharyngodon mola</i>	Mukni
<i>Aspidoparia morar</i>	Chilwa
<i>Tor putitora</i>	Mahseer chiniaru
<i>Puntius chola</i>	Chidu
<i>P.cbrysopterus</i>	Pottiah
<i>P.chonchonius</i>	Chidu
<i>P.sarana</i>	Khangni
<i>P.stigma</i>	Chidu
<i>P.tetrapagrus</i>	--
<i>P.terio</i>	--
<i>Catla catla</i>	Theila
<i>Cirrhina mrigala</i>	Mori
<i>C.reba</i>	Sunni
<i>Garra gotyla</i>	Kurka
<i>Labeo boga</i>	Morah
<i>L.calbasu</i>	Kalbasu
<i>L.dero</i>	Gid

Species	Local Name
<i>L.dyocheilus</i>	Kunni
<i>L.goniis</i>	--
<i>L.pangusia</i>	--
<i>L.rob ita</i>	Rohi
<i>Oreinus plagiostomus</i>	Goolgali
<i>O.sinuatus</i>	Goolgali
<i>Crossocheilus latius punjabensis</i>	Tiller
Family Cobitidae	
<i>Noemacheilus botia</i>	Sundal
<i>N.botia aeurus</i>	Sunda
<i>N.corica</i>	Talana
<i>N.kangrae</i>	--
<i>Botia birdi</i>	Chipar
<i>Lepidocephalus guntea balgara</i>	Jiwa
Family Siluridae	
<i>Ompak bimaculatus</i>	Pallu
<i>Wallago attu</i>	Mullae
Family Bagridae	
<i>Mystus (Mystus) bleekeri</i>	--
<i>M.(Mystus) vittatus</i>	Kingra
<i>M.(Osteobagrus) seengbala</i>	Singhara
<i>Rita rita (Hamilton)</i>	Khagga
Family Amblycipitidae	
<i>Amblyceps mangois</i>	Sundal
Family Sisoridae	
<i>Glyptothorax conirostris</i>	Nao
<i>G.pectinopterus</i>	Mochi nao.
<i>G.stoliczkae</i>	Naiya
Family Schilbeidae	
<i>Clupisoma garua</i>	Bachwa
Family Belontiidae	
<i>Xenentodon cancila</i>	Takla
Family Mugilidae	
<i>Mugil cascasia</i>	Buah
Family Channidae	
<i>Channa gabau</i>	Dauli
<i>C.marulius</i>	Saul
<i>C.punctatus</i>	Daula
Family Anabantidae	
<i>Colisa fasciata</i>	Chidu
Family Mastocembelidae	
<i>Mastacembalus armatus</i>	Bami

### 3.1.7 Reservoirs

The major water bodies so created are Gobind Sagar, Pong and Chamera. Besides these, many more small projects are continuously being added to the already existing ones. Though the small water bodies due to their draw down character are highly difficult to harness, the major reservoirs are developed to this stage by adopting three pronged strategy comprising of selection of appropriate mesh size of fishing gear, increased fishing efforts and stocking support by suitable varieties. Gobind Sagar has recorded fish production from a meager 25kgs/ha to as high as 120 kgs/ha. Due to

increased productivity, the fishing operation has become remunerative enough to sustain these fishermen.

Gobind Sagar and Pong of Himachal Pradesh with mean water spread of 25,000 ha constitute an important fishery resource of the State. The developments of fisheries on scientific lines in these ecotones have shown its tremendous potential for food production and generating employment. In view of series of management measures taken up by the State Fisheries Department, a total of 30,668.79 tonnes of fish valued ` 7021 lakhs was harvested from these two impoundments during (1985-86 to 2009). This has also helped in providing viable vocation to over 5,000 fishermen families, constituting about 20% of the dam's oustees on a sustained basis. The State Government too, realised an income of ` 1357.6 lakhs by way of royalty, fee and fines etc. in view of fishing activities. During 2008-09 alone, a total of 1314.79 tonnes of fish valued at ` 643.12 lakhs was harvested by 3586 fishermen from Gobind Sagar & Pong Reservoirs. The department's income during a single year alone (2008-09) was ` 104.93 lakhs.

Further, while Gobind Sagar is maintaining a unique distinction of highest per ha fish production (over 48 to 100 kgs/ha.) for over one decade, the Pong Reservoir fishermen are getting highest per unit price of their catch at landing sites (^ 41-83/ kg.) in the country. In view of these two characteristic features, while the fishermen of Gobind Sagar have benefitted by continuous increase in total catch over the years, the fishermen of Pong reservoir got benefitted by steep increase in the price of the harvest. The fish fauna of both these water bodies differ widely, while Gobind Sagar is exclusively carp reservoir, the Pong Reservoir is predominantly a catfish reservoir.



**3.1.7.1 Gobind Sagar Reservoir:** Built due to damming of river Sutlej, the Gobind Sagar Reservoir came into existence during mid sixties. The pristine streams of river Sutlej harboured 51 species of fish including exotic trout, snow trout and several species of hill stream fish. Mostly these species were unique due to sub-temperate climate and the zoogeographical affiliation to the Himalayan region. The upper reaches of Sutlej and its tributaries were particularly rich in *Tor putitora*, *Labeo dyocheilus*, *L. dero* and *Schizothorax* species. The available species belong to nine families.

**Fish Stock Composition:** Family Cyprinidae: *Barilius bendelisis*, *B.vagra*, *B.barila*, *B.modestus*, *Oxygaster bacaila*, *Rasbora daniconius*, *Carassius auratus*, *Cirrhinus reba*, *C. mrigala*, *Crossocheilus latius*, *Catla catla*, *Labeo dero*, *L. dyocheilus*, *L. bata*, *L. calbasu*, *L. rohita*, *Cyprinus carpio* var. *communis*, *C. carpio* var. *nudus*, *C. carpio* var. *specularis*, *Schizothorax richardsonii*, *S.plagiostomius*, *Ctenopharyngodonidella*, *Hypophthalmichthys molitrix*, *Tor putitora*, *Garra gotyla gotyla*, *G. lamta*, *Puntius sarana*, *P. ticto*, *P. chola* and *P. sophore*.

- Family Cobitidae: *dario*, *B. birdi*, *B. lobachata*, *Nemacheilus botia*, *N. rupicola*, *N. monatanus*, *N. kangrae* and *N. borai*.
- Family Bagridae: *Mystus seenghala* and *M. aor*.
- Family Schilbeidae: *Clupisoma garua*
- Family Sisoridae: *Glyptothorax pectinopterus* and *G. cavia*
- Family Belontiidae: *Xenentodon cancila*
- Family Ophiocephalidae: *Channa gachua* and *C. punctatus*

- Family Mastocembelidae: *Mastacembelus armatus armatus*
- Family Salmonidae: *Salmo trutta fario*

The following are the commercially important fish in order of their abundance: *Hypophthalmichthys molitrix*, *Cyprinus carpio* var. *specularis*, *C. catla*, *Tor putitora*, *Labeo rohita*, *Labeo dero*, *L. calbasu*, *L. bata*, *L. dyocheilus*, *Cirrhinus mrigala*, *Wallago attu* and *Mystus seenghala*.

**A) Indigenous Carps:** A perusal of indigenous carp composition from 74-75 till date indicate that their proportion increased till 78-79 where after it declined each year barring *Catla catla* which showed some increase. The percentage of indigenous carps during 97-98 was 7% only. All the four Indian major carps viz. *Labeo rohita*, *C. mrigala*, *C. catla* and *L. calbasu* are present in the reservoir. *L. rohita* a commercially highly valued fish has undergone a steep decline in the catches since 1980-81 and for the last 12 years (1995-96 to 2006-07) maintaining a low profile range from 4-7 tonnes each year. *C. mrigala* too has suffered the same fate and is contributing 1-4 tonnes for the last 12 years. *L. calbasu* however, never got established in the reservoir and quantitatively ranged between 1-2 tonnes each year. *Catla catla* has virtually maintained a steady position in the reservoir. While during 1986-87, 20 tonnes of *C. catla* was harvested from the reservoir, the production during 2004-05 was 76 tonnes accounting an increase of 288%. The yearly average during the last 23 years was 69 tonnes. *L. rohita* has shown production of 3.46 tonnes during 2009-10 as an impact of stocking.

**B) Minor Carps:** The minor carps in the reservoir are represented mainly by hill stream species *Labeo dero*, *L. dyocheilus*, *L. bata*, *C. reba* and *Puntius sarana*. The

percentage composition of these fish increased in the reservoir till 1982 and thereafter they started to decline. The catches during 1995-96 to date ranged between 3-4 tonnes per year which is virtually insignificant.

**C) Exotic Carps:** The three Chinese Carps viz, Silver carp, Grass carp and Common carps constitute the exotic fauna of the reservoir. The cumulative percentage of these three carps has increased from 17.4% to 88.3% from 1976-77 to 2009-10 with silver carp alone contributing as high as 48% of the total production during 2006-07. In terms of weightage, exotic carp production was 963.36 out of the total production of 1090.89 tonnes. Silver carp got an inadvertent entry in the reservoir during 1971 by inundation of one of the fish farms of the Fisheries Department when 47 Silver carp specimens ranging from 290-530 mm were washed out. The species started appearing in the catches during 1997-98. During 1977, there was a substantial catch of 10 tonnes of silver carp, although this accounted only 1.4% of the total reservoir landings. In view of congenial water qualities, wide feeding spectrum and high fecundity, silver carp continued to proliferate and during 2004-05, the landing reached to a level of 1023 tonnes. The maximum landing was recorded from lentic sector of the reservoir where the water was comparatively warm. The grass carp, however failed to establish in the reservoir presumably due to absence of weeds and the productivity ranged between 6-11 tonnes which is the highest so far only during 2001-02 to 2009-10. The total production of silver carp during 2009-10 was 737 tonnes.

Mirror carp contributed significantly among the fish catches of Gobind Sagar. This fish has established well as indicated by its composition in the total landing. Regular stocking is being carried out by the Fisheries Department for

sustained production of the species. However, being bereft of weeds, which serve as substrate for stocking of mirror carp eggs, auto stocking has not been observed in the reservoir. The landing of mirror carp ranged from 51 to 215.33 tonnes from 1982-83 to 2009-10. During 2008-09, the landings were of the order of 189 tonnes and during 2009-10 the landings were of the order of 215.33 tonnes.

**D) Carnivore Fish:** The major carnivore fish encountered in Gobind Sagar reservoir are Mahseer ( *Tor putitora*) and *Mystus seenghala*. During the last 10 years, the cumulative percentage ranged from 2.4 % to 6.2%. The highly voracious *M. seenghala* has kept a low profile in the catches as reflected in catch structure. The low proportion of catfish has indeed helped in fast propagation of carps despite the absence of ideal habitat for spawning. *T. putitora* which used to dominate fishery of Sutlej river prior to impoundment has markedly declined. The catches have fluctuated between 8 to 46 tonnes, the lowest (8 tonnes) during 2001-02. The landing of these species during 2009-10 was recorded at 13 tonnes. The major factors attributed to decline in mahseer catches are (i) denial of migration for breeding, (ii) large scale killing of juvenile specimens and (iii) absence of insects and weed fauna in water body which forms the preferred food of mahseer. However, the Fisheries Department has taken action by amending the Fisheries Act and raising the allowable size for catching fish from 30 cm to 50 cm., so that specimen over one kg could only be caught.

**E) Average size of major species:** A review of the fluctuation of major species being caught in the reservoir for the last 27 years (1982-83 to 2009-10) indicate that among carps, the average size of *Labeo rohita*, *Catla catla*, *Cirrhinus mrigala* and *Labeo calbasu* has ranged from 1.2 to 5.1, 3.5 to 11.00, 1.2 to 2.6 and 0.6 to 1.23 kgs. While

in 2009-10 it is 1.93, 2.32, 1.37 and 0.8kg. respectively. During 2006-07, the average size respectively of these was 1.50, 7.2, 1.42 and 1.23 kgs. Among exotic carps the average size of Silver carp and Mirror carp ranged between 3.20 to 9.6 and 0.9 to 2.70 respectively for the same period. Silver carp despite 101% decrease in landing during the last five years 2002-03 to 2006-07 is maintaining a steady average size of 3.2 to 3.95 kgs. Similarly the catches and average size of mirror carp have increased by 30% in the reservoir in the last five years averaging 0.7 to 1.04 kgs. respectively. As far as carnivores are concerned, *Mystus seenghala* ranged between 9-12 tonnes while their average ranged to 1.2 kgs. In case of Mahseer the average size has varied within ranges of 0.6 to 1.8 kgs. for the last ten years (1996-97-to 2009-10). During 2009-10 production has gone up to 13.63 tonnes.

**F) Fish Yield Catch Efforts:** The fish yield from reservoir has ranged from 37.7 to 120 kgs/ha for the last 32 years (1976-77 to 2009-10). The highest was recorded during 2002-03 (1202 tonnes) while lowest during 1986-87 (377 tonnes). In fact starting from 1986-87 when an all time low landings were recorded; there is a constant rise in production each year reaching to a level of 1202 tonnes during 2002-03. The major reason attributed to persistent increase in catches are strict conservation, imposition of closed season, providing better quality subsidized nets to fishermen and initiation of fishermen welfare schemes. But during the last four years (2003-2007) construction of Koldam on Sutlej river and fluctuation in full reservoir level (F.R.L.) reduced value of water in the rivers joining reservoir and heavy siltation are possibly the causes for the decrease in fish production from the reservoir. Due to concerted efforts of Fisheries Department during the year 2009-10, the fish production of Gobind Sagar reservoir has been recorded at 1090.89 the highest in the last five years.

**G) Species Introduction:** Prior to construction of dam, the cold water of upper reaches of river Sutlej used to harbour 51 species of fish of which *T. putitora*, *L. dero*, *L. dyocheilus* and *Schizotharacids* were dominant. The main question which confronted the policy makers during early stages of fisheries development in the impoundment was whether the resident indigenous species of Sutlej would be able to effectively populate in the lacustrine condition of the reservoir or whether new species are to be stocked to utilize the new habitat.

It was a general consensus among the limnologists that none of the indigenous rheophilic species would be able to offer viable commercial fishery and it was recommended that the reservoir should be stocked with Indian and exotic carps. Taking this into consideration, the State Fisheries Department stocked 3500 gravid spawners and 0.5 million fingerlings of Indian major carps which established themselves in the reservoir and started breeding. The stocking in subsequent years continued mainly with mirror carp seed. A number of fish farms were set up in the State for this purpose with the main goal of producing the seed and their transplantation in the reservoir.

**H) Fishermen and their organisation:** At present there are 3881 fishermen recruited from 5500 oustees settled near the reservoir. This accounts for approximately 25% of the total fishermen population. Prior to the impoundment, a subsistence fishery of inconsequential nature existed in the rivers and streams. With the formation of the reservoir, the lucrative fishery started attracting a large number of fishermen and other oustees who lost their property with the emergence of the reservoir. The local fishermen who used to fish in shallow rivers and streams with primitive gears found

them ineffective in the deeper waters of the reservoir. The Fisheries Department then initiated training in the use of deep water fishing gear and boats. The income of the fishermen operating in the reservoir inspired other outcasts of various communities to adopt fishing as a profession and by 1978 the total number of fishermen reached 1280. Besides direct employment to approximately 1000 families, the State provided livelihood to about 1000 additional families engaged in helping the fishermen carrying/ transportation, packing of fish, fishing crafts/ gears, repair, sale of fish etc.

The fishermen of Gobind Sagar are full time licensed fishermen and member of Co-operative Societies and have their own boats. About, 40% of the fishermen have some education. The monthly income ranges from ` 800 to ` 3000. On an average, each fisherman has one boat, usually of the size 16ft x 3ft x 2ft, costing approximately ` 20,000. The fishermen use mainly nylon gill nets. Each fisherman has on an average 3-4 gill net of 100 to 140 mm mesh size which lasts for about 1-2 years.

### **3.1.7.2 Pong Reservoir**

An impoundment across river Beas, the Pong Reservoir with a catchment area of 1256 sq. kms. and mean water spread of 15662 ha. came into existence during 1974. Trial fishing was resorted by the Fisheries Department soon after its filling but during initial years the catches were dominated by rheophilic species belonging to family *Salmonidae*, *Cyprinidae*, *Gobitidae*, *Sisoridae* etc. However, due to tremendous biogenic capacity of the reservoir and systemic seed stocking, undertaken by the Fisheries Department, over a number of years with Indian carps and mirror carps, the catch structure of the reservoir was altered and carps started accounting as high as 50-60% of the catches. During 1987-88 per ha yield of the reservoir also touched a level 53 kgs/ha with cat fish, and carps accounting 70% and 30% in the landing. The limnological studies of the reservoir have

shown a positive curvilinear relationship between standing crop and total alkalinity. The hypsographic curves indicated inverse relationship between volume of water and fish production.

As stated, the commercial fishing in the reservoir was initiated soon after its emergence. The total catch during 1976-77, the first year of fishing operation was 98 tonnes and increased progressively attaining a peak of 797 tonnes during 1987-88, fluctuating within a narrow range of 486-596 tonnes. During 1988, the incessant rains and floods forced the dam authorities to open flood gates which caused large scale escape of fish from the water body, obviously affecting the landing in the subsequent years. Subsequently, the influx of migratory birds to the reservoir also increased. The reservoir has been declared International Wetland at Ramsar Site. On an average, 1,50,000 migratory birds are now visiting the reservoir every year for their winter sojourn. Many families of the birds have become permanent residents of the reservoir due to adequate food & shelter. Approximately 40% of these winged visitors are fish eaters; some of them like black cormorants are the voracious fish eaters. This has reduced the carp fish population in the reservoirs. The reservoir catches are now dominated with catfish like Singhara and the catches have plummeted to 421.48 tonnes during 2009-10. Most of the carp seed being stocked by the Fisheries Department in this water is being used as food either by aquatic birds or catfish.

**Fish Stock Composition:** A total of 27 species (sub-species, varieties) belonging to six families have been encountered in the Pong reservoir.

- Family Cyprinidae: *Barilius bendelisis*, *B. vagra*, *Cirrhina mrigala*, *Crossocheilus latius*, *Catla catla*, *Labeo dero*, *L. bata*, *L. rohita*, *Cyprinus carpio*, *Schizothorax richardsonii*, *Tor putitora*, *Puntius sarana* & *P. ticto*.

- Family Cobitidae: *Botia birdi*, *Nemacheilus kangrae*.
- Family Bagridae: *Mystus seenghala*, *M. aor* & *Bagarius bagarius*.
- Family Siluridae: *Wallago attu*
- Family Sisoridae: *Glyptothorax pectinopterus* & *G. garhwali*.
- Family Belonidae: *Xenentodon cancila*.
- Family Ophiocephalidae: *Channa marulius*, *C. cephalus*, *C. striatus*.
- Family Mastacembelidae: *Mastacembelus armatus armatus*.

**Qualitative and Quantitative fluctuations:** A perusal of indigenous carp composition in the total catches from 1976-77 to 1997-98 indicate that they dominated over carp fish till 1991-92 where after catfish virtually left the ground. During 1991-92, the carps viz. *Labeo rohita*, *Catla catla*, *Cirrhina mrigala*, *L. calbasu* accounted 46.3% (225 tonnes) of the total catches while cat fish viz. *M. seenghala*, *Wallago attu* accounted 37.9% (60 tonnes) and other 2.4 % (12 tonnes). Against this, during 2009-10, the percentage composition of indigenous carps, cat fish, mirror carp, mahseer and others was 25.4% (107 tonnes), 58% (246 tonnes), 5.9% (24 tonnes), 9% (38.31 tonnes), 1.08% (4.58 tonnes) respectively.

Among the Indian major carps, *Labeo rohita* is the dominant fish encountered in the reservoir. The highest catch (491 tonnes) of IMC fish was encountered during 1987-88. In the last six years 2001-02 to 2007-08, the catches have fluctuated from 32-73 tonnes. During 2007-08, the landing of *L. rohita* was 10 tonnes. *C. catla* has always kept a low profile in the reservoir. The maximum (34 tonnes) were encountered during 1994-95. The catches during 2006-07 were 2.6 tonnes. *Cirrhina mrigala* has suffered a marginal decline. The highest catches (77 tonnes) of *C. mrigala* ranged from 1-5 Kgs. *L. calbasu* too used to account significantly in the reservoir during the eighties, the highest being 85 tonnes during 1982-83 and 0.416 during 2009-10.

Pong reservoir may be categorized as a *Mystus seenghala* reservoir. *Mystus seenghala* is showing constant increase during the last 10 years. The highest catch (324 tonnes) was recorded during 2005-06 accounting for 75.52% of the total catch. During 2009-10, fish catch of *M. seenghala* was recorded as highest as 58.3 % i.e. 246 tonnes. *Wallago attu*, however, has suffered a decline as its presence in the catches remained nil during 2007-08.

Mirror carp composition is quite erratic in the reservoir presumably due to the fact that ideal breeding grounds are non-existent in the water body. However, regular stocking has helped in the revival of mirror carp fishery and there is a progressive increase in its composition and from an all time low of two tonnes during 1992-93, the catches have increased to 39 tonnes during 2004. During the year 2009-10 the mirror carp catches have been recorded as 38 tonnes i.e. 9%.

Mahseer is a highly precious and sought after fish of the Pong reservoir. It's probably the only reservoir in the country which provides the opportunity of mahseer angling. The catches of mahseer in the reservoir have shown a remarkable consistency and landings have fluctuated between 30-39 tonnes. The highest catches of mahseer (102 tonnes) were recorded during 1982-83. During 2009-10 total landing of mahseer were 38 tonnes i.e. 9%.

**Average Size of major species:** An analysis of data during 1983-84 to 2006-07 indicates that average size of all species of Indian major carps have progressively increased in the water body. *Labeo rohita*, the principal fish has registered an increase of 1.4 to 7.27 kgs, the average during last 3 years being 3.68 kgs. In 2009-10 the average size of marigal & calborn are 1.66 & 1.41kg. *Catla* catches are more pronounced, the average size being 18.86 kgs. *Cirrhina mrigala* and *L. calbasu*, too have registered increase in average size and the respective figures in terms of average size during 2003-04 to 2006-07 were 1.55 & 2.51 kgs respectively. Mirror carp however has shown a steep decline

in average size during the last few years. This may be attributed to a spurt in catches, while during 1995-96, the total landing of mirror carp was three tonnes with average weight of 1.6 kgs. This has been the result of intensive stocking of this species. Mahseer has kept a steady profile in terms of average size in the reservoirs. The average size has ranged between 1.2 to 1.6 kgs while the total landings have fluctuated between 10 to 102 tonnes during 1995-96 to 2008-09 and the average size of mahseer was 1.3 kgs. The average size of another species encountered in the reservoirs viz. *Labeo dero*, *Wallago attu*, *Channa spp.* were 0.4, 4.3 & 1.8 kgs. respectively.

**Fish Yield Catch Efforts:** An analysis of production figures for the last 28 years indicates that there is consistency in the yield rate, which works out to 30 kgs/ha. the yield ranged between 6 to 53 kgs /ha. the average yield during 2009-10 was 26.34 kg/ha.

**Revenue:** While the fish landings of Pong reservoir have shown a consistency during the last two decades, the value of fish caught has increased significantly mainly attributed to the quality of the catch. The value of fish caught increased from 5.18 to 267.42 lakhs. During 1995-96, the average value of fish catch was 154 lakhs. During 2009-10, fish worth 369.20 lakhs was harvested from the reservoir. The revenue of Fisheries Department recorded during 2009-10 was 63.18 lakhs & the respective contribution by royalty license fee & fines etc. was 87.6%, 3.2% & 3.10% respectively.

**Seed Stocking:** Prior to the construction and completion of the reservoir, detailed study on ecology and fisheries of river Beas was not done. *Oreinus sinnatus*, *S. richardsonii* & *Glyptosternum striatus* are three major fish of river Beas from Beas kund to Largi-a stretch of approximately 150 Km. *Tor putitora*, *Schizothorax richardsonii*, *Labeo dero* & *Wallago attu* are found in Beas river. The creation of the reservoir while at one hand has

created perennial sources of water body but on the other hand certain migratory species started competing to retain their position in the ecosystem. These are three most important Golden mahseer (*Tor putitora*) Snow trout (*Schizothorax richardsonii*) & *Labeo dero*. The mahseer which had its migratory run up to Sultanpur near Kullu has disappeared in this area after the construction of the Pandoh Dam. The other affected species are *S. richardsonii* & *L. dero*. While the former could not establish in the new environment but the latter is struggling to retain its progeny in the reservoir.

The stocking programmes in Pong reservoir were initiated during 1974-75 when the first consignment of 1.30 lakhs fry of mirror carp was released. Since then a regular stocking programme has been undertaken. Stocking has been mainly confined to the seed of mirror carp and Indian major carp, *Labeo rohita*, *Catla catla* and *Cirrhinus mrigala*. The seed of other species e.g. *Tor putitora*, *Schizothorax spp.* and *L. dero* could not be made available due to absence of any large scale seed production technologies. The State Department of Fisheries has set up an improvised fish seed farm located near the reservoir site namely Kangra, Deoli, Nalagarh, Sultanpur and Alsu. Seed stocking is being done with a seed size more than 40 mm. After completion of construction work of the envisaged Mahseer farm in Mandi district, it is hoped that reservoir shall be able to receive regular supply of mahseer seed.

**Reservoir Management:** With a view to enforce effective management and formulate a concerted approach of fisheries development in the reservoirs, a State level 'Reservoir Development Committee' was set up during 1976. As a first step, it was decided to bring all fishermen under a cooperative fold and only a member of the Co-operative Societies would be permitted to operate nets in the water body. Three Societies with the total membership of 303 fishermen were registered during 1976. By 2009-10, the number of societies increased to 15 with membership of 2825 fishermen. No

license fees was charged from the fishermen till 1981-82, but later an annual license fee of ` 50% was levied on each gill net of 80 m. length. The Fisheries Department also charges 15 % royalty on the price of the fish caught by each fisherman.

For sale of fish, the practice of appointing contractors by open auctioning at the beginning of each year was started. The fish caught by the fishermen are required to be brought to the fixed landing centres (15 in all). The representatives of the contractors receive the fish at the fixed landing centres while the Fisheries Departmental staff charges the royalty and record the quantity of the catch species wise. The contractors make weekly payment to the societies besides keeping a lump sum or fixed deposit to be confiscated in the eventuality of any default. The societies make the payment to fishermen after deducting a marginal commission (5.0 to 7.0%) which varies between societies and fixed each year in the general meeting of the societies. To avoid conflict between the societies regarding the area of operation, the reservoir is divided into eight beats demarcated on the basis of area and productivity of water body apportioned for each society. Fishermen who are members of the co- operative societies are issued annual license through the cooperative societies by the respective fisheries' officers of the landing centres at the beginning of each year.

**Fishermen and their organisation:** There are 15 fishermen co-operative societies in the reservoir. There are 2825 active fishermen recruited from 4000 oustees settled near the reservoir. This accounts for about 30.4% of the total population of reservoir fishermen. Prior to the impoundment of the river Beas, a subsistence fishery of inconsequential nature existed in the river and adjoining streams and the average catch hardly exceeded 2 to 4 kgs. fishermen per day, but with the formation of the reservoir, a lucrative fishery started attracting large number of fishermen and the oustees who had no other viable means of

livelihood. The Fisheries Department initiated training courses for operating gears in the deeper waters for fishermen. This, however, inspired large number of oustees of various communities to adopt fishing as a profession. Besides direct employment to over 2014 fishermen, the fishing activities provide indirect jobs to over 1000 families engaged in helping fishermen, carrying/ transportation, packing of fish, weaving and mending of gears, marketing etc.

The fishermen in Pong are mostly full time fishermen. On an average, 30% of the fishermen have education up to primary level. The monthly income ranges from ` 500-1200/- per month. On an average, each fishermen has one boat, usually of the size of 5.0x 1.0x 0.7m, costing approximately ` 30,000/-. The fishermen normally use gill nets and each one has, on an average 3-4 nets of 80.0m x 8.0m of length and varying from 80-140 mm mesh size. The minimum allowable mesh sizes for economically important species are fixed by the Fisheries Department. Assuring highest prices of their product to the fishermen is one of the major concerns of the Fisheries Department. The efforts made on these lines help the fishermen to ensure maximum price of their catch.

The Fisheries Department has initiated a number of welfare schemes for the benefit of fishermen. 50% subsidy is provided by the Fisheries Department to a maximum of ` 3000 for the purchase of fishing gear and craft and tents. The Fisheries Department also arranges procurement of these equipments to meet the needs of the users. A Personal Accident Insurance Scheme has been initiated on fee premium of ` 14/- year. In case of accident, the insured person's family gets an amount of ` 100,000. A risk Fund Scheme has also been initiated under which fishermen are compensated to the tune of 33% for losses such as blowing and sinking of boats or nets. Further, during the period of closed season (1st July – to 31st August), a subsistence allowance of ` 400/-

paid by the State Govt. and ` 400/- by the Central Govt. per month is paid under a Relief Scheme. For this, the fishermen have to pay ` 400/- as contribution on equal installments of ` 40 each for ten months of the fishing season.

**Remarks:** The Pong reservoir depicts a classic example of using reservoir for food production and generating employment avenues. Fisheries development in Pong reservoir has helped in settlement and providing livelihood to families displaced due to the impoundment. Though primarily formed for power generation and irrigational purposes, approximately 4178 tonnes of fish valued at ` 1978.69 lakhs was harvested from the reservoir during 1996-97-2006-07. During 2009-10, fish worth ` 369.20 lakhs was harvested from reservoir. Among the positive decisions taken by the management, the most important was to stock the reservoir with seed of Indian major carps. This helped in establishment of *Labeo rohita*, contributing as high as 42.5% during 1989-90. The enactment of State Fisheries Act, 1976 (Act No, 16), enforcement of mesh size regulation, organization of fishermen under the cooperative fold, imposition of closed season, settling of fishermen during the initial stages from outside the State, initiation of fishermen welfare scheme etc., were other well conceived measures which helped in boosting the reservoir's fishery activities and providing vocation to the displaced inhabitants of the reservoir.

The catch spectrum of the reservoir has altered considerably during the course of years. During the initial years, the catch was mainly dominated by *Mystus seenghala*, *Tor putitora*, *Labeo dero*, *Wallago attu*, *Cirrhinus mrigala* and *C. carpio*. While *L. rohita* had considerable degree of success in getting established in the reservoir, the same is not true for other species such as *Catla catla*, *C.mrigala* and *C. carpio*. The probable reasons which attribute to non-establishment of mirror carp are absence of weed in the water body, dominance of predatory fish fauna and browsing habit of the species. The reasons for non-establishment of

*C. mrigala* and *Catla catla* defy explanation and require detailed scientific studies. In the earlier years, after the formation of the reservoir, the dominance of indigenous fishery was more pronounced. During 1982-83, *M. seenghala* was the most dominant fish (28.45%) followed by Mahseer (20.4%) *L. calbasu* (17.0%) *Wallago attu* (7.0%), *C. mrigala* (5.4%), and Mirror carp (5.8%). However, *L. rohita* was far from recognition and it formed hardly 0.4% of the catch.

Subsequently the catch spectrum altered widely owing to the effect of the dam, the establishment of exotic varieties, vagaries of monsoon and fluctuating water level of the reservoir. The stocking of *Labeo rohita* was initiated during 1974-75 and the species soon established, yielded 83.9 tonnes (15.2% by weight) by 1985-86. In 1987-88, the contribution increased to 42.5%. Thereafter, there was a decline in the fishery due to heavy escape of stock. During 2009-10 the catch recorded 35.67 tonnes i.e. 8.4% of the total catch.

A remarkable feature of the reservoir is the establishment of carps despite dominance of carnivores like *Mystus seenghala*, *Wallago attu* and *Tor putitora*. Their cumulative percentage was 55.8% during 1982-83 against 38.5% during 1989-90. Compared to this, the percentage of herbivore fish was 43.0% during 1982-83 against 56.6% during 1989-90.

### **3.1.7.3 Dehra and Pong Dam Reservoir:**

Pong reservoir from Dehra to the Dam offers excellent fishing for mahseer almost round the year when fishing is open. The Pong reservoir can be approached from Pathankot via Jassur, from Chandigarh via Talwara, and from Dharmsala via Dehta and Nagrota Surian.

The area of Ashni stream upto its confluence with the river Giri, falling in Solan and Sirmour district, provides enjoyable fishing opportunities. Near Solan, about 30 km away,



on the Rajgarh road, passing through a valley dotted with plum orchards, fields and little farm houses, across the Giri bridge, is Gaura, once known for its huge mahseer. The place offered good spot to the erstwhile Patiala rulers and their British guests. Even today, Gaura, apart from being a scenically beautiful place, offers good prospects for mahseer fishing. Another spot is the stretch of river Yamuna from Naught ferry crossing down stream in Paonta Sahib.

**Largi:** A place located at a distance of about 7 km from Aut on National Highway-21 is an ideal trout angling spot on river Tirthan. It has a HPPWD rest House and license office of Sub-Inspector Fisheries. Himachal Pradesh Government has specifically declared Tirthan river as an angling reserve and taken a historic decision not to allow any hydro power project on this river as well as its tributaries in order to maintain its aquatic biodiversity. Every year fingerlings of brown as well as rainbow trout are stocked in this river by the department.

### **3.1.8 Threat and the recent status of mahseer catches**

Due to their proximity to human intervention, mahseer stock is threatened with multifaceted dangers posed by construction of series of dams, barrages/ weirs across the rivers on one hand and over-exploitation on the other. While uncontrolled fishing and destructive fishing devices have adversely affected the riverine population, the construction of dams are acting as physical barrier to this migratory species, tending to prevent their access to their usual breeding and feeding grounds. Dams interrupt the river continuum and block the longitudinal connectivity of rivers. They also generate a complex web of impacts which affect the physical and biological components of the riverine environment. The denial of migration also results in permanent and irrevocable eradication of fish stock ranging from depletion to complete extermination. The ever-diminishing catches of mahseer from the river

Sutlej, Giri, Beas, Chenab and their tributaries clearly show the effects caused by the construction of Pandoh, Chamera, Pong, Bhakra & Giribata barrages. Regardless of their height, weirs and dams constitute barriers to breeding migration of mahseer. Furthermore, mahseer population is also affected by morphological modifications resulting from completion of river valley projects. These include change in slope, river-bed profile, submersion of gravel zones or riffle section as well as destruction of riparian vegetation. Most of the negative factors affect upper parts of the streams where lacustrine conditions are superimposed on the river. Downstream, the hydrological conditions get severely altered through reduction of water discharge. The adverse conditions of the flow can extend over many kilometers downstream of the obstruction so that fish passages become difficult.

Indiscriminate hooking, netting, dynamiting and electrocuting have also greatly affected the mahseer availability in the State's rivers and streams. In the pursuit of more and more catches, even the declared State's sanctuaries have not been spared by the poachers. Furthermore, due to reduced availability of large mahseer in the streams, fishing pressure on juveniles is on the increase with the result that streams earlier assuring a bountiful harvest have started giving a dismal picture. The various anglers' associations have painted a similar picture of other States of the country. Once teeming with thousands of mahseer, streams like Giri, Ashwani, Binwa Neugal, Beas, etc. the returns are sharply declining, raising the number of disgruntled anglers each year.

The sharp decline in mahseer catches has also been noticed in the State's reservoirs. Gobind Sagar reservoir- known earlier as store-house of mahseer has recently become a Silver carp reservoir. Mahseer used to constitute as high as 9% of the total catch during 1984-95 which plummeted to a level of 1% during 1999-2000. Pong reservoir, however, has had a steady catch of mahseer during the last two decades ranging

from 60-90 tonnes. The mahseer catches during 1999-2000 were 90 tonnes accounting 20% of the total catch. Further, the average size of mahseer in Pong reservoir has ranged from 1.5 to 1.7 kgs. during the last 15 years. Against this the average size of mahseer in Gobind Sagar declined from 1.9 to 0.6 kgs. during the last 15 years barring the last two years when it increased to 1.2 kgs. in view of the number of management efforts by the Fisheries Department.

### 3.2 In addition to the above listed common parameters, those specific to fisheries are as follows:

**A. Gobind Sagar Reservoir:** Built due to damming of river Sutlej, the Gobind Sagar Reservoir came into existence during the mid sixties. The pristine streams of river Sutlej harbour 51 species of fish including exotic trout, snow trout and several species of hill stream fish. Mostly these species are unique due to sub-temperate climate and the zoo-geographical affiliation to the Himalayan region. The upper reaches of Sutlej and its tributaries are particularly rich in *Tor putitora*, *Labeo dyocheilus*, *L. dero* and *Schizothorax* species. The available species belong to nine families.

#### Fish Stock Composition:

##### **Family Cyprinidae:**

*Bariliusbendelisis*, *B.vagra*, *B.barila*, *B.modestus*, *Oxygaster bacaila*, *Rasbora daniconius*, *Carassius auratus*, *Cirrhinus reba*, *C. mrigala*, *Crossocheilus latius*, *Catla catla*, *Labeo dero*, *L. dyocheilus*, *L. bata*, *L. calbasu*, *L. robita*, *Cyprinus carpio var. communis*, *C. carpio var nudus*, *C. carpio var specularis*, *Schizothorax richardsonii*, *S.plagiostomius*, *Ctenopharyngodonidella*, *Hypophthalmichthysmolitrix*, *Tor putitora*, *Garra gotyla gotyla*, *G. lamta*, *Puntius sarana*, *P. ticto*, *P. chola* and *P. sophore*.

- Family Cobitidae: *Botia dario*, *B. birdi*, *B. lobachata*, *Nemacheilus botia*, *N.*

*rupicola*, *N. monatanus*, *N. kangrae* and *N. horai*.

- Family Bagridae: *Mystus seenghala* and *M. aor*.
- Family Schilbeidae: *Clupisoma garua*
- Family Sisoridae: *Glyptothorax pectinopterus* and *G. cavia*
- Family Belonidae: *Xenentodon cancila*
- Family Ophiocephalidae: *Channa gachua* and *C. punctatus*
- Family Mastocembelidae: *Mastacembelus armatus armatus*
- Family Salmonidae: *Salmo trutta fario*

The following are the commercially important fish in order of their abundance: *Hypophthalmichthys molitrix*, *Cyprinus carpio var. specularis*, *C. catla*, *Tor putitora*, *Labeo robita*, *Labeo dero*, *L. calbasu*, *L. bata*, *L. dyocheilus*, *Cirrhinus mrigala*, *Wallago attu* and *Mystus seenghala*.

**B Pong Reservoir:** An impoundment across river Beas the Pong Reservoir with a catchment area of 1256 km<sup>2</sup>. and mean water spread of 15662 ha. came into existence during 1974. Trial fishing was resorted by the Fisheries Department soon after its filling but during initial years the catches were dominated by rheophilic species belonging to family Salmonidae, Cyprinidae, Gobitidae, Sisoridae, etc. However, due to tremendous biogenic capacity of the reservoir and systemic seed stocking, undertaken by the Fisheries Department, over a number of years with Indian carps and mirror carps, the catch structure of the reservoir was altered and carps started accounting as high as 50-60% of the catches. During 1987-88, the per ha yield of the reservoir also touched a level 53 kgs/ha with

cat fish, and carps accounting 70% and 30% in the landing. The limnological study of the reservoir has shown a positive curvilinear relationship between standing crop and total alkalinity. The hypsographic curves indicated inverse relationship between volume of water and fish production.

As stated, commercial fishing in the reservoir was initiated soon after its emergence. The total catch during 1976-77, the first year of fishing operation, was 98 tonnes and increased progressively attaining a peak of 797 tonnes during 1987-88, fluctuating within a narrow range of 486-596 tonnes. During 1988 the incessant rains and floods forced the dam authorities to open flood gates which caused large scale escape of fish from the water body, obviously affecting the landing in the subsequent years. Subsequently the influx of migratory birds to the reservoir also increased. The reservoir has been declared International Wetland at Ramsar Site. On an average 1,50,000 migratory birds are now visiting the reservoir every year for their winter sojourn. Many families of the birds have become permanent residents of the reservoir due to adequate food & shelter. Approximately 40% of these winged visitors are fish eaters; some of them like black cormorants are the various fish eaters which have resulted in the reduction in the carp fish population in the reservoirs. The reservoir catches are now dominated with catfish like Singhara and the catches have plummeted to 283.60 tonnes during 2008-09. Most of the carp seed being stocked by the Fisheries Department

in this water is being used as food either by aquatic birds or catfish.

**Fish Stock Composition:** A total of 27 species (sub-species, varieties) belonging to six families have been encountered in the Pong reservoir.

- Family Cyprinidae: *Barilius bendelisis*, *B. vagra*, *Cirrhina mrigala*, *Crossocheilus latius*, *Catla catla*, *Labeo dero*, *L. bata*, *L. robita*, *Cyprinus carpio*, *Schizothorax richardsonii*, *Tor putitora*, *Puntius sarana* and *P. ticto*.
- Family Cobitidae: *Botia birdi*, *Nemacheilus kangrae*.
- Family Bagridae: *Mystus seenghala*, *M. aor* & *Bagarius bagarius*.
- Family Siluridae: *Wallago attu*
- Family Sisoridae: *Glyptothorax pectinopterus* and *G. garhwali*.
- Family Belonida: *Xenentodon cancila*
- Family Ophiocephalidae: *Channa marulius*, *C. cephalus*, *C. striatus*
- Family Mastocembelidae: *Mastacembelus armatus armatus*

### 3.3 Inventory of threatened species and area of occurrence

Status of the specific bio-diversity components: The biotic life of Inland ecosystem is little known. The problem is compounded due to the fact that a large number of organisms including fish germplasm are getting extinct from the ecosystems. Status of Fisheries in H.P. is given in Table 13.

**Table 13: Status of Fisheries in H.P.**

Species	Common Name	Maximum size observed	Occurrence
Family Notopteridae <i>Notopterus notopterus</i>	Moh	240	Collected from a pool below the Nangal which gets connected with the river during the floods.
Family Cyprinidae <i>Barilius barila</i> <i>B. bendelisis</i> <i>B. modestus</i> <i>B. vagra</i>	Bhareli	80 72 132 105	Abundant in the reservoir, serving as food of the piscivorous forms such as <i>Tor putitora</i> .
<i>Rasbora daniconius</i>		59	Not very frequent.
<i>Catla catla</i> <i>Cirrhinaus mrigala</i>	Theila Mori	391	Infrequent.
<i>C. reba</i>	Sunni	567 231	

Species	Common Name	Maximum size observed	Occurrence
<i>Crossocheilus latius punjabensis</i>	Tiller	150	Very common in the Ali khad where it joins the reservoir.
<i>Cyprinus carpio</i> 1. var. <i>communis</i> 2. var. <i>nudus</i> 3. var. <i>specularis</i>		780 665 770	All the three varieties of the exotic common carp have been transplanted into the reservoir and are apparently showing good growth. The variety <i>communis</i> is most common and <i>Indus</i> least so.
<i>Garra gotyla</i>	Kurka	150	Abundant in the hill streams joining the reservoir; mostly sticking on to the stones at the stream bed.
<i>Labeo boga</i>	Bangan	544	Commercially important fish. Abundant in the Lunkhar arm from the reservoir.
<i>L. calbasu</i>	Kalbasu		Said to have been transplanted but never caught during the present investigation.
<i>L. dero</i>	Gid	522	Highly important from the commercial point of view. Distribution most abundantly throughout the reservoir especially in the upper reaches near Bilaspur and in the Lunkhar ar.
<i>L. dyochelius</i>	Kunni	396	Common in the upper reaches.
<i>L. rohita</i>	Rohi	543	Caught sometimes in the warmer waters of the Lunkhar farm.
<i>Osteobrama cotio</i>		109	Caught from a pool which gets connected with the river during floods.
<i>Puntius ambassis</i>		30	Somewhat infrequent.
<i>Puntius chola</i>		121	Recorded from the Lunkhar farm.
<i>Puntius ticto</i>	Ticto	47	
<i>P. sarana</i>	-	358	
<i>P. sophore</i>		124	Fairly common. Fed upon by the piscivorous forms.
<i>Scizothorax plagiostomus</i>	Gulgul, talore	510	Rare in the reservoir but frequently found in the Sutlej below the Bhakra Dam.
<i>Tor putitora</i>	Mahseer	930	Commercially important fish. Common throughout the reservoir.
Family Cobitidae	Chipar Sundal	112	Common in the Ali Khad.
<i>Botia birdi</i>	Talana	57	
<i>N. corica</i>		48	
<i>N. denisonii</i>			
<i>Nemacheilus botia</i>	Bhareli	64	Very common in hill streams as well as in the reservoir.
Family Bagridae			Commonly caught from the river below Bhakra Dam and from hill streams.
<i>Mystus bleekeri</i>		155	
<i>M. seenghala</i>	Singhara	1108	Commercially important fish, very common in the middle and lower reaches but rare in the upper reaches.
Family Sisoridae			Infrequent in the hill streams. Remains mostly sticking on to the bottom of stones.
<i>Glyptothorax lonab</i>	Nai	86	
Family Schilbeidae			Caught both from Bhakra and the Nangal reservoirs but frequent.
<i>Clupisoma montana/garua</i>		391	
Family Belonidae			Rare in Bhakra reservoir.
<i>Xenentodon cancila</i>		232	
Family Channidae Channa			More common in the hill streams.
<i>orientalis C. punctatus</i>	Dholla	235 230	
Family Mastocembelidae			Widely distributed in the reservoir and hill streams.
<i>Mastacembelus armatus</i>	Bami	600	

Source: Himachal Pradesh State Biodiversity Strategy & Action Plan 2003

Changes in catch spectrum in Pong reservoir during 1982-83 to 2000-01 suggest local level (reservoir) dwindling and fish disappearance. The data is indicative of changes brought out

by new introductions of fish and the species that have now become dominant. Data including changes in the Pong reservoir fisheries is given in Table 14.

**Table 14: Changes in the Pong reservoir fisheries**

Introduced	Disappeared	Dwindled	Now dominant
<i>Labeo rohita</i>	<i>L. dyocheilus</i>	<i>Tor putitora</i>	<i>L. rohita</i>
	<i>L. gonius</i>	<i>L. dero</i>	<i>Mystus seenghala</i>
<i>Cirrhinus mrigala</i>	<i>Schizothorax plagiostomus</i>	<i>Puntius</i> spp.	<i>L. calbasu</i>
<i>Cyprinus carpio</i>	<i>Mastacembelus</i> sp. <i>Salmo trutta</i> <i>fario</i>	<i>Puntius sabbore</i> Wallago <i>attu Notopterus</i> <i>notopterus</i>	

Source: Himachal Pradesh State Biodiversity Strategy & Action Plan 2003

### 3.4 Patterns of planning and development in the sector

It often becomes evident early in the planning of fishery development programmes that the fishermen themselves are in need of education and re-equipment. A vigorous fishery extension programme can meet this need but, to be successful, should go into operation at a very early stage of planning so as to offset the shock caused by the sudden appearance of a new man-made lake. The 10th Five Year Plan, Planning Commission, Working Group document stressed that reservoir fish production of the State requires to be raised to 2000 tonne to 2007. To attain the above-indicated target, following steps are required to be undertaken:

- Regular stocking of at least 50 lakhs each year fry of Indian major carp in the reservoirs;
- Intensification of fishing effort by enrolment of additional unemployed youths under fishing activities;
- Installation of fish cages in all the three reservoirs for raising stockable size of fish seed;
- Taking up the issue with Punjab State for initiation of fishing in Ranjit Sagar dam;
- Ensure regular fishing in Chamera reservoir by stocking large-scale advance fry of mahseer in the reservoir.

For convenience, fisheries of Himachal Pradesh may be classified into four types. Riverine fisheries and aquaculture also has two sub classifications namely Riverine fisheries, Sport fisheries, General fisheries, Aquaculture, Carp farming, Trout farming, High altitude fisheries and Reservoir fisheries.

#### Riverine Fisheries

- The State has a fishable riverine stream length of 3000 kms out of which 600 falls under Trout waters while the rest under General Waters.
- The annual stocking of approximately 2 lakhs fingerlings in trout waters for two years could greatly enhance the biostock of trout waters.
- The State's trout farms have the capacity to raise this requisite seed and implement the programme. This would obviously ensure the availability of fish to the General Waters. There is a continuous decline of fish catches in rivers & streams due to several natural & man-made factors. While the indiscriminate illegal fishing and emergence of large number of dams have seriously depleted the fish stretches, conservation and watch & ward have hardly been able to protect wanton killing of brood stock and notwithstanding that 50% of the departmental conservation force (about 150 personnels are deployed on in the protection of open waters). Presently there is hardly any river & stream, which has not been covered under the hydel project. It is important that the clearance for construction of hydel project be given after strict scrutiny and full thought.
- There is thus an urgent need to start seed production of Mahseer and initiate work on seed production of snow trout.
- As of now, mahseer seed stocking in general waters is being undertaken by procuring mahseer fry from private fish farms of Lonavla fish farm or Nalagarh fish farm.

## Aquaculture

In view of limited scope of enhancement of State's fish production from reservoirs and rivers/streams it is important to lay stress on aquaculture-farming in ponds and raceways. Further, not only aquaculture generates large scale employments but requisite subsidy grants @ ` 60,000/- ha are released by GoI under the Centrally Sponsored Scheme' Extension & Aquaculture". The State Govt. has established two FFDA's for implementation of Centrally Sponsored Schemes.

- Vision Plan envisages coverage of 100 ha water area as well as 500 running water units by the end of two years. This would help in generation of 700 employments (200 under pond culture & 500 under running water fish culture) under the aquaculture programme.
- State's FFDA is very well in position to achieve the above said targets provided the Agency is strengthened in terms of staff and with the pro-active role of the Fisheries Departmental officers.

## Trout Farming

- Upgradation of trout farms and completion of on-going works under construction;
- To ensure setting up of new trout farming units in private sector under Centrally Sponsored Scheme;
- To ensure supply of inputs viz. seed and feed to private farmers;
- Trout diagnostic laboratory at Patlikuhl farm has been established and trained officials at Norway have been deployed at trout farm Patlikuhl.

**Trout Fish:** The trouts were introduced in the country mainly to encourage Sport Fisheries. Introduction of trouts has helped the fish to become established in most of the cold water bodies of the country. Now apart from sport fisheries, culture of trouts is increasingly being identified as a commercial venture for Table fish

production. Two major trouts available in waters are brown trout (*Salmo trutta fario*) and rainbow trout (*Salmo gairdneri gairdneri*).

These two exotic game-fish soon established in the streams and tributaries adapting to congenial water temperature and abundance of biotic life. The transplantations provided excellent game fishing to the anglers and started attracting large number of tourists to the country. In the last three to four decades, however, a sharp decline was observed in the catches on account of multiple factors such as large scale road construction in the valley followed by destruction of breeding and feeding grounds of the fish, emergence of river-valley projects, rapid urbanization, fishing pressure and of course illegal and destructive means of fishing etc. The matter received serious attention of the various State Governments and some States have taken steps to rehabilitate the exotic trouts in the streams as well as commercialization of trout farming in the farms.

## Carp Farming

- Renovation and augmentation of water supply to carp farms;
- To depute farm officials for short term training in latest breeding technologies and seed rearing at a National Institute;
- Initiation and completion of National Mahseer seed propagation;

Keeping in view the variegated nature of water resources, the Government of Himachal Pradesh through its department of Fisheries has setup two types of fish seed farms - Coldwater or Trout fish seed farms and warm water or Carp seed farms. The mandate of these farms till recently was to produce the seed of trout and carps and stock it in rivers and reservoirs with an aim of replenishing the harvested stocks from these water bodies. With the advancement in fish farming it has been now possible to produce fish for human consumption at these farms, thus making them revenue-earning centres.

*Source: Courtesy: Manmade lakes & reservoirs: Planning and development*

Additional planning for optimal fishery development will include:

- Appraisal of relevant aids to navigation safety requirements;
- Provision of systems for landing, handling, storing, processing, transporting and marketing the aquatic produce, possibly through fishermen's co-operatives;
- Organization of a fishery trade school;
- Development of an advisory system on the investment of venture capital in the fishery;
- Financing as required, by means of bank loans, for both the fishermen and the fishing industry. Supporting services that may need to be developed including the supply of fishing gear, boats, ancillary goods, and repairs.

The Government of India had not only increased substantially the subsidy component being paid to the beneficiaries under the on going fish farming development schemes but also initiated a number of new schemes. The beneficiary now is entitled for the financial assistance of Rs. 0,000 per hectare for pond construction, Rs. 20,000 per hectare for pond renovation, Rs.6,000 per hectare for the 1st year inputs, Rs.4,000 per unit under running water fish culture, Rs. 6,000 per hectare under integrated fish farming and Rs. lacs for setting fish feed unit. With the construction of Chamera Dam on the river Ravi, the area under fisheries has increased many folds. In addition, small area of about 67 hectares is in the form of village ponds, has been identified for development of fishery. The requirement of the fish seeds is met from the various seed farms in the State i.e. Doli, Alsu, Kangra, Milwan (Bilaspur district), Solan, Mandi and Kullu districts. Further, 25% higher subsidy is earmarked for the beneficiaries belonging to weaker sections of Scheduled Castes and Scheduled Tribes for Kinnaur. Fishing in the district has provided an additional source of gainful employment to the fishermen in the Kinnaur district.

The Fisheries Department provides subsidy to fishermen for the purchase of nets and other

equipments besides providing 50 per cent subsidy to Scheduled Castes Community and 25 % subsidy to the others for the construction/renovation of ponds for fish culture under the scheme for development of pond fisheries in the rural areas. A new scheme called 'Running water Fish Culture' is being implemented by the department in the Bilaspur district. The State Government distributes subsidy for setting up fish ponds to the fishermen in the form of nets, boats, tents etc.

As with most other secondary aspects of reservoir construction, the disciplines of fisheries and related hydrobiology should be represented at the earliest stages of planning. Fishery expertise will be required to evaluate the effect of the engineering works and the proposed land and water uses (especially the projected water regimes) on the living aquatic resources and to avoid costly losses of aquatic production.

Fairly lengthy pre impoundment research and study is required to make predictions of future fishery potential for economic assessment and planning. The components of such investigations are:

- Species composition and relative abundance of stocks of the riverine fish population, both downstream and upstream from the proposed dam site;
- Soil types and their extent and distribution in the basin, especially in relation to the spawning grounds;
- Location and characteristics of tributary streams, including character and amount of silt load;
- Areas and rate of siltation;
- Extent and volume of water available for fish production, including water level regime and flushing rate;
- Thermal and chemical stratification probabilities;
- Current and historic yields by species in the riverine fishery.

Combining this local information with experience recorded elsewhere, including testing the validity of similar estimates of production will enable a fishery scientist and managers to make predictions of future fishery yields. Alternative predictions based on alternative forms of engineering work will assist in making the best decisions as to the location and design of the dam. Design features, which might be affected, would include:

- Vertical location of draw-off structures, such as pen stock (sluice gate) openings;
- Need for, and character of fish passes or devices for controlling the movement of fish;
- Best water regimes for the fishery component of an economically optimized multiple-water use scheme.

Early predictions regarding the aquatic resources that may bear on engineering works and on land- and water-use planning are many. Some of the most important of these are:-

### 3.4.1 Mahseer Fish

The importance of mahseers as a World-famous game fish is well known. The group comes in a spectrum of colours from deep burnt copper, through gold, silver, dark black, and inhabits different rivers throughout the length and breadth of India, Pakistan, Burma, Bangladesh Sri Lanka, and even Thailand. Among the seven different recorded species are *Tor putitora*, *T. mussulab*, *T.khudree*, *T mosal*, *T. progeneius*, *T. tor* and *Acrossocheilus hexangonolepis*. *Tor putitora* or golden mahseer is one of the most- sought after species providing the main fishery in the uplands all along the Himalayan belt extending from Kashmir in the north-west to Sadiya in the north-east. The fish is also known as Greyhound or the thick-lipped mahseer and has been observed to attain the weight of 70-80 kgs. To the local fishermen too, mahseers have been of considerable importance because of their large size, hardy texture, high commercial

value and longer shelf life. Trial breeding of Mahseer fish is done at Ghagus carp farm by Fisheries Department official or by hiring private experts.

Progress under Mahseer Fish seed project: The site of Mahseer seed propagation farm has been finalized with HIMUDA for construction of ponds and water supply channel including intake.

### 3.4.2 Fisheries Conservation

Conservation of aquatic resources are generally defined as management of water bodies towards specified aims with the intention of maintaining fish stock or rehabilitating their physical, chemical or biological qualities. This may be done passively or actively. In the former case it may involve only the protection of areas so as to maintain their status quo while in the latter case efforts are made to sustain catches by offsetting the fishing losses. Watch and ward of specified stretches, declaring certain areas as protective waters or sanctuaries, observance of 'closed season', imposing restrictions on fishing in the rivers, specified areas near the weirs, reserving certain stretches for rod and line only and enforcement of bag-limits and catch limits also come under the purview of passive exercise and are a must for propagation, growth and rehabilitation of particular fishing.

The quantitative improvement of stock by transplantation of farm reared stocking material is termed as active conservation step. Setting up farms/ hatcheries near the streams/ reservoirs sites, followed by artificial breeding of mahseer in the farms and enrichment of stock in the water bodies usually go a long way in the rehabilitation and enhancement of a particular fishery. Stocking, introduction and transfer of fish are considered valuable management tools which complement the physical rehabilitation of the environment. Trials have been undertaken successfully on artificial breeding of mahseer at Lonavala Fish Farm in Maharashtra and other national institutes. The breeding successes have raised new hopes on the prospects of revival of



mahseer fishery. A need exists to intensify these efforts for undertaking large scale regular 'mahseer seed ranching programmes', and revival of fishery.

### **3.4.3 Reservoir Management**

During the first phase of reservoir development in 1964-75, the Department issued license @ ` 10/- per gill net and fishermen were free to dispose their catch as they wished. This, however, failed to develop a commercial fishing of appropriate size and hardly benefitted the fishermen. During 1976, a fishing policy was formulated and implemented. As a first step all the fishermen were organized under Co-operative Societies. The fish caught by the fishermen were now brought to the fixed landing centres for handing over to the Fish Federation, an apex body entrusted solely for the sale of fish. The Federation was free to sell the fish either at their own retail outlets or to the contractors. This Federation, an intermediary body between the societies and contractors, was made fully responsible for making payment to the fishermen at the rate fixed each year during the beginning of the year. Due to some management problem, the Federation has been closed since 2006. Now societies are providing their produce at the rates fixed at the beginning of the year to contractors. Seed stocking, conservation, watch and ward, implementation of Fisheries Act /Rules, monitoring of catches, initiation of welfare schemes, providing subsidy and arranging loans were made as the major responsibility of the Fisheries Department.

The Gobind Sagar offers a classic example of exploiting the large reservoirs created in view of completion of river valley project for job generation and production of high quality animal protein i.e. fish. The reservoir has in fact created a history of maintaining highest per unit fish production in large reservoirs. This could be made possible by adopting a sound management and development policy which inter alia include formulation and

implementation of Fisheries Act, regular stocking, providing assistance to fishermen for pursuance of fishing equipment, strict enforcement of closed season and mesh size regulations etc. As per available figures, a total of 12090.53 tonnes fish valued at Rs. 3149.42 lakhs was harvested from Gobind Sagar reservoir. The Fisheries Department earned revenue of Rs. 497.96 lakhs in terms of royalty, fees and fines. Further, 1737 direct and 1474 indirect jobs were made available in view of these fishing operations.

## **3.5 Technology adopted in the sector along with any changes in technology**

### **3.5.1 Technology Dissemination**

Under this programme, it is envisaged to provide about 4000 trout fingerlings each of 10 to 25 g weight for rearing on intensive basis up to the portion size of 250 g to the prospective farmers. Initially about 20 sites have been selected for the setting up of about 35 to 40 raceways each of size 12M x 2M x 1.5 M in Kullu district. Schematic drawings of rearing units in respect of all the sites have been prepared for the guidance of the beneficiaries and added into a study report on this subject which includes a manual for the selection of sites as well as analysis on the economics of trout farming in village raceways. It is proposed to provide major inputs of trout seed and dry compound pelletized feed to the farmer besides aqua-engineering guidance to build a suitable raceway with assured supply of sufficient good quality, pollution free water throughout the farming period. The selected farmers will be provided full technical support in the shape of 2 weeks training in rearing and harvesting techniques to achieve the targeted level of productivity and a unified extension approach through the trained staff to solve their day-to-day problems. It is proposed to set up a 'Training Centre' with boarding facilities at the project farm in Patlikuhl.

A fair degree of success has been achieved in the development of an efficient and economic trout feed at the farm from raw materials available within the country. Hopefully, its formulation will be soon standardized with per kilo production cost of around 20/-. The

objective feed conversion ratio has been kept at 1:1.5 and a production plan has been designed to raise one ton of 200 g portion size fish in one standard size village raceway in 10-12 months. Expected production Plan is given in Table 15.

**Table 15: Expected production plan of one tonne of portion size fish in 10 to 12 months**

Month	April	May	June	July	August	September	October	November	December	January
Day Nos.	1	30	61	91	122	153	183	214	244	275
Temp. Co	15	15	16	16	18	18	10	10	10	8
Individual size (g)	20	29	42	59	84	114	154	193	232	268
Total biomass (kgs)	80	116	169	237.8	336	457	616	775	930	1074
Sum harvest (t)	0	0	0	0	0	0	0	0	0	1.074
Food req. (kgs)	-	54	80.09	101.9	147.4	182.3	239	238	232	216
% feeding	2.25	2.25	2	2	1.75	1.75	1.25	1	0.75	-

### 3.5.2 Hatchery practice

According to this practice Fibre-glass hatchery troughs with Californian type of incubators are installed. Each hatching tray should have the capacity to treat 1.5 litres of eggs i.e. about 15 to 18 thousand in number and there can be 4-7 trays depending upon the length of the trough. On the perforated Aluminum- sheet bottom of the hatching tray is kept a same sized piece of Astroturf and over this is kept a plastic egg basket for laying the eggs. This plastic egg basket is removed after eggs hatch out and the dead yolks settle down into the Astroturf. The advantage of Astroturf is that it prevents the drifting of the dead yolks resulting in quicker absorption of the yolk sac. The eggs should be shielded from light by covers over the incubators to avoid damage by light. In the entire period, daily attention to the incubation process is needed so that (i) the dead eggs do not increase the spread of fungi (ii) malachite green bath is given to the eggs two days in a week depending upon the attack of fungus, (iii) dead eggs are removed after the embryonic eye has appeared, (iv) all egg shells are simultaneously removed, and (v) all dead yolk sac (alevins) fry are also picked up side by side. After about 75% of the yolk sac is consumed, the fry is transferred to a 'Starter Unit' where it is fed with very small flakes of protein rich 'start feed'. This is the most critical stage in the life of

fish because if there is a slight delay in feeding or the feed is not of good quality, the young fish will lose its interest in feeding and start dying. Young rainbow trout should not be reared in earth ponds due to the danger of 'whirling disease'. With growth of this stock, to prevent imbalance in the unit weight of this biomass, grading at least once in hatchery and later during on-growing whenever it doubles its weight should be done. A high class hygiene level is required to be maintained if good results are to be obtained. Complete cleanliness of premises, removal of dead fry, excrement and uneaten food has to be ensured. Outlets of starter units, generally tend to foul with accumulation of metabolites and therefore, all drain pipes and screen be kept clean by using a high pressure hose.

### 3.5.3. Farming Cycle

Under the technology transfer phase of this Indo-Norwegian Trout Project, a production plan has been followed covering the following aspects:

- i. 100,000 certified pathogen free eyed eggs of improved strain of rainbow trout were imported from Denmark for three years. They were incubated in the State and a survival rate of 92% was obtained upto the swim-up fry stage.

- ii. It took about 20 days at an average temperature of 100C ie 195 degree days upto hatching.
- iii. The fry upto 1 g was retained in the hatchery and later shifted to nursery ponds and retained there till it acquired the weight of 5 g.
- iv. The stocking rate in start feeding was kept at 6kgs/ m<sup>3</sup> and in nursery at 10 kgs/ m<sup>3</sup>.
- v. From 5-50 gms weight the fish was shifted to smaller raceways of 5M x3 M x 1M with a stocking rate of 10 kgs/ m<sup>3</sup>.
- vi. From 50 g to portion size of 250 g the fish was reared in bigger concrete raceways of size 15M x2M x 1.5 M at a stocking density of 30 kgs/ m<sup>3</sup>.

It took 10-12 months to attain the marketable size of 250 g of imported stock of rainbow trout. To begin with, trout feed imported from Norway was administered to the fish but during October, 1991 feed prepared in the plant set up at Patlikuhl farm was initiated.

100% Centrally Sponsored Scheme on strengthening of post harvest infrastructure: A Scheme of ` 100.00 lakhs on Strengthening of Post Harvest Infrastructure has been approved by the Government of India. Its first installment of ` 50.00 lakhs has been sanctioned by the Union Government and the said amount has also been received by the Society. The Governing Council has approved the construction of Ice plant at Trout Farm Patlikuhl and four Aqua shops one each at Ghagus, Barot, Sultanpur Dhamwari and Ice Plant at Patlikuhl has been approved for HIMUDA.

### **3.6 Stakeholder involvement in environment preservation and restoration**

#### **3.6.1 Major Stakeholders and their current role:**

Major stakeholders and their role relevant to aquatic biodiversity are as follows:

**Government Agencies:** The Department of Environment, Science Technology Govt. of Himachal Pradesh has formulated an 'Environment Policy' with the view to develop approaches compatible with the mountain ecosystems and its unique aspects such as fragility, inaccessibility, marginality, diversity, climatic peculiarities etc. The policy guidelines cover important areas such as; land, water, air, mineral resources, health, bio-diversity, agriculture, horticulture, fisheries etc.

Three lakes have been identified as wetlands of national importance by the Ministry of Environment & Forest, Govt. of India namely Renuka lake, Chandertal lake and Pong wetland. The conservation problems being faced in most of these lakes are related to excessive inorganic loading of silt flushing through the catchment areas and intense organic loading due to eutrophication. The Policy document enlists series of action required to be taken for revival of past glory of these pristine water bodies. Training is also imparted in pisciculture to the interested persons at Mirror carp fish, training centre, Deoli during the month of September every year.

**SJVN sponsored project 'Development of Fisheries in Nathpa Jhakri reservoir and tail end of Sutlej river':** 98.83.00 lakhs has been incurred against the received funds of ` 100.00 lakhs under the Project: The Sutlej Jal Vidyut Nigam authorities has been requested to release the final installment of ` 60.00 lakhs after the joint inspection conducted by the officials of fisheries department, Sutlej Jal Vidyut Nigam and SIDC of the works executed under the Sutlej Jal Vidyut Nigam project at trout farm Sangla. The detail of work is given in Table 16.

**Table 16: Progress under SJVN sponsored project**

Sl. No.	Name of works	Present status
1	Construction of 6 no. additional raceways	Completed.
2	SRMO of Raceways at Sangla farm	Completed.
3	C/o Intake channel and water channel from Hurba khad to main water storage tank	Completed.
4	Special repair and maintenance of sedimentation tank at Hurba khad	Sedimentation tank has been washed away in floods during 2005-06.
5	Construction of feeder channel for water supply from the Rukti stream to farm`	work has been completed.
6	Hatchery building including hatching troughs, start feed tanks, internal water supply system and water storage	Work in progress 75% work has been completed.
7	Purchase of farm equipments, machinery etc.	Supply order has been placed for hatchery equipments.
8	Air-lifting of eyed ova of genetically improved quick growing strains of Lake trout ( <i>Salvelinus namycush</i> ), Arctic char ( <i>Salvelinus alpinus</i> ) and Brown ( <i>Salmo trutta fario</i> ) from European/ Scandinavian countries including visit of State personnel, if necessary.	One Govt. Officer has undertaken the visit Norway. Eyed ova of Arctic char have been imported and is being reared at departmental trout farm's viz. Sangla, Patlikuhl and Holi. Genetically improved mirror carp purchased and being reared at Alsu farm.
9	Hiring of consultants /experts for implementation of programme	
10	Construction of feed mill (including extruder, palletizer, drier etc.)	
11	Sundry expenditure	

**BBMB sponsored project 'Promotion of fisheries in the riparian area of Suketi Khad and its adjacent streams':** Joint inspection of works under the BBMB funded project is conducted along with departmental officials, BBMB officials and HIMUDA. 1st instalment

of 36.00 lakhs was received from BBMB against sanctioned amount of 72.00 lakhs and following expenditure has been incurred till date under the project ( Table 17). BBMB authorities have been requested to release the 2nd installment of 36.00 lakhs.

**Table 17: Progress under BBMB sponsored project**

Sr. No.	Name of items	Present status
a.	Providing assistance to 25 beneficiaries under fish farming programme and coverage of over 12 ha of water area under pisciculture	Financial assistance has been provided to 20 beneficiaries.
b.	For construction of percolation well, pump house and electrification etc, of Alsu farm.	The construction work of Percolation well has been started by HIMUDA at Alsu farm.
c.	For digging/construction of fish seed rearing nurseries at Deoli fish farm	Work has been completed
d.	For construction of water channel for providing water supply to newly constructed nurseries	Work has been completed
e.	For providing subsidy to 25 beneficiaries toward cost of fish seed fish seed fishing nets fertilizers equipments etc.	Financial assistance has been provided to five effected families.
f.	For undertaking practical/attachment training programme to 50 beneficiaries on latest fish farming technique at Deoli fish farm. To defray expenditure on stipends and to and from travel expenditure to beneficiaries.	Training imparted to the beneficiaries at Deoli Farm. And financial assistance provided to three families
g.	For organizing training courses, strengthening infrastructure at the farm, providing TA/ honorarium to departmental staff, preparation of printing of training material/pamphletsbulletins etc.	28 beneficiaries have been trained at CIFT Cochin.

### 3.7 Critical environment issues /hotspots associated with the sector

#### a. Shrinking of wetland/ water body/reservoirs area due to change in land use, human & livestock activities:

Anthropogenic activities, unplanned urban and agricultural development, industries, road construction, impoundment, resource extraction and dredge disposal are leading to continuous shrinking of wetland/water body/ reservoirs area. Encroachment because of unclear land tenure and lack of property rights of the wetlands and surrounding areas is the major reason for shrinkage of these areas. This leads to loss of eco-system function, fish species and fish productivity.

#### b. Deforestation / removal of vegetation/ grazing in the catchment are leading to soil erosion and siltation of the wetland/ water body/ reservoir:

Continuous deforestation both legal & illegal in the catchment is leading to declining forest cover and degradation of support lands. Further, uncontrolled grazing in meadows & pasture land is leading to increased pressure and reduced water holding capacity of forests and other lands. This is causing continuous soil erosion & siltation. Further, the destruction of habitat of fish including mollusks (pila, snails, etc.), phytoplankton and zooplankton/ grasses lead to loss of fish productivity and species. The reduced depth of reservoirs due to siltation further adds to loss of fish productivity and species. For example in Pong reservoir, it has been observed that due to heavy siltation, shallow areas get choked in the periphery leading to destruction of fish feeding grounds. Some of the fish species, which either disappeared or dwindled, include *Labio dyochillus*, *L. gonius*, *Schizothorax plagiostoms*, *Mastacembalus sp.* *Salmo trutta fario*, *Tor putitora*, *L. dero*, *Puntius spp.*, *Puntius saphore*, *Wallago attu.*, *Notopterus notopterus*. The draw down areas of Pong reservoir are occupied by

nomadic graziers and gujjars during March-June. Besides this, stray cattle also graze in the fringe area.

#### c. Agriculture-horticulture activities in the wetland/ reservoir/ water body buffer zone, fringe areas and catchment area:

Shift in land use and agricultural production patterns in the catchment, buffer zone and fringe areas is leading to adverse impacts on wetlands/ reservoir/ water body in Himachal Pradesh e.g. Shorelines of lakes/ wetlands are farmed during the draw down phase in Pong reservoir. The water bodies become recipient of insecticides, pesticides, fertilizers and heavy metals. Depleted oxygen and higher nutrient levels may lead to decline in fisheries. Further, bioaccumulation may lead to potential health risk e.g. It has been reported in Pong wetland report of forest department that the chemicals such as CAN, Urea, 12-32-16, DAP, Sulphur Phosphate and insecticides such as nuvan, etc. pollute water for reservoir and deteriorate flora and fauna.

#### d. Poor surface water quality due to unrestricted dumping of sewage, solid wastes and toxic chemicals from households, tourists destination and industries which leads to water pollution and eutrophication of wetlands/ water body/ reservoir:

Infrastructure development and poor management of waste (municipal solid waste, construction and demolition waste and waste water) in the catchment and in vicinity of wetland/ water bodies/ reservoirs leads to water pollution and increased influx of organic waste, which leads to water pollution & eutrophication. Dumping of dung of horse and ponies near wetland/ water bodies/ reservoirs frequented by tourists (e.g. Khajjiar) also contributes to water pollution & eutrophication. Increased runoff in the degraded catchment areas of wetlands leads to siltation and weed growth, water pollution & eutrophication. Littering of non-biodegradable materials by pilgrims and tourists increases pollution load in the wetland/ water body/ reservoir. This increased pollution load decreases dissolved oxygen levels leading to fish mortality.

**e. Depletion of benthic flora and fauna in wetlands/ reservoir/ water body due to dredging/ desilting:** Dredging / desilting leads to high TDS/ turbidity and decreased oxygen level thereby increasing fish mortality. Further, disturbance in benthic flora and fauna leads to decreased fish productivity.

Depletion of fisheries also occurs due to introduction of invasive plant and fish species. Congestion of natural outdoor recreational sites is leading to depletion of wetland/ water body/ reservoir flora & fauna. *Eichhornia crassipes* (Water Hyacinth), *Azolla* and *Salvinia molesta* clog waterways and compete with native vegetation, leading to loss of wetland's area, and depletion of wetland's flora and fauna. Indiscriminate introduction of new species of fish for commercial exploitation, over harvesting of particular species and fishing methods are leading to depletion of wetlands/ reservoir/ water body fauna. Commercial fisheries lead to change in composition of fisheries for instance increase in the carnivorous fish. Several fish species have disappeared due to over exploitation and introduction of carps.

**f. Poor Enforcement of regulated activities due to jurisdiction issues on account of unclear land tenure and other aspects related to fisheries :** Indiscriminate hooking, netting, dynamiting and electrocuting have greatly affected the qualitative and quantitative availability of fish in the rivers, streams, lakes and reservoirs. Taking advantage of the ascending nature of Mahseer fish, during breeding season, high tension wires are put into the water for electrocuting the fish. Similarly, it is a common practice in Himachal Pradesh to poison the water with Tejpahal seeds or DDT, which kill the whole progeny of fish over considerable stretches of rivers. Catching by specially designed traps 'Chips' and dragnet in conjunction with stake net and cast nets have caused serious damage to the mahseer resources of the State. In pursuit of more and more catches, the commercial fisheries have not spared even some of the declared sanctuaries.

Further, due to reduction in the large-sized fish, fishing pressure has shifted to the juveniles, with the result that streams earlier assuring a bountiful of variegated fish fauna have started presenting a dismal picture and may turn into aquatic deserts, if corrective steps are not taken. Some of the other uncontrolled activities include poaching of avifauna, illegal harvesting of crops and commercial fishing e.g. Introduction of fish seeds/ varieties and commercial activities without permission of Chief Wildlife Warden. Furthermore, remote and inaccessible areas, lack of trained enforcement staff, lack of enforcement infrastructure and lack of coordination leads to poor enforcement of the rules.

**g. Change in natural flow/hydrology and water dynamics of the reservoir/wetland/ water body:** Construction of a large number of reservoirs and dams; diversion of streams and rivers and hydroelectric projects lead to reduced flow into wetlands/ water bodies/ reservoir. Further, release of impounded water by dam/reservoir depends on the management authority. Small hydropower projects and other infrastructure development projects requiring water diversion also change the hydrology of the wetland/ water body/ river. The reduced down stream ecological flow leads to ecological imbalance in aquatic flora and fauna including fisheries.

**h. Uncontrolled/ unregulated tourism in the buffer zone leads to disturbance of fish feeding and breeding habitat** Tourists feed fish and turtles with bread, biscuits, wheat, flour, grains nuts etc. thereby disturbing and declining of habitat and fish productivity. Movement of high speed motorised boats of tourists, allied activities of water sports like training programmes and fishing vessels, poor camp management and waste disposal lead to disturbance of fish feeding and breeding habitat.

### 3.8 Environment initiatives taken by the sector to address critical environment issues

Himachal Pradesh Government has specifically declared Tirthan river as an angling reserve and taken a historic decision not to allow any hydro power project on this river as well as its tributaries in order to maintain its aquatic biodiversity. During 2006, in order to safeguard the aquatic biodiversity, Government of Himachal Pradesh took a historic decision by making release of at least 15% water downstream of dams & weirs of Hydro Power Project, mandatory, besides declaring Tirthan river as free from Hydro Power Projects. The fish production of the State increased to 7798 tonnes during year 2009-10 thus registering an increase of 461.57 tonnes over the previous year 2007-08. The revenue earned by the department reached at a level of 185.5 lakhs during 2008-09.

#### 3.8.1 State Government Sponsored Welfare Schemes

a. **Reservoirs Fishermen Accident Insurance Scheme:** Fishing in the big reservoirs is a hazardous job. There is risk of life during heavy rains and storms. Keeping this scenario in mind all active fishermen working in the reservoirs have been insured for Rs.50,000/- in case of permanent disability and 1, 00, 000/- in case of death of the fishermen. The insurance premium of Rs.30 /- is being shared by the Government of India and Government of Himachal Pradesh in 50:50 ratio.

b. **Saving-cum-Relief Scheme (closed season assistance):** In order to ensure sustained yield of fish from the reservoirs apart from the other management measures, a fishing 'closed-season' of two months from 1st June to 31st July every year has been enforced. This measure has helped in building up fisheries of considerable magnitude by facilitating free run to the mother fish spawner during breeding season and the auto stocking of the fish seed. Every year fish over 4 Crores of value are being

harvested accounting an income of ` 60 lakhs to the State exchequer. This measure has also generated considerable resentment in the fishermen community and they were insisting on the provision of some financial assistance during this period. Himachal Pradesh is perhaps the 1st State in the country which has acceded to the demand of fishermen by introducing a 'Contributory Saving cum Relief Scheme' to its reservoir fishermen. Under this scheme each fisherman who is a member of the cooperative society deposits ` 40/- for ten consecutive fishing months from August to May. Proportionate amount is contributed by the Central and State Government with contribution of ` 400/- and 400/- respectively. The total amount of `1200/- thus, raised is distributed to the fishermen in two installments during the 'closed season'.

c. **Fishermen Risk Fund Scheme:** Fishing in the reservoir is nocturnal in nature and hence involves a considerable risk to the life of the fishermen as well as fishing equipments. Due to changes in atmospheric pressure, followed by cyclonic storms, the reservoirs become quite rough and such situations create a lot of hardships to the poor fishermen. To mitigate to a certain extent the losses to the fishermen a 'Fishermen Relief Fund Scheme' has been formulated in the State. Under this scheme each reservoir fisherman contributes Rs. 20/- annually, to be collected from him at the beginning of the year while issuing the licenses. The State Government contributes an amount equal to the total contribution of the fishermen. The assistance from the fund to the fishermen is given only on loss of gill nets, wooden boats, and tents. Based on the present value of the equipments, the compensation is given up to 33% of the loss of each item. Maximum assistance is given in case of total loss/ destruction of the equipment.

d. **Grant-in-Aid / Subsidy for the Construction of Fish Ponds:** Fish culture is an important activity and aims at improving the nutritional standard of people by increasing production and consumption of fish as well as

to improve the economic condition of the operators by providing them with gainful vocation. In order to assist the people to taking the fish culture, the State Government has formulated a scheme to provide subsidy up to a maximum of Rs 5,000 for the construction/renovation of ponds. The subsidy is available @ 50% of the total project cost to Scheduled Castes/Tribes, while others living Below Poverty Line @ 20%. The State Government is also providing training and technical guidance to the entrepreneurs.

### 3.8.2 Central Govt. Sponsored Welfare Schemes:

#### a. Fish Farmer's Development Agency:

The objectives of the Fish Farmer's Development agency are as under:

1. Progressively reclaim and bring all potential under water bodies fish culture such as swamps, beels, silted up/ neglected ponds, water logged/ low lying areas, etc. for optimum fish production in the State;
2. To work out the programme in such a way that it serves as a nucleus of activity to be further spread to other areas;
3. To provide training and popularize a new vocation by way of fish culture to the people thereby building-up a trained cadre of fish farmers to undertake intensive fish farming thus providing increased employment to rural unemployed;
4. Contribute to the strengthening of rural economy by making fish farming economically viable;
5. To effectively involve financial assistance to provide loans for capital investment to fish farmers for excavating ponds or for improving existing water areas; and;
6. To provide initial technical and financial assistance to the fish farmers as required from time to time.

A package of assistance is provided to the prospective fish farmers under different segments of the schemes, the details of which are mentioned below:

**b. Renovation/reclamation of ponds and Tanks:** The scheme envisages renovation/ reclamation of old ponds and tanks which are owned or taken on lease by the farmers. The estimated per ha. renovation cost of the pond is 75,000/- and subsidy @ 20% with a maximum of 15,000 /- for Non Scheduled Castes other fish farmers and for S.C/S.T it is 18,750/- per ha. (25%).

**c. Construction of new ponds:** This scheme has been introduced only during 1991-92 with an aim to create more ponds for increased fish production. The unit cost of the scheme is Rs 4 lakhs per ha. in the plain areas including arrangement of water supply either in the form of tube-well or gravity flow. The subsidy component is available @ 20% with a maximum of 80,000/- per ha. for Non Scheduled Castes / other farmers and for S.C/S.T farmers it is 1,00,000/- per ha. (25%).

**d. Integrated fish farming:** The scheme envisages assistance for setting up integrated units including hatcheries for Ornamental Fish-Unit cost 15 lakhs which includes hatchery of 5-10 million in capacity.

**e. Construction of fresh water prawn & other fish hatchery:** Fish seed is the nucleus of aquaculture. The State Department of Fisheries at its seed farms is producing 20.0 million fish seed annually which is not sufficient to meet the fish seed stocking requirements of its reservoirs and open waters. Hence, there is a need to involve private entrepreneurs in fish seed production. The scheme envisages 12.00 lakhs for a fish seed hatchery with 10 million (fry) capacity for the plain areas and 16.00 lakhs with the same capacity for the hilly States/ districts. Subsidy @ 10% with a maximum ceiling of 1.20 lakhs in the plain and ` 1.60 lakhs in the hilly areas for entrepreneurs only is provided.



**f. Establishment of fish feed unit:** After meeting out the seed requirement of the beneficiaries, the next important part in the aquaculture is availability of the optimum quantity of the fish feed. For setting up of a fish feed unit, Govt. of India sanctioned the cost @7.5 lakhs for building, machinery and equipment. These will be set up in the private sector. Subsidy @ 20% with a maximum ceiling of 1.50 lakhs is admissible for each entrepreneur.

**g. Subsidy on 1st year inputs:** The fish farmers who avail the benefits of Grant-in-Aid subsidy for the renovation and construction of ponds are also provided subsidy on the purchase of 1st year inputs such as fish seed, feed and manure etc. @ 20% with a maximum ceiling of Rs 10,000/- per ha. for all farmers except SC's/ST's for whom it is 12,500/- per ha.(25%). The total cost per ha. has been allowed at 30,000/-

### 3.8.3 Schemes for Youth

- a. Construction of New Ponds: Assistance for construction of a pond (size 1 hac.) ` 1, 00, 000/- for SC/ST and ` 80,000/- for General Category farmers.
- b. Reclamation/ Renovation of Ponds: Assistance for a pond (size 1 hac.) ` 18,750/- for SC/ST and 15,000/- for General category farmers.
- c. Integrated Fish Farming: Additional Assistance for integrated fish farming Pond (size 1 hac.) 20,000/- for S.C./S.T. & 16,000/- for general category.
- d. Freshwater Fish Seed Hatchery: Assistance for setting up hatchery with 10 million seed (fry) capacity 1.6 lakhs for each unit only.
- e. Fish Feed Unit: Assistance for setting up fish feed unit in ` 1.50 lakhs on a unit cost of 7.50 lakhs.

- f. Setting up of integrated units including hatcheries for ornamental fish: Assistance for setting up hatchery with 5-10 million (fry) capacity of 1.50 lakhs to all categories of fish farmers.

*Source: Himachal Pradesh Fisheries Department  
(<http://hpfisheries.nic.in/scheme.htm>)*

### 3.8.4 Strategy of the 11th FY Plan

- Fish seed is the nucleus of fisheries' development hence maximum thrust is laid on the strengthening of Carp and Trout farms. Nine seed farms (five Trout and four Carp) would be either upgraded or renovated. One trout farm, Nagini (Kullu) washed away due to the floods in 2005 shall be reconstructed and fish seed ranching of Tirthan river resumed.
  - Plan aims at immediate arrest of the downward trend in the reservoir fish catches. For achieving this intensive fish seed, stocking would be done besides an improvement in the management measures.
  - Intensification of aquaculture practices through Fish Farmer's Development Agencies.
  - Implementation of welfare schemes such as accident insurance, risk fund and saving cum relief for fishermen.
  - Revival of riverine fisheries by setting up Mahseer fish farm at an estimated cost of ` 505 lakhs.
  - Initiation of ornamental fish farming and dissemination of technology to private sector.
  - Extension of commercial trout farming technology in private sector.
- a. Management and Development of Reservoir Fisheries**
- (i) Conservation of reservoir fisheries: Various studies conducted by the scientific institutions and past experience gained by the department

during their management days indicate that fish production can be further enhanced. Instead of increasing the catches from Gobind Sagar & Pong, which had been showing a downwards trend for the last two years, a decision has been taken to stock these water bodies with adequate seeds of commercially important fish species besides giving new orientation to the observance of fishing close season during breeding season of fish. There is a need to bring these reservoirs under one administrative control on the links of trout farming.

- (ii) **Production of Carp Seeds:** The State has achieved success in breeding Golden Mahseer ( *Tor putitora*) at its farm and it has been stocked in Chamera reservoir. All the existing carp farms in the State have been assigned clear mandate for the production of fish seed of a particular fish species instead of keeping all the different species irrespective of the fact whether they are capable of breeding at these farms or not. Besides, a fish farm is being remodeled for conversion into ornamental fish seed farm. Every year angling competitions of Mahseer are organized by the Fisheries Department in collaboration with the Tourism Department to promote angling competitions/angling meet in the State. Such competitions are becoming popular and giving publicity to tourist in-flux in the State. Such competitions give an assessment of the establishment of the particular sport fish in the water body.

**b. Development and Maintenance of Sports Fisheries-Trout Seed Farm:** The department has initiated a phased programme on remodelling and expansion of existing trout farms as well as construction of new ones. Under this programme, augmentation of water supply and setting up of modern hatchery has

been taken up at Barot and at Dhamwari farms. The department intends to continue trout farms modernization programmes in view of compelling the need of large seed stocking in the rivers and streams as well as promotion of trout farming in the rural areas of the State. All the State trout farms are proposed to be upgraded to the level of Indo-Norwegian trout farming project with adequate water supply provision, filtration, modern hatchery equipped with latest hatching equipments, adequate rearing space, feed mill and residential accommodation. Maximum stress would be given on quality seed production in trout farms for stocking in river/ streams as well as supplying to enterprising trout farmers.

**c. Development & maintenance of carp farms:** There is no denial that Golden Mahseer ( *Tor putitora*) a prestigious game fish of hills is quickly depleting from State waters in view of several man made and natural hazards. The present situation warrants large-scale seed transplantation of this species in the different ecologically suitable pockets of streams and rivers. The State Government has decided to set up a Mahseer farm at Machhiyal, Tehsil Joginder Nagar, District Mandi. The land for the construction of the farm has been arranged and the work has been proposed to be completed.

### **3.8.5 Extension & Training**

Training has been identified as the weakest link of the Fisheries Department. A number of State & Centrally Sponsored Schemes initiated by the Fisheries Department could not get adequate popularity in view of poor extension and training efforts. Presently, the training programme organized by the Fisheries Department lack regularity and run purely on ad- hoc manner. There are no fixed training schedules and selections of the trainees are also not done in a systematic way. Similarly, extension programme, especially participation in exhibitions, melas, state fairs, holding of camps etc., lack requisite planning and projection. In

fact, there is no such 'Extension & Training' wing in the Fisheries Department, which can be entrusted for carrying out these programmes and due to lack of such a mechanism aquaculture programme is not making a good headway or impact especially in the rural pockets of the State.

### **3.8.5.1 Intensification of Aquaculture Programme**

**a. Fish Farmers Development Agency (FFDA):** Development of aquaculture programme would be one of the major priority areas of the department during the plan period. Despite having tremendous potential of raising the State's fish production, generation of employment, strengthening of fish production, aquaculture could not make any discernable impact in the State in earlier years due to inadequate availability of quality seed and lack of technical know how which could benefit the State's complex topography. The running water scheme initiated in the State during the 10th Plan period has provided an adequate answer to many of the problems of pond fish culturists. In view of plenty of water flowing in the form of streams, kuhls and abundance of Mirror Carp seed in the State, the scheme of 'Running Water' fish culture is getting increasingly popular amongst the fish farmers of the State. The pond culture is also going to get a boost during the coming years in view of availability of fish seed, initiation of several extension & training schemes and Fisheries Department's stress on extension programme.

**b. Development of Inland Fisheries Aquaculture:** State of Himachal Pradesh is hilly & few districts like Shimla, Kullu, Lahaul & Spiti, Kinnaur, part of Chamba & Mandi, Kangra & Sirmaur are cold-water zones, therefore, under FFDA, the entire State was not being benefitted from the ongoing schemes. A new dimension has been given to the FFDA schemes for cold-water areas under the title Inland Fisheries & Cold Water Aquaculture, "Development of Inland Fisheries

& Aquaculture". This shall cover cold-water fisheries & aquaculture along with reservoir fisheries' development through training, purchase of craft & gear and construction of landing centres.

*Source: XI FYP, Himachal Pradesh*

### **3.8.6. Strategy/ action plan of State Government for rehabilitation of mahseer stock in lentic & lotic waters**

The action plan of Himachal Pradesh Government for restoring of mahseer fish stock in the various rivers, streams, tributaries, lakes and reservoirs combines both passive and active measures and may be summarised as under:

- Legislative action: As is well known that maximum damage to Mahseer stock is done during the breeding season, the mahseer migrate in shoals upstream in shallow running streams for spawning. This gives ample opportunity to unscrupulous fishermen to kill the brood stock with nets, traps, sticks, sword, spears etc. as the gravid fish are heavily loaded with eggs and vulnerable to all these destructive fishing methods.
- Taking this into consideration, a special clause has been incorporated in the Himachal Pradesh Fisheries Act under which Fishing during breeding season has been made cognizable and a non-bailable offence inviting imprisonment upto three years.
- Further based on scientific studies, a clause has been incorporated in the H.P. Fishing rules under which minimum catchable size for mahseer has been increased from 300 to 500 mm or approximately 1.2 kgs. giving opportunity to each female mahseer to breed at least once before being caught. Since incorporation of this clause in the Fisheries Act during 1998, the average size of mahseer has increased from 0.12 to 1.7 kgs in Pong dam and 0.6 to 0.9 kgs in Gobind Sagar reservoir.

- Research efforts: An I.C.A.R. sponsored collaborative research project between State Government & Punjab University on “Breeding and seed production of golden mahseer” has been initiated. Under this project, besides building up a mahseer brood stock, a modern mahseer hatchery has been set up at Deoli (Bilaspur) fish farm. Few breeding trials of mahseer have been undertaken with limited success.
- Setting up National Mahseer Fish Farm: Taking the importance of mahseer and the efforts made by Himachal Pradesh Government, the Government of India has approved a State Government’s proposal of setting up a ‘National Mahseer Fish Farm’ in the State involving financial assistance of ` 2.00 Crores. The requisite modalities viz. drawings, dimensioning, water supply lines etc. are being worked out in consultation with experts. The farm would be able to meet the long standing demand of mahseer seed transplantation in open waters.

### 3.8.7 GoI grant for Establishment of Pathological Laboratory

The Pathological Laboratory has been established at Patlikuhl which is fully equipped with, chemicals, laboratory equipments etc.

### 3.8.8 NHPC sponsored project Stage-II

The fund of 60.00 lakhs was received which has been spent on items described in Table 18.

### 3.8.9 Care & Maintenance of Trout Farms

Fishing in the Bilaspur district is allowed only under a license. There is size restriction on catching important species. The use of dynamite, other explosives and poisoning of fish is prohibited. There are also restrictions on the size of meshnets, use of weirs and erection of dams and diversion of water for the purpose of killing fish.

**Table 18: Progress under NHPC sponsored project Stage-II**

1.	Augmentation of water supply to Sultanpur fish farm
2.	Infrastructural development at Sultanpur fish farm
3.	Construction of alternate water supply to fish farm Holi
4.	Construction of degas chamber at Holi fish farm
5.	Purchase of Motor Boat
6.	Purchase of vehicle
7.	Aquarium building
8.	Furniture, Computer, Fax machine for ADF office
9.	Angling Hut constructed by BHPC at Sultanpur
10.	Salary & Traveling expenses of Driver
11.	Misc. expenses & bank draft commission deducted by NHPC
12.	Construction of 22 number of fish pond drain etc. at carp farm Sultanpur Distt. Chamba

The Fisheries Department has also initiated fish surveillance programme of private trout growers. Maintaining a high sustained yield is the backbone of the reservoir fisheries management. The Fisheries Department, while giving it a priority attention, has carefully developed a monitoring system. At each landing centre, fisheries officers, field assistants, sub-inspectors and helpers have been posted, who weigh the landed fish and species-wise record is maintained. They also maintain strict surveillance on mesh sizes, apprehend poachers and take action against them. Further in view of a long shoreline, the surveillance of the reservoir places a great demand on the limited man-power of the department. The situation becomes extremely acute during the closed season when fish are scarce in the market and the prices shoot up. The concentration of fish in the shallower areas for breeding makes them vulnerable to poaching. The Fisheries Department sets up a number of field camps during the closed season at such vulnerable points to control the poachers. The Fisheries Department has also set up flying squads in order to reinforce the surveillance. A conservation unit with a speed boat moves round the clock in the reservoir to protect the spawning grounds. In this way the Fisheries Department has been able to control the illegal fishing in the reservoir to a considerable extent. The Himachal Pradesh Government has enacted the Fisheries Act, 1976, and fishing

during closed season has been made a cognizable and non-bailable offence, inviting imprisonment upto three years and fine upto ` 3000/-. Further, the watch and ward staff has been given full power to seize fishing gears and to forfeit or confiscate fishing devices and fish.

### **3.9 Environment related studies carried out in the sector**

#### **3.9.1 An Evaluation Study of Community Fish Ponds Programme in Himachal Pradesh:**

Rural Planning Committee of 10<sup>th</sup> Vidhan Sabha (2005-06) in its 27<sup>th</sup> report under item 3 & 4 has recommended to check the construction quality of community fish ponds constructed during the year 2002-03 to 2004-05 under Scheduled Castes Sub Plan for Scheduled Castes and to fix the responsibility of defaulting individuals / agencies for poor construction quality. Keeping this in view, the evaluation of community fish ponds has been conducted with the following main objectives:-

1. To study the construction quality of community fish ponds.
2. To study the functional and non functional community fish ponds and the reasons for non functional community fish ponds.
3. To study the economics of community fish ponds.
4. To study the role of individuals / agencies for poor construction quality of community fish ponds.
5. To know the public perception about the community fish ponds.
6. To suggest the corrective measures for more effective implementation of the programme.

The findings of the study show that out of 32 ponds, 18 ponds were functional at the time of the survey. Non-functionality of tanks is due to lack of water supply and also due to leakage of tanks. The study reveals that average cost of production per pond is 10183 per annum. The

average annual turn out per pond is 510 kgs and net revenue is ` 9197 per annum. The cost of majority of surveyed tanks (27) was found to be less than 1.5 lakhs per pond. The detailed findings of the study are as under:

- 90.63% of the ponds are less than 0.5 ha. in area.
- 68.75% of ponds are kutcha, 18.75% are pucca ponds and 12.50% ponds are semi pucca.
- 56.25% ponds are functional and remaining 43.75% are non functional.
- 53.12% ponds are maintained by the panchayat itself and 46.88% ponds are maintained by individuals on lease basis.
- Procurement of fish seed for majority of ponds, i.e. 66.67% has been done from government source and for remaining 33.33% ponds it is done from private source.
- Average cost of production per pond is 10183 per annum.
- Average annual turn out per pond is 510 kgs and net revenue is ` 9197 per annum, which shows that community fish pond venture is profitable.
- 50% of the ponds are non-functional due to non-availability/ lack of water supply in ponds. Similarly 50% ponds are not functioning due to leakage of water, beside some other reasons.
- 50% of total sampled ponds cost between 1 lakhs and less than 1.5 lakhs whereas 34% are in the category of less than 1 lakhs and 16% falls in the category of 1.5 lakhs and 2 lakhs.

Considerable qualitative information is available on the biotic life of these ecosystems viz. fisheries, planktonic fauna and other micro organisms. The hill streams of Kangra valley are rich in fish fauna but majority of the species do not grow to large size. Large fish are mainly confined to the sanctuaries. These sanctuaries

mostly abound in *Tor putitora*, *Labeo dero* and *Cyprinus carpio*. Fish fauna from the flowing and stagnant waters of Himachal Pradesh has been studied which reported occurrence of 83 fish species belonging to 38 genera, fourteen families, seven orders, four super orders and super class Pisces. The ichthyofauna of Himachal Pradesh is represented by typical hill stream fish having peculiar adaptations conforming to the fast current of water, irregular basin and high levels of oxygen content. The presence of six exclusively coldwater fish species is the characteristic feature of the fish fauna of the State. Due to degradation of aquatic habitats of most of the fish species, a declining trend in the abundance of commercial fish species and overall fish biodiversity has been observed.

Under the project funded by Swedish International Development Agency (SIDA), a

team of experts carried out a survey of selected hill streams of Shimla and Solan districts to identify fish of Saror and Giri streams. Four species were characteristically rheophilic and mainly distributed along the southern Himalayan streams; *Schizothorax richardsonii* in both the Sutlej and Giri rivers, while other species were more localized. *Garra gotyla* has also been previously reported from Shimla. The *Crossocheilus* is tentatively identified as *C.gohama* and seems to be larger and more elongated than *C.latus*. *Gyptothorax pectinopterus* was found in both Giri and the Sutlej. *Barilius bendelisis* was encountered in large numbers in the two streams. Further four species of Balitorid loaches were encountered in Giri waters but notably no *Triplophysa*. *Schistura montana* was also encountered in Giri. Details of the survey are tabulated in Table 19.

**Table 19: Details of Survey**

Family	Species	Giri river Yashwant Nagar	Giri river Kotle	Saror stream
Cyprinidae	<i>Schizothorax richardsonii</i>	65	361	60
Cyprinidae	<i>Crossocheilus gobama</i>			11
Cyprinidae	<i>Bangana dero</i>			6
Cyprinidae	<i>Opsarius cocas</i>	49		
Cyprinidae	<i>Opsarius sp. cf. barna</i>	14		
Balitoridae	<i>Acanthocobitis botia</i>	6		
Balitoridae	<i>Schistura montana</i>	12	16	
Balitoridae	<i>Schistura sp. cf. afasciata</i>			2
Sisoridae	<i>Pseudocheilinus sulcata</i>		4	
Sisoridae	<i>Glyptothorax pectinopterus</i>	4	2	14
Mastacembelidae	<i>Mastacembalus armatus</i>	1		

Source: Himachal Pradesh State Biodiversity Strategy & Action Plan 2003

### 3.9.2 Gaps in information

Though the information on the variedness of aquatic ecosystems of Himachal Pradesh is available to a large extent but the same is not true of the aquatic fauna. The studies undertaken to record the aquatic life, both micro and macro organisms are highly limited; A list of fish available in the Himalayan region has been prepared. An inventory of the fish species available in the Kangra valley has been prepared. The planktonic, periphytic and fisheries of the Beas river have been recorded.

51 species of fish available in Gobind Sagar reservoir have been recorded. List of fish available in Pong reservoir has been prepared. However, there is no authentic record of the aquatic life available in different upland lakes and streams of Himachal Pradesh except for the study on Chandra and Bhaga river streams in Kinnaur and Lahaul & Spiti.

### 3.10 Environment monitoring (key parameters such as air and water pollution) carried out for activities related to the sector

#### 3.10.1 Surface Water Quality

The month wise variation in surface water quality of rivers in Himachal Pradesh is given in Table 20, Table 21, Table 22, Table 23 and Table 24 respectively.

**Table 20: River Quality Data (Annual Avg.)Year 2003**

Location	Temp (°C)	pH	DO (Mg/l)	BOD (Mg/l)	FC (MPN/100 ml)
Beas at u/s Manali, HP	6	8.1	10.0	0.3	135
Beas at d/s Kulu	10	8.0	9.1	0.7	283
Beas at d/s Aut,	7	8.0	10.1	0.9	82
Beas at u/s Pandon dam,	8	8.2	9.8	0.6	20
Beas at exit of Tunnel Dehal Power House	8	8.0	10.8	1.3	29
U/s Mandi	9	8.1	9.3	1.1	25
Beas at d/s Mandi	10	8.0	8.2	1.2	421
Beas at d/s Alampur	17	8.1	8.1	0.8	10
Beas at d/s Dehragopipur	19	8.1	7.7	1.0	26
Beas at d/s Pong dam	24	8.1	8.3	0.7	6
Sutlej at Neptha Zakhai	14	8.3	9.5	0.3	7
Sutlej at u/s Rampur	13	8.1	9.4	0.1	152
Sutlej at d/s Rampur	14	8.2	9.4	0.2	226
Sutlej at u/s Tatapani	15	8.2	9.2	0.2	104
Sutlej at u/s Slapper	10	8.4	9.5	0.8	38
Sutlej at d/s Slapper	9	8.3	10.2	0.9	41
Sutlej at d/s Bhakhra	16	8.3	9.2	0.4	2
Ravi at u/s Chamba	12	8.2	9.2	0.7	8
Ravi at u/s Madhopur	18	7.8	8.2	0.8	7
Parvati before conf. To river Beas	9	7.8	9.8	0.7	152
Largi at d/s, HP	6	7.8	10.4	0.6	80
River Sirsa, u/s Sitomajri Nallahgarh	23	8.3	8.0	0.2	77
River Sirsa, d/s Nalagarh bridge	26	8.3	7.6	0.4	318
Yamuna at d/s, at Paonta Shahib	20	8.9	8.0	2.0	46
Yamuna at u/s, at Paonta Shahib	22	8.9	7.7	4.8	76

Source: Central Pollution Control Board (<http://cpcb.nic.in/>)

**Table 21: River Quality Data (Annual Avg.)Year 2004**

Location	Temp (°C)	pH	DO (mg/l)	BOD (mg/l)	FC (MPN/100 ml)
Beas at u/s Manali	5	8.4	11.0	0.5	8
Beas at d/s Kullu	7	7.9	10.5	0.6	12
Beas at d/s Aut	8	8.1	10.2	0.5	7
Beas at u/s Pandon Dam	10	7.8	9.8	0.5	6
Beas at exit of tunnel Dehal Power House.	13	7.8	8.3	0.3	4
U/s Mandi	16	8.2	7.7	0.4	10
Beas at d/s Mandi	17	7.7	7.5	0.6	13
Beas at d/s Alampur	20	7.5	9.6	0.8	4

Location	Temp (°C)	pH	DO (mg/l)	BOD (mg/l)	FC (MPN/100 ml)
Beas at d/s Dehragopipur	21	7.7	9.3	1.3	5
Beas at d/s Pong Dam	25	8.1	7.5	0.8	4
Sutlej at Nethpa Zakhai	13	8.2	9.3	0.1	3
Sutlej at u/s Rampur	15	8.1	9.3	0.1	115
Sutlej at d/s Rampur	15	8.2	9.3	0.1	142
Sutlej at u/s Tatapani	17	8.1	9.4	0.1	107
Sutlej at u/s Slapper	15	7.6	7.7	0.7	7
Sutlej at d/s Slapper	15	7.8	7.9	0.3	7
Sutlej at d/s Bhakhra	21	8.0	8.8	0.1	8
Ravi at u/s Chamba	12	7.8	10.0	0.7	2
Ravi at u/s Madhopur	20	7.3	8.8	1.4	7
Parvati before conf. To river Beas	7	7.8	11.1	0.3	7
Largi at d/s, H.P.	6	7.8	10.7	0.7	4
River sirsa, u/s Sitomajri Nallahgarh,	25	8.2	8.2	0.3	30
River sirsa, d/s Nalagarh Bridge	30	8.1	7.2	2.3	460
Yamuna at d/s, at Paonta Shahib	20	7.5	7.3	5.4	31
Yamuna at u/s, at Paonta Shahib	20	7.9	7.5	5.8	56

Source: Central Pollution Control Board

**Table 22: River Quality Data (Annual Avg.)Year 2005**

Location	Temp (°C)	pH	DO (mg/l)	BOD (mg/l)	FC (MPN/100 ml)
U/s Manali	4	7.78	11.1	0.9	5
D/s Kulu	7	7.64	10.1	0.7	8
D/s Aut, h.p.	6	7.85	9.8	0.4	6
U/s Pandon Dam	7	7.77	9.2	0.7	6
Exit of tunnel Dehal Power House	11	8	10.1	0.7	7
U/s Mandi	16	8.01	9.2	0.6	8
D/s Mandi	18	7.98	9	0.7	17
D/s Alampur	26	7.8	8.7	1	4
D/s Dehragopipur	27	7.99	8.3	1.3	6
D/s Pong Dam	26	8.23	7.9	0.9	8
B/c with river Spiti at Khab, distt.Kinnaur	10	7.9	8.5	0.2	-
Neptha Zakhai	10	8.09	9.7	0.1	2
U/s Rampur	13	8.05	9.2	0.2	58
D/s Rampur	13	8.19	9.1	0.3	73
U/s Tatapani	13	8	9.3	0.2	77
U/s Slapper	14	8.05	9.1	0.5	10
D/s Slapper	16	8.09	9.6	0.6	8
D/s Bhakhra	12	8.13	9	0.1	20
Ravi at u/s Chamba	10	7.74	10.5	0.6	2
Ravi at u/s Madhopur	28	7.88	7.9	1.2	5
Parvati b/c to river Beas	6	7.74	10.4	0.7	8
Largi at d/s HP	5	7.88	10.2	0.7	5
River Sirsa, u/s Sitomajri Nallahgarh	25	7.99	8.3	0.9	29
River Sirsa, d/s Nalagarh Bridge	25	8.26	8.9	3.9	393



Location	Temp (°C)	pH	DO (mg/l)	BOD (mg/l)	FC (MPN/100 ml)
River Sirsa at d/s Nalagarh distt. Solan	30	8.12	8.9	2.1	270
Yamuna at d/s, at Paonta Shahib	21	8.3	7.6	2.5	18
Yamuna at u/s, at Paonta Shahib	21	8.3	7	4.3	29

Source: Central Pollution Control Board

**Table 23: River Quality Data (Annual Avg.)Year 2006**

Location	Temp (°C)	pH	DO (mg/l)	BOD (mg/l)	FC (MPN/100 ml)
Beas at u/s Manali	4	7.49	11	1	2
Beas at d/s Kullu	7	7.66	9.8	0.8	3
Beas at d/s Aut	7	7.88	10.6	0.7	2
Beas at u/s Pandon Dam	8	7.86	9.9	0.6	5
Beas at exit of tunnel Dehal Power House	9	7.85	9.5	0.7	4
U/s Mandi	15	7.97	8.8	0.7	2
Beas at d/s Mandi	16	7.85	8.5	0.9	7
Beas at d/s Alampur	19	7.72	7.6	0.7	5
Beas at d/s Dehragopipur	21	7.84	7.4	0.8	11
Beas at d/s Pong Dam	19	7.83	6.7	0.7	10
River Sutlej b/c with river Spiti at Khab, distt.Kinnaur	14	8.07	8.5	0.5	
Sutlej at Nethpa Zakhai	10	8.18	9.8	0.2	
Sutlej at u/s Rampur	11	8.03	10.3	0.1	28
Sutlej at d/s Rampur	12	8.18	10.3	0.4	38
Sutlej at u/s Tatapani	12	8.03	10.1	0.3	37
Sutlej at u/s Slapper	11	7.96	9	0.7	6
Sutlej at d/s Slapper	11	8.03	9.1	0.8	7
Sutlej at d/s Bhakhra	16	8.13	8.7	0.2	4
Ravi at u/s Chamba	10	7.85	10.1	0.8	5
Ravi at u/s Madhopur	21	7.7	7.6	0.6	5
Parvati before conf. To river Beas	7	7.61	10.1	0.4	3
Largi at d/s, H.P.	6	7.78	11	0.7	2
River Sirsa, u/s Sitomajri Nallahgarh	17	8.11	10.3	1.1	35
River Sirsa, d/s Nalagarh bridge	25	8.37	12.4	1.6	395
River Sirsa at d/s Nalagarh distt. Solan	25	7.85	9.2	23	950
River Yamuna at u/s at Paonta Shahib	20	9.12	8	4.6	11
River Yamuna at d/s at Paonta Shahib	20	9.22	8.1	4.3	15

Source: Central Pollution Control Board

**Table 24: River Quality Data (Annual Avg.)Year 2010**

Location	Temp (°C)	pH	DO (mg/l)	BOD (mg/l)	FC (MPN/100 ml)
Beas at u/s Manali	9	7.5	9.1	0.2	56
Beas at d/s Kullu	13	7.4	9.1	0.5	399
Beas at d/s Aut	12	7.6	9.5	0.3	127
Beas at u/s Pandon Dam	14	7.6	9.1	0.3	26

Location	Temp (°C)	pH	DO (mg/l)	BOD (mg/l)	FC (MPN/100 ml)
Beas at exit of tunnel Dehal Power House	18	7.5	9.6	0.2	39
U/s Mandi	18	8.0	8.8	0.5	1389
Beas at d/s Mandi	17	7.6	8.8	0.7	849
Beas at d/s Alampur	17	7.6	8.3	0.5	11
Beas at d/s Dehragopipur	16	7.4	8.2	0.5	12
Beas at d/s Pong Dam	19	7.4	7.2	0.8	12
River Sutlej b/c with river Spiti at Khab, distt.Kinnaur	8	8.1	8.8	0.2	3
Sutlej at Nethpa Zakhai	19	7.9	8	0.3	9
Sutlej at u/s Rampur	10	8.2	9.5	0.5	9
Sutlej at d/s Rampur	11	8.2	9.3	0.6	7
Sutlej at u/s Tatapani	11	8.1	9.5	0.6	12
Sutlej at u/s Slapper	17	7.6	9.6	0.4	86
Sutlej at d/s Slapper	16	7.8	9.7	0.4	124
Sutlej at d/s Bhakhra	20	7.9	8.8	0.3	6

Source: Central Pollution Control Board

3.8.2 Lakes/ Reservoir Water Quality: Lakes and reservoir water quality for the year 2003 to 2006 are given in Table 25, Table 26, Table 27 and Table 28 respectively.

**Table 25: Lakes Water Quality Data Year 2003**

Location	Temp (°C)	pH	Conductivity (Micromaho / cm)	DO (Mg/l)	BOD (Mg/l)	COD (Mg/l)	FC (MPN / 100 ml)	TC (MPN/ 100 ml)
Gobindsagar lake at Bilaspur	10	8.4	308	9.3	0.6	53	58	159
Pong dam lake at Pong village	24	8.4	236	8.1	0.9	3	5	27
Renuka lake , 35 km from Paonta Sahib	20	8.6	1207	8.1	6	42	33	85

**Table 26: Lakes and Reservoir Water quality data 2004**

Location	Temp (°C)	pH	Conductivity (Micromaho/ cm)	DO (Mg/l)	BOD (Mg/l)	FC (MPN/100 ml)	TC (MPN/100 ml)
Gobindsagar lake at Bilaspur	17	8	205	7.5	0.3	9	22
Pong dam lake at Pong village	27	8.1	229	7.7	1.1	2	13
Renuka lake, 35 km from Paonta Sahib	20	7.7	1077	7.3	4	24	53

**Table 27: Lakes /dam water Quality data 2005**

Location	Temp (°C)	pH	Conductivity (Micromaho/ cm)	DO (Mg/l)	BOD (Mg/l)	COD (Mg/l)	Nitrate (Mg/l)	FC (MPN/ 100 ml)	TC (MPN/ 100 ml)
Gobindsagar lake at Bilaspur	14	8.15	250	9.2	0.6	-	0.26	17	48
Pong dam lake at Pong village	27	8.33	169	7.7	1	3	0.37	2	22
Renuka lake , 35 km from Paonta Sahib	22	8.79	703	6.5	4.1	100	2.31	15	34

**Table 28: Lakes/ Reservoir Water quality data 2006**

Location	Temp (°C)	pH	Conductivity (Micromaho/cm)	DO (Mg/l)	BOD (Mg/l)	COD (Mg/l)	Nitrate (Mg/l)	FC (MPN / 100 ml)	TC (MPN / 100 ml)	TSS (Mg/l)
Gobindsagar lake at Bilaspur	12	8.06	221	8.8	0.5	7	0.2	9	469	1598
Pong dam lake at Pong village	24	7.95	211	8.4	0.8	4	0.2	4	31	7.2
Renuka lake , 35 km from Paonta Sahib	21	8.17	585	6.8	2.3	19.6	1.5	10	22	30

### 3.11 Institutional mechanisms within the sector to address identified environment issues

Fisheries Department in Himachal Pradesh was created during August 1950 as a wing of Forest Department headed by Deputy Warden of Fisheries. The main activities envisaged for the department was conservation of riverine fisheries, production and protection of sport fisheries, issuing of licenses, breeding and production of trout seed, their transplantation in rivers & streams for augmentation of riverine stock. Till February 1965, the control of the department mainly remained vested under the Forest department but later it was shifted to the Agriculture department for a short period of 6-7 months while subsequently it was declared as an independent department in early 1966. The Fisheries Department has been set up with the following mandates:

- To increase fish production in the State by judicious management of all the culturable water resources;
- To develop reservoir fishery of the State with an aim to increase per hectare production from the open impoundments;
- To undertake breeding programme of Indian and exotic carps, mahseer, trouts and other sub-temperate species for augmenting the seed stocking programme in reservoirs, river and streams; and tributaries;
- To protect and conserve reservoir and lacustrine fisheries' resources of the State;

- To promote game fishery in the State with particular emphasis on promotion of Tourism;
- To promote commercial farming of Rainbow Trout in the high altitude areas;
- To promote aquaculture in the State by providing technical and financial assistance to the fishermen and rural youths;
- To generate employment opportunities in the fishery sector and ameliorating the condition of fishermen of the State.

The Department of Fisheries is the nodal department for carrying out all activities connected with Fisheries in the State of Himachal Pradesh. The department is headed by Director-Cum-Warden of Fisheries. S/ he is assisted by Deputy Director (H.Q.), Deputy Director (Patlikuhl-Kullu) and Assistant Director(s) of Fisheries. The existing institutional framework of Department of Fisheries is shown in Figure 1 and responsibilities of the officers are described below:-

Director-Cum-Warden: - Director-cum-Warden of Fisheries being the administrative and professional head of the Fisheries Department in the State is responsible for the efficient working of this department; exercise all administrative and financial powers as adjoined upon the heads of the department in the Himachal Pradesh Government. S/he formulates various schemes for Development and Management of Inland Fisheries, Reservoir Fisheries and Cold Water Aquaculture in the

State and submits budget & re-appropriation proposals in consolidated form to the Govt. for the whole department for consideration & approval.

Deputy Director (H.Q.): - The Deputy Director of Fisheries (H.Q.) assists the Director-cum-Warden of Fisheries in the performance of his duties and responsibilities. S/he is responsible for finalizing all establishment matters and any other job assigned by the Head of Department.

Deputy Director -INTFP (Patlikuhl- Kullu): - The Deputy Director of Fisheries, Patlikuhl, Distt. Kullu, the head of the Indo-Norway Trout Farming Project, Patlikuhl (Kullu). He/She is assisted by Senior Fisheries Officer, Fisheries Officer ( Trout Farming), Fisheries Officers, Sub-Inspector Fisheries and Chief Executive Officer (FFDA). S/he responsible for the fisheries activities of entire Kullu district including Trout Fish Hatchery at Batahar, Kullu & Trout Fish Farm, Hamni (Kullu) and Technical/ Administrative head of area under his/her jurisdiction.

Assistant Director(s) of Fisheries: - The Assistant Director(s) of Fisheries of respective divisions will be the nodal officers who will be accountable for the entire departmental activities in their jurisdiction. They execute the plans & schemes earmarked by the Director of Fisheries, Budget control of various Fisheries schemes under him/her, assess impact of Hydel Power Projects envisaged in their areas and furnish the survey report and attend the departmental review meetings & District level meetings held in the respective districts/ jurisdiction where their presence is needed.

Senior Fisheries Officer(s): - The Senior Fisheries Officer(s) look after breeding, feeding, brood stock management in farms under their control, distribute fish seed to the fish farmers on demand against payment, process various schemes under component plan, process FFDA's cases & subsidy cases of fish farmers and assist the Assistant Director of Fisheries in the implementation of various schemes & plans.

Fisheries Officer(s):- The Fisheries Officer(s) look after breeding, feeding, brood stock management in farms under their control, distribute fish seed to the fish farmers on demand against payment, process various schemes under component plan, process FFDA's cases & subsidy cases of fish farmers and assist the Assistant Director of Fisheries in the implementation of various schemes & plans.

Assistant Engineer (Civil):- S/he responsible for maintaining departmental buildings in proper State, responsible for preparing necessary layouts & estimates for repairs or minor works and responsible for Technical Scrutiny of estimates prepared by other agencies for carrying out Minor & Major construction works in respect to departmental buildings.

Junior Engineer (Civil):- S/he prepares estimates for departmental construction works; prepare estimates of ponds under 20-point programme & other departmental subsidy schemes and any other duty assigned by the Director (Fisheries).

Sub-Inspector (s) Fisheries: - She/He record fish landings at their respective landing centres, implement Fisheries Act and Rules in water under their jurisdiction, assist Fisheries Officers/ Sr. Fisheries Officer in the Management of Fish farms/ hatcheries and extension activities.

Superintendent Grade-I: - He/She responsible for maintaining liaison between the staff and the Branch Officer or Middle-level officer in various matters, train and guide the staff posted in the section and to point out their shortcomings and deficiencies, if any, for remedial action; keep himself/herself well acquainted with the moral, conduct and discipline of the staff and also ensure that the staff comply with government instructions issued from time to time.

Based on the above institutional structure, gaps have been identified within the existing institutional framework which is described in Institutional Mechanism report. Further,

institutional responsibilities to implement actions identified and approved by the nodal department and line departments have also been described in Institutional Mechanism Report. In order to address environmental

issues identified in concerned sectoral guidelines, a number of interventions are required from the nodal department with identified line departments.

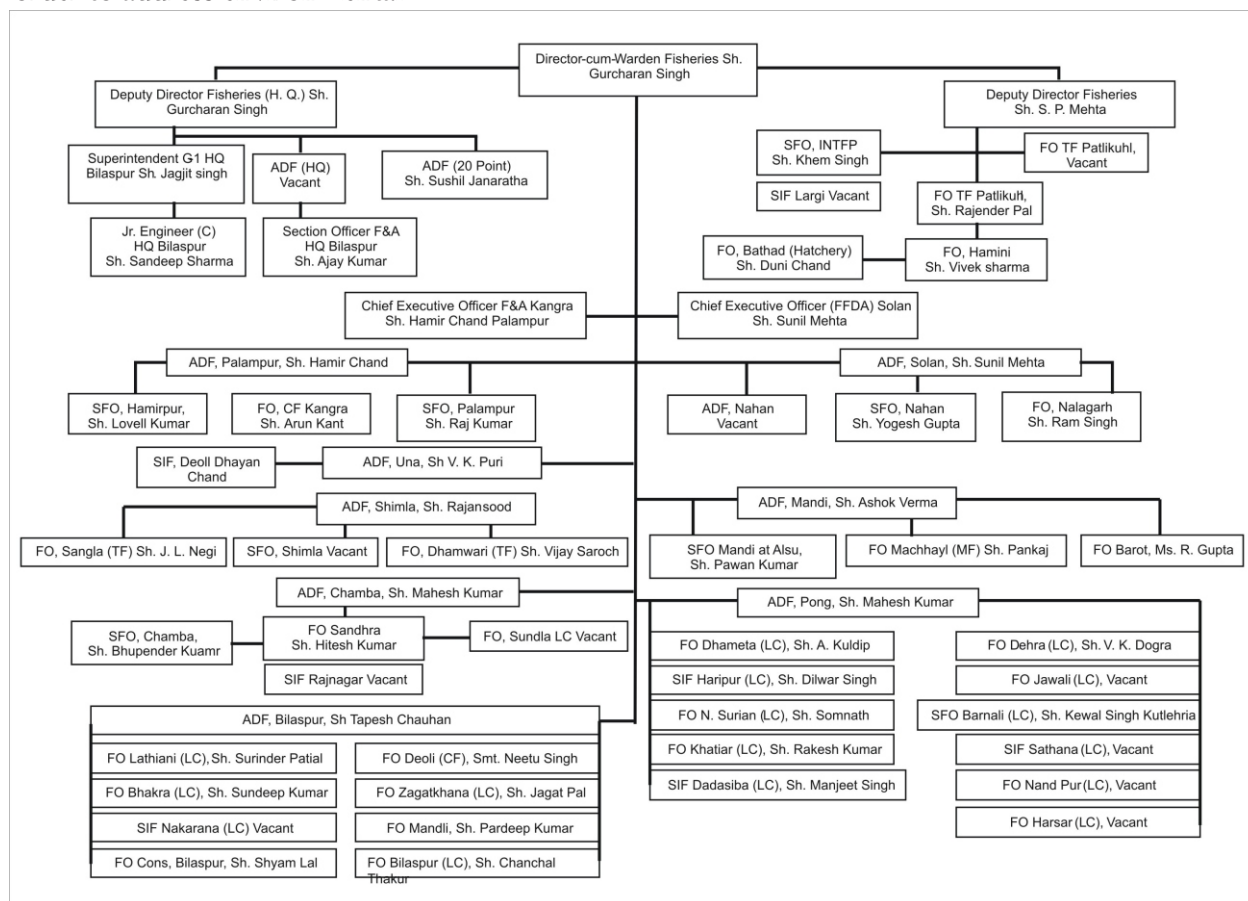


Figure 1: Organisational Chart of Fisheries Department

**3.12 Data / documentation pertaining to addressing demographic issues in the context of the sectors, such as population changes; requirements of population and changing lifestyles; migratory population including tourists;**

**transhumants; transit labour population; pressures felt by communities due to degraded environment conditions.**

Increase in incidences of illegal fishing as recorded in the districts in shown in Table 29 to Table 39

Table 29: Fishing activities in Bilaspur district

Year	Licensed fishermen (No.) registered	Production of fish (MT)	Approximate value of fish caught ('000 `)	Fishing offences detected	Compensation realised (`)
1	2	3	4	5	6
1994-95	1,054	1,128.3	158.56	539	59,847
1995-96					
1996-97	1,215	1,056.5	215.97	528	67,890
1997-98	1,327	1,015.9	205.80	500	77,405
1998-99	1,398	1,135.1	256.37	464	67,690
1999-2000	1,387	957.4	215.57	505	76,950

Source:- District Statistical Abstract-2000 (page-69) and Assistant Director of Fisheries, Bilaspur

**Chamba:** The Table given below gives the number of licensed fishermen, production of

fish and other related offences etc. from 1990-91 to 1998-99

**Table 30: Number of licensed fishermen and production of fish in Chamba district**

Year	No. of Licenced fishermen registered	Production of fish (MT )	Approximate Value of fish caught ('000)	Fishing offences detected	Compensation realised (₹)
1	2	3	4	5	6
1990-91	288	219.5	4438	31	1002
1991-92	319	260.2	6,505	42	1591
1992-93	327	268	6,698	45	1,940
1993-94	350	283	8,487	59	2,165
1994-95	343	257	7,697	65	4185
1995-96	341	270	8,112	41	2020
1996-97	322	216	8,650	42	1,950
1997-98	343	269	10,075	45	232
1998-99	304	229	9,158	16	690

Source: District Statistical Abstract, 2000

## Hamirpur

**Table 31: Production and value of catch fish from 1991-92 to 1999-2000 Fisheries**

Year	Registered and licensed	Fish production	Value of catch	Illegal fishing	Fine charged
1	2	3	4	5	6
1991-92	315	215	1,269	13	780
1992-93	326	255	4,558	11	1,200
1993-94	331	266	4,627	19	1,275
1994-95	107	156	3,120	8	550
1995-96	168	258	3,120	9	750
1996-97	202	256	3,120	21	1,900
1997-98	218	280	3,240	15	840
1998-99	219	318	9,548	11	900
1999-00	275	314	8,100	8	1,500

Source: District Statistical Abstract, Hamirpur-2001

**Kangra:** Production and value of fish during year 1987-88 to 1997-98 (Pong Reservoir).

**Table 32: Production and value of fish in Kangra district**

1	Production Ranges (in tonnes)	330 to 797
2	Total Production (in tonnes)	5,023
3	Average Yearly Production (in tonnes)	456
4	Value of Fish (₹ in lacs)	1,172
5	Total income (Rs in lacs)	196
6	Yearly (₹ in lacs)	17.90

During the year 1999-2000, there were 1,512 registered fishermen in the district and the total fish production was 1,930 metric tonnes, and the approximate value was Rupees 829 lacs.

**Table 33: Fisheries status in Kangra district**

Sl. No.	Items	1998-99	1999-2000
1	2	3	4
1	Number of licensed fishermen registered	1224	1512
2	Production of fish (in quintals)	2022	1930
3	Estimated values of fish (in lacs)	833	829
4	Fishing offences detected	74	74
5	Penalties realized (in Rupees)	7,810	10,345

Source: District Statistical Abstract, Kangra 2000

## Kinnaur

**Table 34: Fisheries status in Kinnaur District**

Sl. No.	Items	1998-99	1999-2000
1	2	3	4
1	Number of licensed fishermen registered	1224	1512
2	Production of fish (in quintals)	2022	1930
3	Estimated values of fish (in lacs)	833	829
4	Fishing offences detected	74	74
5	Penalties realized (in Rupees)	7,810	10,345

Source: District Statistical Abstract, Kinnaur 2000

## Mandi

**Table 35: Fisheries activities in Mandi district during the year 1998-99**

Year	No. of registered licensed fisherman	Fish Production (MT)	Estimated value of sale of fish (in lacs)	Unauthorized fishing offences	Fine received from offender
1	2	3	4	5	6
1998-99	614	414	178	168	18,000/=

Source: District Statistical Abstract, 2000 page 78

**Solan:** The following statement shows the position of fisheries in Solan district for the period from 1995 to 2000:

**Table 38: Fishermen, fish production, income etc. in Solan District**

Sl. No.	Item	1995-96	1996-97	1997-98	1998-99	1999-00
1	Licensed fishermen registered	232	240	255	240	259
2	Production of fish (M.Tonnes)	156	176	192	171	179
3	Approximate value of fish caught (000)	3,120	5,200	6,720	6,823	7,145
4	Fishing offenses detected(Numbers)	30	27	27	15	25
5	Compensation received(°)	7,619	3,810	3,830	2,000	4,320

Source: District Statistical Abstract, Solan 2000 page 82

**Una:** Fish production and its value, during year 1998-99 and 1999-2000 are given in the following statement.

## Shimla

**Table 36: Fisheries activities in Shimla district during the year 1998-99**

District	No. of registered fishermen	Production of fish (MT)	Cases of unauthorized fishing	Fine received for unauthorized fishing	Remarks
1	2	3	4	5	6
Shimla	261	269	52	6,310	-

Source: Statistical Abstract Shimla, 2000.

## Sirmaur

**Table 37: Fishing activities during the year 1998-99**

Sl. No.	Name of Item	Particulars
1	Registered License holder Fishermen	757 Numbers
2	Production of Fish	804 M.T.
3	Estimated value of fish caught during the year	18,400,000/-
4	Unauthorised Fishing Offences	94 numbers
5	Fine received from offenders	15,055/-
6	Fish Ponds	-

Source: Statistical Abstract Sirmaur, 2001 P. 54.

**Table 39: Fisheries status in Una District**

Sl. No.	Items	1998-99	1999-2000
1	2	3	4
1	No. of registered fishermen	242	241
2	Fish Production (in tonnes)	397.5	317.5
3	Value of catch fish (*000)	5,293.36	6,773.7
4	Illegal case of fish catdthng	118	125
5	Fine Recovered (°)	26,595	29,100

Source: District Statistical Abstract, Una 2001

### 3.12.1 Source wise production of fisheries:

The Department of Fisheries data shows that the, major source of fish production are rivers, ponds and reservoirs etc. Highest production of fisheries comes from the river, the production of fish in the year 2007 was 4027.2 MT, which slightly increased (4170.1 MT ) in the year 2009.

Pond and reservoirs also contribute to significant production of the total production of fish in Himachal Pradesh. The pond production was 2013.1MT in 2007 which has been increased to 2268.2 in the year 2009. The Carp production continuously decreased from the year 2007 to 2009. The production and the values of fisheries are given in Table 40 to Table 67.

**Table 40: Statistical Summary of source wise Production & Values of Fisheries Department of Fisheries for the month March 2007**

Name of District	Fish Production in tones					Value of Fish Production in lakhs						
	Rivers	Ponds	Reservoirs	Carp	Table Size Fish	Total	Rivers	Ponds	Reservoirs	Carp	Table Size Fish	Total
Bilaspur	271.5	181.5	484.5	0.4	0.0	937.9	95.0	63.5	164.9	0.1	-	323.6
Chamba	240.3	15.0	2.4	0.1	0.2	258.0	96.1	6.0	1.0	0.0	0.4	103.6
Hamirpur	318.0	201.0	0.0	0.0	0.0	519.0	127.2	80.4	-	-	-	207.6
Kangra	1465.0	706.5	311.6	0.0	0.0	2483.1	586.0	282.6	179.7	0.1	-	1048.4
Kullu	242.7	15.5	0.0	0.0	29.1	287.3	145.6	9.3	-	-	57.1	212.0
Mandi	618.0	100.5	0.0	0.0	17.9	736.4	247.2	40.2	-	0.1	35.0	322.5
Shimla	167.7	7.6	0.0	0.0	0.0	175.4	117.4	5.3	-	-	-	122.8
Sirmaur	454.0	251.8	0.0	0.0	0.0	705.8	181.6	100.7	-	-	-	282.3
Solan	168.7	131.9	0.0	0.0	0.0	300.6	67.5	52.8	-	-	-	120.2
Una	81.3	401.8	0.0	0.0	0.0	483.0	32.5	160.7	-	-	-	193.2
Kinnaur	0.0	0.0	0.0	0.0	0.4	0.4	0.0	0.0	-	-	0.8	0.8
Lahaul & Spiti	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	-	-	0.0
Total	4027.2	2013.1	798.4	0.6	47.6	6886.9	1696.2	801.5	345.6	0.3	93.3	2937.0

**Table 41: Statistical Summary of source wise Production & Values of Fisheries Department of Fisheries for the month March 2008**

Name of District	Fish Production in tones					Value of Fish Production in lakhs						
	Rivers	Ponds	Reservoirs	Carp	Table Size Trout	Total	Rivers	Ponds	Reservoirs	Carp	Table Size Trout	Total
Bilaspur	300.5	191.5	769.1	0.2	0.0	1261.4	150.3	95.8	313.0	0.2	0.0	559.1
Chamba	261.2	20.8	3.2	0.1	2.3	287.6	130.6	10.4	1.5	0.1	2.3	147.0
Hamirpur	251.5	235.8	0.0	0.0	0.0	487.3	100.6	94.3	-	0.0	0.0	194.9
Kangra	1470.6	742.5	375.0	0.0	0.0	2588.2	588.2	297.0	26.54	0.0	0.0	1145.9
Kullu	275.4	13.0	0.0	0.0	35.8	324.1	165.2	7.8	-	0.0	35.8	243.1
Mandi	593.9	100.0	0.0	0.0	26.1	720.0	296.9	50.0	-	0.0	26.1	398.1
Shimla	195.5	25.4	0.0	0.0	2.4	224.3	137.5	17.8	-	0.0	2.4	160.0
Sirmaur	398.0	222.5	0.0	0.0	0.0	620.5	199.0	11.3	-	0.0	0.0	310.3
Solan	166.3	132.0	0.0	0.0	0.0	298.3	83.1	66.0	-	0.0	0.0	149.1
Una	84.3	440.1	0.0	0.0	0.0	524.4	59.0	308.0	-	0.0	0.0	367.1
Kinnaur	0.0	0.0	0.0	0.0	0.7	0.7	0.0	0.0	-	0.0	0.7	1.5
Lahaul & Spiti	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	0.0	0.0	1.0
Total	3998.1	2123.6	1147.3	0.3	67.3	7336.6	1910.5	1058.4	314.5	0.3	67.3	3676.9



**Table 42: Statistical Summary of source wise Production & Values of Fisheries  
Department of Fisheries for the month March 2009**

Name of District	Fish Production in tones						Value of Fish Production in lakhs					
	Rivers	Ponds	Reservoirs	Carp	Table		Rivers	Ponds	Reservoirs	Carp	Table	
					Size	Total					Trout	Total
Bilaspur	300.5	201.0	1028.4	0.3	0.0	1530.2	150.3	100.5	440.0	-	-	-
Chamba	267.5	25.0	2.8	0.6	0.2	296.0	133.7	12.5	1.5	0.1	0.5	148.5
Hamirpur	256.0	244.0	0.0	0.0	0.0	500.0	128.0	122.0	-	0.3	-	250.0
Kangra	1481.7	775.0	283.6	0.1	0.0	2540.4	740.9	387.5	201.6	-	-	330.0
Kullu	252.0	15.0	0.0	0.0	37.3	304.3	151.2	9.0	-	0.0	73.1	233.3
Mandi	608.2	87.0	0.0	0.1	3.1	698.5	304.1	43.5	-	-	6.1	353.8
Shimla	270.6	53.6	0.0	0.0	2.7	326.9	189.4	37.5	-	0.1	5.3	232.3
Sirmaur	488.0	278.4	0.0	0.0	0.0	766.4	244.0	139.2	-	-	-	383.2
Solan	166.3	138.2	0.0	0.0	0.0	304.5	83.1	69.1	-	-	-	152.2
Una	79.4	451.0	0.0	0.0	0.0	530.4	31.8	180.4	-	-	-	212.2
Kinnaur	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	-	-	2.2	2.2
Lahaul & Spiti	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	-	-	0.0
Total	4170.1	2268.2	1314.8	1.0	44.5	7798.6	2156.4	1101.2	643.1	0.5	87.2	3988.5

**Table 43: Statistical Summary of Fish Production (Riverine), Department of Fisheries for the month March 2007 to 2009**

Name of Division	Fish Production in tones – 2007			Fish Production tones – 2008			Fish Production in tones – 2009		
	During the month	C Total	FFDA Ponds	During the month	C Total	FFDA Ponds	During the month	C Total	FFDA Ponds
Chamba	96.89	240.27	15	53.12	261.462	20.8	27.1	267.46	25
Hamirpur	30	318	201	61.2	251.462	235.8	40.5	256	244
Kangra	82.5	1465	706.5	188.442	1470.624	742.5	190.6	1481.72	775
Kullu	24.937	242.705	15.45	86.175	275.373	13	36.21	252	15
Mandi	118.4	618.023	100.5	107.863	593.866	100	106.19	608.2	87
Shimla	37.38	167.715	7.64	32.438	196.469	25.4	80.89	270.59	53.64
Sirmaur	93	454	251.82	59	398	222.53	83	488	278.35
Solan	16.946	168.676	131.911	24.937	166.251	132	24.94	166.26	138.19
Una	7.25	81.29	401.75	14.7	84.315	440.05	14.17	79.415	451
G Total	545.303	4027.179	2013.071	674.375	3998.06	2123.58	632.505	4170.144	2268.18

**Table 44: Statistical Summary of Fish Production (Reservoir), Department of Fisheries for the month March 2007 to 2009**

Name of Reservoir	Fish Production in tones - 2007		Value of Fish - 2007		Fish Production in tones - 2008		Value of Fish - 2008		Fish Production in tones - 2009		Value of Fish - 2009	
	During Month	C Total	Produced (lakhs)	Produced (lakhs)	During Month	C Total	Produced (lakhs)	Produced (lakhs)	During Month	C Total	Produced (lakhs)	Produced (lakhs)
Gobind Sagar	28.49	484.48	164.89	164.89	126.56	769.13	313	313	133.41	1028.4	440	440
Pong Dam	27.26	311.56	179.69	179.69	80	375	260.54	260.54	24.85	283.6	201.63	201.63
Chamera	0.477	2.39	0.99	0.99	0.9	3.15	1.45	1.45	0.96	2.785	1.49	1.49
Total	56.2268	798.43	345.57	345.57	207.46	1147.28	574.99	574.99	159.22	1314.785	643.12	643.12

**Table 45: Statistical Summary of Production (Trout), Department of Fisheries for the month March 2007 – 2009**

Name of Trout	Trout Production in Nos. 2007		Seed Trout Production in Nos. 2008		Trout Production in Nos. 2009		Seed Trout Production in Nos. 2009		Fry/fingerlings Production in Nos. 2007		Fry/fingerlings Production in Nos. 2008		Fry/fingerlings Production in Nos. 2009	
	Ova	Alvin	Ova	Alvin	Ova	Alvin	Ova	Alvin	Fry	Fingerlings	Fry	Fingerlings	Fry	Fingerlings
Patlikuhl (kullu)	326022	243280	370755	219724	394178	249737	224600	165876	216298	216298	245737	204323		
S.F.O. Kullu	0	0	NA	NA	NA	NA	0	0	NA	NA	NA	NA		
Nagni	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Barot (Mandi)	325000	247950	245800	225365	327400	256359	238312	104666	198760	82136	212025	97981		
Sangla	22000	25162	31300	28189	60000	28291	24224	9466	27625	18643	31653	24990		
Dhamwari	27200	71860	44700	14550	53600	47620	43883	0	41973	35249	37400	58900		
Holi	81443	4522	74400	45698	0	0	0	20032	38963	38963	34433	38859		
Total	781665	592774	766955	533526	835178	582007	531019	300040	523619	391289	561248	425053		

**Table 46: Statistical Summary of Production/Sale (Trout), Department of Fisheries for the month March 2007 – 2009**

Trout	Table size production/ Sale kgs- 2007		Table size production/ Sale kgs- 2008		Table size production/ Sale kgs- 2009	
	Brown (Table)	Rainbow (Table)	Brown (Table)	Rainbow (Table)	Brown (Table)	Rainbow (Table)
Patlikuhl (kullu)	0	14618.9	0	11766.35	0	10312
S.F.O Kullu	0	0	NA	NA	NA	NA
Nagni	0	0	0	0	0	0
Barot (Mandi)	71.1	1242.15	217.95	1861.22	187.5	1785.3
Sangla	0	421.1	0	739.7	0	1106.9
Dhamwari	0	0	0	0	0	430.96
Holi	0	219.5	0	395.141	0	185.1
Total	71.1	16501.65	217.95	14762.411	187.5	13820.26

**Table 47: Statistical Summary of Total Production (Carp), Department of Fisheries for March 2007–2009**

Crap Farms	Total (C.C.+I.M.C+Gold+Other)- 2007			Total (C.C.+I.M.C+Gold+Other)- 2007			Total (C.C.+I.M.C+Gold+Other)- 2007		
	Spawns in Lakhs	Fry in lakhs	Sale of Table size in kg	Spawns in Lakhs	Fry in lakhs	Sale of Table size in kg	Spawns in Lakhs	Fry in lakhs	Sale of Table size in kg
Deoli	115.4	10.5	408.0	120.5	10.6	242.0	120.5	9.9	265.5
Alsu	22.1	0.4	44.5	29.9	2.8	4.0	30.1	7.5	129.3
Kangra	15.3	1.9	29.5	19.3	2.1	28.4	15.4	1.0	56.9
Sultanpur	17.0	10.2	105.0	30.2	9.2	101.0	50.0	17.8	102.0
Total	169.8	22.9	507.0	199.9	24.7	375.4	261.1	36.1	553.7

Note: CC: Common Carp, IMC: Indian Major Carps

**Table 48: Carp Farms Stocking Details (Fry/Fingerlings in lakhs) 2007- 09**

Name of Farms	Gobind Sagar			Pong Dam			Chamera Reservoir			B.T. I & II			Rural Ponds of Shimla Division		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Carp Farms	2007	2008	2009	2007	2008	2009	2007	2008	2009	2007	2008	2009	2007	2008	2009
Deoli (C.C.)	7.2	5.5	5.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	1.0	0.4
(I.M.C.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alsu (C.C.)	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
(I.M.C.)	0.0	2.8	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kangra (C.C.)	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(I.M.C.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sultanpur (C.C.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	8.0	0.0	0.0	0.0	0.0	0.0	0.0
(I.M.C.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Name of Farms 1	Rural Ponds of Bilaspur Div.			Rural Ponds of Palampur Div.			Rural Ponds of Mandi Division			Rural Ponds of other Division		
	17	18	19	20	21	22	23	24	25	26	27	28
Carp Farms	2007	2008	2009	2007	2008	2009	2007	2008	2009	2007	2008	2009
Deoli (C.C.)	1.0	0.8	1.1	0.6	0.9	2.3	1.1	1.3	0.6	0.0	0.0	0.0
(I.M.C.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alsu (C.C.)	0.0	0.0	0.1	0.0	0.0	1.5	0.0	0.0	0.6	0.0	2.0	0.0
(I.M.C.)	0.0	0.0	0.1	0.1	0.0	0.1	0.2	0.0	0.5	0.0	0.0	0.2
Kangra (C.C.)	0.0	0.0	0.0	0.0	2.1	0.0	0.0	0.0	0.0	1.9	0.0	0.0
(I.M.C.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	-	-
Sultanpur (C.C.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.5	0.0
(I.M.C.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Name of Farms 1	Transferred to other farms/died			Total Stocking			Balance Stock on Farm		
	29	30	31	32	33	34	35	36	37
Carp Farms	2007	2008	2009	2007	2008	2009	2007	2008	2009
Deoli (C.C.)	0.0	0.0	0.0	10.4	9.5	9.9	0.0	1.1	0.0
(I.M.C.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.7
Alsu (C.C.)	0.0	0.0	0.0	0.0	2.0	3.7	0.0	0.2	19.7
(I.M.C.)	0.0	0.0	0.0	0.4	2.8	3.8	0.0	0.0	0.0
Kangra (C.C.)	0.0	0.0	0.0	1.9	2.1	1.5	0.0	0.0	13.9
(I.M.C.)	-	-	-	0.0	0.0	0.0	0.0	0.0	0.0
Sultanpur (C.C.)	0.2	0.2	0.6	6.4	5.5	8.0	1.0	3.5	9.2
(I.M.C.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

**Table 49: Trout Farms Stocking Details (Fry/Fingerlings in lakhs) 2007 – 09**

Name of Farms 1	Kandu (Ani)			Jibi Khad			Tirthan			Bagipul	Lamba Khad	Lambad ag	Uhal, Lambadag & Thadukhad
	2	3	4	5	6	7	8	9	10	11	12	13	14
Trout Farms	2007	2008	2009	2007	2008	2009	2007	2008	2009	2007	2008	2009	2007
Patlikuhl	5000	0	0	5000	0	0	5000	0	0	10000	0	0	0
Nagni	0	0	0	0	0	0	0	0	0	0	0	0	0
Barot	0	0	0	0	0	0	11700	6000	0	0	26500	36000	66556
Sangla	0	0	0	0	0	0	0	0	0	0	0	0	0
Dhamwari	0	0	0	0	0	0	0	0	0	0	0	0	0
Holi	0	0	0	0	0	0	0	0	0	0	0	0	5812

Name of Farms 1	Janjali & chorah		Pawar	Auhl		Bakholi Khad	Other place		Other / Died			Transferred to other farm		
	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Trout Farms	2008	2009	2007	2008	2009	2007	2008	2009	2007	2008	2009	2007	2008	2009
Patlikuhl	0	0	0	0	0	4000	0	0	11380	16790	10524	0	0	0
Nagni	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Barot	0	0	0	4000	0	0	0	0	4851	4724	8463	1933	0	0
Sangla	0	0	0	0	0	0	0	13000	1400	0	449	0	0	0
Dhamwari	0	0	1695	0	0	0	0	39425	0	0	19475	0	0	0
Holi	0	0	0	0	0	0	12880	12000	1539	14527	9647	0	0	0

Name of Farms 1	Sale of Fingerlings			Total			Balance Stock		
	29	30	31	32	33	34	35	36	37
Trout Farms	2007	2008	2009	2007	2008	2009	2007	2008	2009
Patlikuhl	73506	156403	163533	113886	173193	174057	51990	43105	30266
Nagni	0	0	0	0	0	0	0	0	0
Barot	14660	36267	43100	99700	77491	87563	4966	4645	10418
Sangla	770	1000	1475	2170	1000	14924	7296	17643	10066
Dhamwari	0	0	0	1695	0	58900	0	35249	0
Holi	1200	4400	4500	2739	31807	26147	17293	7156	12712

**Table 50: Revenue from Riverine for the Month of March (2007 to 2009)**

Division	Av. Sale Rate / Kg	License Fee	Compensation	Auction of Con. Fish	Royalty	Sale of Seed	Deptt. Rent	Misc.	Other	Total
<b>Riverine (Revenue) in ` - 2007</b>										
Bilaspur	35	36,000	9,550	-	-	-	-	-	-	45,550
Chamba	40	20,300	8,050	-	-	-	12,290	-	14,236	54,876
Hamirpur	40	36,000	700	235	-	-	-	-	-	36,935
Kangra	40	171,500	21,200	100	-	-	8,424	-	9,035	210,259
Kullu	60	28,500	2,700	-	-	-	23,462	-	16,235	70,897
Mandi	40	80,000	19,450	-	-	-	26,855	-	1,140	100,590
Shimla	70	27,400	6,100	1,824	-	-	-	-	1,077	36,401
Sirmaur	40	52,880	5,350	-	-	-	-	-	500	58,730
Solan	40	23,180	3,350	3,300	-	-	8,399	-	84,366	122,595
Una	40	10,000	650	-	-	-	1,368	-	-	12,018
<b>Total</b>	<b>44.5</b>	<b>485,760</b>	<b>77,100</b>	<b>5,459</b>	<b>0</b>	<b>0</b>	<b>53,943</b>	<b>0</b>	<b>126,589</b>	<b>748,851</b>
<b>Riverine (Revenue) in ` - 2008</b>										
Bilaspur	50	39,800	10,250	-	-	-	-	-	-	50,050
Chamba	50	23,300	10,410	-	-	-	12,472	-	6,186	52,368
Hamirpur	40	34,000	1,200	-	-	-	-	-	-	35,200
Kangra	40	177,900	23,800	1,200	-	-	9,079	9,000	-	220,979
Kullu	60	27,200	4,800	-	-	-	-	-	-	32,000
Mandi	50	81,100	19,800	-	-	-	-	-	100	101,000
Shimla	70	33,100	9,800	-	-	-	8,915	-	-	51,815
Sirmaur	50	59,040	4,700	-	-	-	-	-	-	63,740
Solan	50	22,400	3,150	2,250	-	-	7,616	-	7,611	43,027
Una	70	10,500	950	-	-	-	1,442	-	100	12,992
<b>Total</b>	<b>53</b>	<b>508,340</b>	<b>88,860</b>	<b>3,450</b>	<b>0</b>	<b>0</b>	<b>39,524</b>	<b>9,000</b>	<b>13,997</b>	<b>663,171</b>
<b>Riverine (Revenue) in ` - 2009</b>										
Division	Av. Sale Rate / Kg	License Fee	Compensation	Auction of Con. Fish	Royalty	Sale of Seed	Deptt. Rent	Misc.	Other	Total
Bilaspur	50	40,400	13,800	-	-	-	-	-	-	54,200
Chamba	50	23,860	11,000	-	-	-	13,328	-	2,996	51,184
Hamirpur	50	35,000	300	-	-	-	-	-	-	35,300
Kangra	50	185,680	27,935	120	-	-	9,204	-	5,205	228,144
Kullu	60	27,700	2,400	-	-	-	-	-	-	30,100
Mandi	50	82,080	21,000	-	-	-	-	-	5,935	109,015
Shimla	70	41,300	8,200	2,000	-	-	9,288	-	220	61,008
Sirmaur	50	57,720	13,650	-	-	-	-	-	75	71,445
Solan	50	23,600	5,000	2,230	-	-	8,568	-	3,060	42,458
Una	40	10,500	1,000	-	-	-	342	-	14,396	26,238
<b>Total</b>	<b>52</b>	<b>527,840</b>	<b>104,285</b>	<b>4,350</b>	<b>-</b>	<b>-</b>	<b>40,730</b>	<b>0</b>	<b>31,887</b>	<b>709,092</b>

**Table 51: Revenue from Reservoir for the Month of March 2007 to 2009**

Reservoir	Average Rate per Kg.	License Fee	Compensation	Auction of Con. Fish	Royalty	Sale of Seed	Deptt. Rent	Misc.	Other	Total
<b>Reservoir (Revenue) in `-2007</b>										
Gobind Sagar	34.0	97840	108635	13745	2475360	-	-	12603	-	2708183
Pong Dam	57.7	178104	180085	10974	2696304	-	25151	163230	-	3253848
Chamera	41.4	4800	7430	20	15044	-	-	90	-	27384
<b>G. Total</b>	<b>44.4</b>	<b>280744</b>	<b>296150</b>	<b>24739</b>	<b>5186708</b>	<b>-</b>	<b>25151</b>	<b>175923</b>	<b>0</b>	<b>5989415</b>
<b>Reservoir (Revenue) in `-2008</b>										
Gobind Sagar	40.7	100160	117675	46585	4704360	0	0	10471	0	4979251
Pong Dam	69.48	180952	207650	6895	3910439	0	32853	16571	0	4355360
Chamera	46.03	6350	7500	115	23040	0	0	75	0	37080
<b>G. Total</b>	<b>52.07</b>	<b>287462</b>	<b>332825</b>	<b>53595</b>	<b>8637839</b>	<b>0</b>	<b>32853</b>	<b>27117</b>	<b>0</b>	<b>9371691</b>
<b>Reservoir (Revenue) in `-2009</b>										
Gobind Sagar	42.78	120450	145250	42385	6599044	0	0	11352	0	6918481
Pong Dam	71.1	188084	210280	13188	3023006	0	30023	72194	0	3536775
Chamera	53.5	6350	7615	240	24000	0	0	0	0	38205
<b>G. Total</b>	<b>55.79</b>	<b>314884</b>	<b>363145</b>	<b>55813</b>	<b>9646050</b>	<b>0</b>	<b>30023</b>	<b>83546</b>	<b>0</b>	<b>10493461</b>

**Table 52: Revenue from Trout for the Month of March (2007 to 2009)**

Trout	Fish Feed Production in Kg.	Sale Fish		Licence Fee	Compensation	Sale of Trout		Sale of Table Size trout	Sale Fish Feed	Other	Total	Revenue with Society	Revenue with Department
		Feed in Kg. (Feed)	Ova / Alvin			Fry/ Finger-lings							
<b>Trout (Revenue in `Rs.) 2007</b>													
Patlikuhah (Kullu)	64,278	17,739	-	-	3,081	251,638	3,362,491	999,346	787	4,617,343	NA	NA	
S.F.O. Kullu	-	-	40,100	5,300	-	-	-	-	-	45,400	NA	NA	
Nagni	-	-	-	-	-	-	-	-	-	-	NA	NA	
Barot (Mandi)	-	-	11,200	2,200	-	138,061	262,650	-	700	414,811	NA	NA	
Sangla	-	-	700	-	-	-	87,180	-	-	87,880	NA	NA	
Dhamwari	-	-	700	-	-	-	-	-	-	700	NA	NA	
Holi	-	-	1,000	-	9,000	-	43,900	-	600	54,500	NA	NA	
<b>Total</b>	<b>64,278</b>	<b>17,739</b>	<b>53,700</b>	<b>7,500</b>	<b>12,081</b>	<b>389,699</b>	<b>3,756,221</b>	<b>999,346</b>	<b>2,087</b>	<b>5,220,634</b>	<b>NA</b>	<b>NA</b>	
<b>Trout (Revenue in `Rs.) 2008</b>													
Patlikuhl (Kullu)	76,477	33,384	52,500	4,200	-	507,095	2,802,362	2,244,986	24,025	5,635,168	NA	NA	
S.F.O. Kullu	-	-	-	-	-	-	-	-	-	-	NA	NA	
Nagni	0	0	-	-	-	-	-	-	-	-	NA	NA	
Barot (Mandi)	0	0	16,400	800	-	369,401	440,574	-	2,745	829,920	NA	NA	
Sangla	0	0	700	-	-	3,800	156,487	-	-	160,987	NA	NA	
Dhamwari	0	0	800	-	-	63,000	-	-	2,900	66,700	NA	NA	
Holi	0	0	2,000	-	-	3,000	98,317	-	-	103,317	NA	NA	
<b>Total</b>	<b>76,477</b>	<b>33,384</b>	<b>72,400</b>	<b>5,000</b>	<b>-</b>	<b>946,296</b>	<b>3,497,740</b>	<b>2,244,986</b>	<b>29,670</b>	<b>6,796,092</b>	<b>NA</b>	<b>NA</b>	
<b>Trout (Revenue in `Rs.) 2009</b>													
Patlikuhah (Kullu)	80,690	39,487	59,100	11,800	20,000	494,599	2,227,431	2,915,092	29,380	5,757,402	5,677,602	79,800	
S.F.O. Kullu	-	-	-	-	-	-	-	-	-	-	-	-	
Nagni	0	0	-	-	-	-	-	-	-	-	-	-	
Barot (Mandi)	0	0	18,700	2,400	-	292,830	434,093	-	365	748,388	726,923	21,465	
Sangla	0	0	1,200	300	-	4,935	243,581	-	-	249,953	-	249,953	
Dhamwari	0	0	900	-	-	-	94,740	-	3,200	98,840	-	98,840	
Holi	0	0	2,000	-	-	13,500	41,162	-	-	56,662	-	56,662	
<b>Total</b>	<b>80,690</b>	<b>39,487</b>	<b>81,900</b>	<b>14,500</b>	<b>20,000</b>	<b>805,864</b>	<b>3,040,944</b>	<b>2,915,092</b>	<b>32,945</b>	<b>6,911,245</b>	<b>6,404,525</b>	<b>506,720</b>	

**Table 53: Revenue from Carp Farms for the Month of March (2007 to 2009)**

Carp Farms	Common Carp			Common Carp			Gold	Other	R. House	Total	Revenue with Society	Revenue with Deptt
	Spawns	Fry (C.C.)	Table Size (C.C.)	Spawns (I.M.C.)	Fry (I.M.C.)	Table Size (I.M.C.)	Fry (Gold Fish)	Table Size (Grass/Other)	Others			
<b>Carp (Revenue in Rs. ) 2007</b>												
Deoli	0	32900	0	0	0	0	13776	12240	6,529	65,445	NA	NA
Alsua	0	0	0	0	3815	900	10515	525	760	16515	NA	NA
Kangra	0	885	19178	0	0	0	2573	0	1030	23,666	NA	NA
Sultanpur	0	11700	4200	0	0	0	0	0	0	15900	NA	NA
<b>Total</b>	<b>0</b>	<b>45485</b>	<b>23378</b>	<b>0</b>	<b>3815</b>	<b>900</b>	<b>26864</b>	<b>12765</b>	<b>8319</b>	<b>121,526</b>	<b>NA</b>	<b>NA</b>
<b>Carp (Revenue in Rs.) 2008</b>												
Deoli	0	41557	12125	0	0	0	14930	5915	14962	89489	NA	NA
Alsua	0	0	0	0	0	200	7350	0	0	7550	NA	NA
Kangra	0	21226	1420	0	0	0	5606	0	2686	30938	NA	NA
Sultanpur	0	12100	5050	0	0	0	0	0	0	17150	NA	NA
<b>Total</b>	<b>0</b>	<b>74883</b>	<b>18595</b>	<b>0</b>	<b>0</b>	<b>200</b>	<b>27886</b>	<b>5915</b>	<b>17648</b>	<b>145127</b>	<b>NA</b>	<b>NA</b>
<b>Carp (Revenue in Rs.) 2009</b>												
Deoli	0	45945	13050	0	0	0	16520	4920	10973	91408	91,408	-
Alsua	0	50	23750	0	13810	6415	0	0	2255	46280	-	46280
Kangra	0	0	19498	0	0	0	9875	0	50	29423	-	29423
Sultanpur	0	13400	5100	0	0	0	0	0	0	18500	-	18500
<b>Total</b>	<b>0</b>	<b>59395</b>	<b>61398</b>	<b>0</b>	<b>13810</b>	<b>6415</b>	<b>26395</b>	<b>4920</b>	<b>13278</b>	<b>185611</b>	<b>91,408</b>	<b>94,203</b>

**Table 54: Statistical Summary of Licenses (Riverine), Department of Fisheries for the month March 2007 to 2009**

Name of Division	Detail of Licenses in Nos. 2007					Detail of Licenses (in Nos.) 2008					Detail of Licenses in Nos. 2009				
	Cast Net	Rod & Line	Bar Pata	Duplicate	Total	Cast Net	Rod & Line	Bar Pata	Duplicate	Total	Cast Net	Rod & Line	Bar Pata	Duplicate	Total
Bilaspur	360	0	0	0	360	398	0	0	0	398	404	0	0	0	404
Chamba	203	0	0	0	203	233	0	0	0	233	237	4	0	0	241
Hamirpur	360	0	0	0	360	340	0	0	0	340	350	0	0	0	350
Kangra	1555	0	16	0	1571	1639	0	14	0	1653	1672	12	18	0	1702
Kullu	285	0	0	0	285	267	0	0	0	267	277	0	0	0	277
Mandi	800	0	0	0	800	811	5	0	0	816	820	2	0	0	822
Shimla	274	0	0	0	274	331	0	0	0	331	404	9	0	0	413
Sirmaur	512	42	0	0	554	496	236	0	0	732	542	88	0	0	630
Solan	229	7	0	0	236	222	5	0	0	227	236	0	0	0	236
Una	100	0	0	0	100	105	0	0	0	105	105	0	0	0	105
G. Total	4678	49	16	0	4743	4842	246	14	0	5102	5047	115	18	0	5180

**Table 55: Statistical Summary of Licenses (Reservoir), Department of Fisheries for the month March (2007 to 2009)**

Name of Division	Detail of Licenses in Nos. 2007					Detail of Licenses (in Nos.) 2008					Detail of Licenses in Nos. 2009				
	Cast Net	Rod & Line	Bar Pata	Duplicate	Total	Cast Net	Rod & Line	Bar Pata	Duplicate	Total	Cast Net	Rod & Line	Bar Pata	Duplicate	Total
Gobind Sagar	1710	265	0	0	1975	1600	504	0	0	2104	2013	495	0	0	2508
Pong Dam	3450	140	0	2	3592	3422	246	0	6	3674	3536	282	0	2	3820
Chamera	96	0	0	0	96	127	0	0	0	127	127	0	0	0	127
Total	5256	405	0	2	5663	5149	750	0	6	5905	5676	777	0	2	6455

**Table 56: Statistical Summary of Licenses (Trout), Department of Fisheries for the month March (2007 to 2009)**

Name of Division	Detail of Licenses in Nos. 2007					Detail of Licenses (in Nos.) 2008					Detail of Licenses in Nos. 2009				
	Cast Net	Rod & Line	Bar Pata	Duplicate	Total	Cast Net	Rod & Line	Bar Pata	Duplicate	Total	Cast Net	Rod & Line	Bar Pata	Duplicate	Total
Patlikuhah (Kullu)	0	0	0	0	0	0	525	0	0	525	0	591	0	0	591
S.F.O. Kullu	0	401	0	0	401	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nagni	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Barot (Mandi)	0	112	0	0	112	0	164	0	0	164	0	187	0	0	187
Sangla	0	7	0	0	7	0	7	0	0	7	0	13	0	0	13
Dhamwari	0	7	0	0	7	0	8	0	0	8	0	9	0	0	9
Holi	0	10	0	0	10	0	20	0	0	20	0	20	0	0	20
Total	0	537	0	0	537	0	724	0	0	724	0	820	0	0	820

**Table 57: Target and Achievements in licence upto March (2007 to 2009)**

Division	Licence - 2007					Licence - 2008					Licence - 2009				
	General Water Target	General Water Achieved	Trout Water Target	Trout Water Achieved	Reservoir Achieved	General Water Target	General Water Achieved	Trout Water Target	Trout Water Achieved	Reservoir Achieved	General Water Target	General Water Achieved	Trout Water Target	Trout Water Achieved	Reservoir Achieved
Bilaspur	360	360	0	0	1710	378	398	0	0	1600	400	404	0	0	2013
Chamba	320	203	50	10	96	336	233	20	20	127	240	241	22	20	127
Hamirpur	360	360	0	0	0	378	340	0	0	0	350	350	0	0	0
Kangra	1800	1571	0	0	0	1890	1653	0	0	0	1700	1702	0	0	0
Kullu	280	285	600	401	0	294	267	630	525	0	270	277	550	591	0
Mandi	870	800	10	112	0	914	816	115	164	0	820	822	170	187	0
Shimla	300	274	50	7	0	315	331	15	8	0	335	413	15	9	0
Sirmaur	600	554	0	0	0	630	732	0	0	0	735	630	0	0	0
Solan	250	236	0	0	0	262	227	0	0	0	235	236	0	0	0
Una	100	100	0	0	0	105	105	0	0	0	105	105	0	0	0
Kinnaur	0	0	50	7	0	0	0	20	7	0	0	0	10	13	0
Lahaul & Spiti	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pong Dam	0	0	0	0	3450	0	0	0	0	3422	0	0	0	0	3536
Directorate	-	-	0-	-	-	-	-	-	-	-	-	-	-	-	-
Total	5240	4743	850	537	5256	5502	5102	800	724	5149	5190	5180	767	820	5676

**Table 58: Achievements in Illegal Cases upto March (2007 to 2009)**

Division	Illegal Cases in Numbers - 2007			Illegal Cases in Numbers - 2008			Illegal Cases in Numbers - 2009		
	General Water Achieved	Reservoir Achieved	Trout Water Achieved	General Water Achieved	Reservoir Achieved	Trout Water Achieved	General Water Achieved	Reservoir Achieved	Trout Water Achieved
Bilaspur	44	507	0	46	552	0	50	524	0
Chamba	94	76	0	108	70	0	110	58	0
Hamirpur	8	0	0	3	0	0	3	0	0
Kangra	52	0	0	57	0	0	63	0	0
Kullu	27	0	46	48	0	33	22	0	81
Mandi	155	0	22	151	0	6	169	0	22
Shimla	36	0	0	49	0	0	38	0	1
Sirmaur	45	0	0	42	0	0	63	0	0
Solan	27	0	0	29	0	0	34	0	0
Una	13	0	0	17	0	0	15	0	0
Kinnaur	0	0	0	0	0	0	0	0	0
Lahaul & Spiti	0	0	0	0	0	0	0	0	0
Pong Dam	0	416	0	0	380	0	0	422	0
Directorate	-	-	-	-	-	-	-	-	-
Total	501	999	68	550	1002	39	567	1004	104

**Table 59: Target and Achievements in Fish production from March (2007 to 2009)**

Division	Riverine			Reservoir			Ponds		
	Target	Achieved	%	Target	Achieved	%	Target	Achieved	%
<b>Fish Production in tonnes-2007</b>									
Bilaspur	270	272	101%	800	484.5	61%	180	182	101%
Chamba	240	240	100%	5	2.4		15	15	100%
Hamirpur	270	318	118%	0	0		200	201	101%
Kangra	1350	1465	109%	0	0		700	707	101%
Kullu	210	243	116%	0	0		50	15	31%
Mandi	644	618	96%	0	0		113	101	89%
Shimla	224	168	75%	0	0		126	8	6%
Sirmaur	450	454	101%	0	0		250	252	101%
Solan	172	169	98%	0	0		200	132	66%
Una	70	81	116%	0	0		400	402	100%
Kinnaur	0	0		0	0		0	0	
Lahaul & Spiti	0	0		0	0		0	0	
Pong Dam	0	0		450	311.6	69%	0	0	
Directorate	-	0		-	0		-	0	
<b>Total</b>	<b>3900</b>	<b>4027</b>	<b>103%</b>	<b>1255</b>	<b>798.4</b>	<b>64%</b>	<b>2234</b>	<b>2013</b>	<b>90%</b>
<b>Fish Production in tonnes-2008</b>									
Bilaspur	300	300.5	100%	500	769.13	154%	190	191.5	101%
Chamba	260	261.2	100%	5	3.15		16	20.8	130%
Hamirpur	330	251.462	76%	0	0		210	235.8	112%
Kangra	1700	1470.624	87%	0	0		740	742.5	100%
Kullu	265	275.373	104%	0	0		16	13	81%
Mandi	670	593.866	89%	0	0		105	100	95%
Shimla	180	196.469	109%	0	0		24	25.4	106%
Sirmaur	480	398	83%	0	0		260	222.53	86%
Solan	175	166.251	95%	0	0		140	132	94%
Una	85	84.315	99%	0	0		420	440.05	105%
Kinnaur	5	0	0%	0	0		1	0	
Lahaul & Spiti	0	0	0%	0	0		0	0	
Pong Dam	0	0	0%	350	375	107%	0	0	
Directorate	-	-	0%	-	-		-	-	
<b>Total</b>	<b>4450</b>	<b>3998</b>	<b>90%</b>	<b>855</b>	<b>1147</b>	<b>134%</b>	<b>2122</b>	<b>2123.58</b>	<b>100%</b>
<b>Fish Production in tonnes-2009</b>									
Bilaspur	300	300.5	100%	800	1028.4	129%	200	201	101%
Chamba	260	267.46	103%	5	2.785		25	25	100%
Hamirpur	255	256	100%	0	0		240	244	102%
Kangra	1475	1481.72	100%	0	0		775	775	100%
Kullu	275	252	92%	0	0		15	15	100%
Mandi	595	608.2	102%	0	0		110	87	79%
Shimla	196	270.589	138%	0	0		25	53.64	215%
Sirmaur	400	488	122%	0	0		250	278.35	111%
Solan	168	166.26	99%	0	0		140	138.19	99%
Una	84	79.415	95%	0	0		445	451	101%
Kinnaur	0	0	0%	0	0		0	0	
Lahaul & Spiti	0	0	0%	0	0		0	0	
Pong Dam	0	0	0%	400	283.6	71%	0	0	
Directorate	-	-	0%	-	-		-	-	
<b>Total</b>	<b>4008</b>	<b>4170.144</b>	<b>104%</b>	<b>1205</b>	<b>1314.79</b>	<b>109%</b>	<b>2225</b>	<b>2268.18</b>	<b>102%</b>

**Table 60: Target and achievements in revenue from March (2007 to 2009)**

Division	Revenue in Lakhs-2007			Revenue in Lakhs-2008				Revenue in Lakhs-2009			
	Target	Achieved	%	Target	Deposited in Deptt. Head	Deposited in AFMS Head	Total	% on Deptt. Receipt	Target	Achieved	%
Bilaspur	38.5	28.19	73%	43.45	50.29	0.89	51.19	116%	43.45	70.64	163%
Chamba	2	1.53	76%	2.1	2.1	0	2.1	100%	2.1	1.65	78%
Hamirpur	0.25	0.37	148%	0.38	0.35	0	0.35	93%	0.38	0.35	93%
Kangra	2.75	2.34	77%	2.75	2.52	0	2.52	92%	2.75	2.58	94%

Division	Revenue in Lakhs-2007			Revenue in Lakhs-2008					Revenue in Lakhs-2009		
	Target	Achieved	%	Target	Deposited in Deptt. Head	Deposited in AFMS Head	Total	% on Deptt. Receipt	Target	Achieved	%
Kullu	1.6	47.34	2959%	1.25	0.89	55.78	56.67	71%	1.25	1.1	88%
Mandi	2.05	5.32	259%	2.05	1.26	8.13	9.38	61%	2.05	1.77	86%
Shimla	0.75	0.37	49%	0.5	1.19	0	1.19	237%	0.5	1.6	320%
Sirmaur	0.95	0.59	62%	0.6	0.64	0	0.64	106%	0.6	0.71	119%
Solan	0.38	1.23	323%	1.25	0.43	0	0.43	34%	1.25	0.42	34%
Una	0.22	0.12	55%	0.15	0.13	0	0.13	87%	0.15	0.26	175%
Kinnaur	0.85	0.88	103%	0.9	1.61	0	1.61	179%	0.9	2.5	278%
Lahaul & Spiti	0	0	0%	0	0	0	0	0%	0	0	0%
Pong Dam	39.35	32.54	83%	47.8	43.55	0	43.55	91%	47.8	35.37	74%
Directorate	1.35	4.18	310%	1.35	3.29	0	3.91	244%	1.35	2.52	187%
Total	91	124.98	137%	104.53	108.24	64.81	173.67	104%	104.53	121.5	116%

**Table 61: Target and Achievements in Carp Farm Production from March, 2007 to 2009**

Name of Farms	Seed Production Table Size Production - 2007				Seed Production Table Size Production - 2008				Seed Production Table Size Production - 2009			
	In lakhs		In tones		In lakhs		In tones		In lakhs		In tones	
	Targets	Achieved	Targets	Achieved	Targets	Achieved	Targets	Achieved	Targets	Achieved	Targets	Achieved
Deoli	115.00	115.40	1.00	0.41	120.00	120.50	1.95	0.24	120.00	120.50	0.65	0.27
Alsua	50.00	22.12	0.50	0.04	50.00	29.94	0.75	0.00	50.00	30.14	0.05	0.13
Kangra	20.00	15.28	0.25	0.03	20.00	19.25	0.05	0.03	20.00	15.42	0.05	0.06
Sultanpur	30.00	17.01	0.25	0.11	30.00	30.16	0.25	0.10	50.00	50.03	0.25	0.10
Nalagarh					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gargret					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	215.00	169.81	2.00	0.59	220.00	199.85	3.00	0.38	240.00	216.09	1.00	0.55

**Table 62: Target and Achievements in Trout Farm Production from March (2007 to 2009)**

Trout Farms	Ova Production		Fingerlings		Table size production		Sale of Fish Feed	
	In lakhs	In lakhs	In lakhs	In lakhs	In lakhs	In lakhs	In lakhs	In lakhs
	Targets	Achieved	Targets	Achieved	Targets	Achieved	Targets	Achieved
<b>Trout Farms Production – 2007</b>								
Patlikuhl	3.00	3.26	1.50	1.66	13.00	14.62	NA	NA
Nagni	0.00	0.00	0.00	0.00	0.00	0.00	NA	NA
Barot	2.00	3.25	1.00	1.00	1.50	1.31	NA	NA
Sangla	0.25	0.22	0.13	0.13	0.50	0.42	NA	NA
Dhamwari	0.50	0.27	0.50	0.50	0.50	0.00	NA	NA
Holi	1.00	0.81	0.25	0.25	0.50	0.22	NA	NA
Total	6.75	7.82	3.38	3.38	16.00	16.57	NA	NA
<b>Trout Farms Production – 2008</b>								
Patlikuhl	3.50	3.71	2.10	2.16	14.00	11.77	0.00	76.48
Nagni	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Barot	3.00	2.46	1.80	0.81	3.00	2.08	0.00	0.00
Sangla	0.30	0.31	0.18	0.19	1.00	0.74	0.00	0.00
Dhamwari	0.50	0.45	0.42	0.35	1.00	0.00	0.00	0.00
Holi	0.70	0.74	0.30	0.39	1.00	0.40	0.00	0.00
Total	8.00	7.67	4.80	3.91	20.00	14.98	0.00	0.00
<b>Trout Farms Production – 2009</b>								
Patlikuhl	3.75	3.94	2.25	2.04	12.00	10.13	0.00	80.69
Nagni	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Barot	3.00	3.27	1.80	2.20	2.20	1.97	0.00	0.00
Sangla	0.50	0.60	0.30	0.80	0.80	1.11	0.00	0.00
Dhamwari	1.00	0.54	0.60	0.50	0.50	0.43	0.00	0.00
Holi	0.80	0.00	0.48	0.50	0.50	0.19	0.00	0.00
Total	9.05	8.35	5.43	16.00	16.00	14.00	0.00	0.00

**Table 63: Reservoirs Species-wise Catch statistics (Qty in tonnes) 2007 to 2009**

Name of Reservoir	Reservoirs Species-wise Catch statistics (Qty in tons) 2007													
	Catla catla	L. rohita	C. mirgal	L. calbhas	C. carpio	Tot putitora	L. Dero	Silver carp	M. seenghala	W. Attu	Grass carp	Channa Sp.	Other	Total
Gobind Sagar	36.3	14.8	4.0	0.7	147.6	17.9	8.8	231.3	12.6	0.0	10.7	0.0	0.0	484.5
Pong Dam	1.0	8.4	13.8	0.3	20.5	50.2	0.3	0.1	213.3	0.0	0.0	2.3	1.5	311.6
Chamera	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	2.4



**Table 64: Statistical Summary of Illegal Cases (Riv erine), Department of Fisheries for the month March 2007 to 2009**

Name of Division	Illegal Cases in Nos. 2007			Illegal Cases (in Nos.) 2008			Illegal Cases (in Nos.) 2009		
	Case Reg.	Comp.	Pend.	Case Reg.	Comp.	Pend.	Case Reg.	Comp.	Pend.
Bilaspur	44	44	0	46	46	0	50	50	0
Chamba	94	94	0	108	108	0	110	110	0
Hamirpur	8	8	0	3	3	0	3	3	0
Kangra	52	52	0	57	57	0	63	63	0
Kullu	27	27	0	48	48	0	22	22	0
Mandi	155	155	0	151	151	0	169	169	0
Shimla	36	36	0	49	49	0	38	38	0
Sirmaur	45	45	0	42	40	2	63	63	0
Solan	27	27	0	29	25	4	34	34	0
Una	13	13	0	17	17	0	15	15	0
G. Total	501	501	0	550	544	6	567	567	0

**Table 65: Statistical Summary of Illegal Cases (Reservoir, Department of Fisheries for the Month March 2007 to 2009**

Name of Reservoir	Illegal Cases (in Nos.) - 2007			Illegal Cases (in Nos.) - 2008			Illegal Cases (in Nos.) - 2009		
	Case Reg.	Comp.	Pending	Case Reg.	Comp.	Pending	Case Reg.	Comp.	Pending
Gobind Sagar	507	491	16	552	540	12	524	321	203
Pong Dam	416	416	0	426	426	0	422	421	1
Chamera	76	76	0	70	70	0	58	58	0
Total	999	983	16	1048	1036	12	1004	800	204

**Table 66: Statistical Summary of Illegal Cases (Trout), Department of Fisheries for the Month March 2007 to 2009**

Name of Reservoir	Illegal Cases (in Nos.) - 2007			Illegal Cases (in Nos.) - 2008			Illegal Cases (in Nos.) - 2009		
	Case Reg.	Comp.	Pending	Case Reg.	Comp.	Pending	Case Reg.	Comp.	Pending
Patlikuhl (Kullu)	0	0	0	33	33				
S.F.O. Kullu	46	46	0	NA	NA				
Nagni	0	0	0	0	0				
Barot (Mandi)	22	22	0	6	6				
Sangla	0	0	0	0	0				
Dhamwari	0	0	0	0	0				
Holi	0	0	0	0	0				
Total	68	68	0	39	39				

**Table 67: Statistical Summary of Co-op. Societies (Reservoir), Department of Fisheries (March 2007 – 2009)**

Reservoir	Fisheries Co-op. Societies – 2007			Fisheries Co-op. Societies – 2008			Fisheries Co-op. Societies – 2009		
	No. of So.	Member	ID	No. of So.	Member	ID	No. of So.	Member	ID
Gobind Sagar	18	2726	1497	18	2746	1412	21	3211	1737
Pong Dam	15	2594	1725	15	2587	1711	15	2658	1768
Chemera	5	117	96	3	117	86	3	125	81
Total	38	5437	3318	36	5450	3209	39	5994	3586

### 3.13 Information on human resource management issues (which may have relevance to environment management) in the sector such as: manpower, vocational training, awareness levels etc.

The Department of Fisheries has capabilities to manage all kind of activities/ problems related to Fisheries. The existing status of Fisheries officers/ employees is given in Table 68 and the organization structure of Department of Fisheries, Govt. of Himachal Pradesh is given in figure 1. The status of employees/ officers and their responsibilities are as under:

**Table 68: Manpower status (as on 31-10-2009) in Department of Fisheries**

Sr. No.	Fisheries Officials/ Staff	Existing Staff (No.)	Sanctioned Staff (No.)	Vacant Position (No.)
1	Assistant Director of Fisheries	8	-	-
2	Sr. Fisheries Officer	4	7	3
3	Fisheries Officer	23	31	8
4	Sub-Inspector Fisheries	12	15	3
5	Superintendent Grade- II	4	4	0
6	Senior Assistant	9	9	0
7	Personal Assistant	1	1	0
8	Farm Assistant	3	7	4
9	Field Assistant	129	143	14
10	Jr. Assistant Clerk	24	39	15
11	Steno Typist	1	1	0
12	Feed Mill Operator cum Mech.	1	1	0
13	Pump Operator	1	1	0
14	Motor Mechanic	1	1	0
15	Fishermen	39	48	9
16	Motor Boat Driver	0	4	4
17	Drivers	8	9	1
18	Peons	22	22	0
19	Chowkidar	12	13	1
20	Chowkidar-cum- Sweeper	1	1	0

Source: Department of Fisheries, Himachal Pradesh

### Manpower Status of trout fish and carp fish farms

Manpower Status of trout fish farms: The present status of trout farms in terms of availability of human resources and their development are as under:

#### 1. Bathar Hatchery

• Deputy Director	1
• Senior Fisheries Officer	1
• Fisheries Officer	-
• Sub Inspector Fisheries	1
• Superintendent G-II	1
• Clerk	3
• Stenographer	-
• Farm Assistant	-
• Feed mill Mechanic	1
• Field Assistant / Fishermen / Pump opp.	10
• Chowkidar / Peon	2
• Driver	1

#### 2. Barot Trout Farm

• Fisheries Officer	1
• Farm Assistant	-
• Fishermen / Field Assistant	4 + 3*(for Uhl river)
• Chowkidar	1

#### 3. Holi Trout Farm

• Fisheries Officer	1
• Sub Inspector	1
• Field assistant	3
• Chowkidar	1

#### 4. Trout Farm Dhamwari

• Fisheries Officer	1
• Field Assistant	2
• Fishermen	3
• Chowkidar	1

**Manpower Status of carp fish farms:** The present status of carp farms are given below.

#### 1. Deoli (Bilaspur)

• Fisheries Officer	1
• Farm Assistant	1
• Field Assistant / Fishermen	5
• Chowkidar	-

#### 2. Alsu Farm (Mandi)

• Fisheries Officer	1
• Farm Assistant	1
• Field Assistant / Fishermen	5
• Chowkidar	1

#### 3. Kangra Farm

• Fisheries Officer	1
• Farm Assistant	-
• Fishermen	4
• Chowkidar	1

#### 4. Sultanpur Farm (Chamba)

• Assistant Director	1
• Senior Fisheries Officer	1
• Clerk	2
• Assistant Director	1
• Senior Fisheries Officer	1
• Clerk	2
• Peon	2
• Chowkidar	1
• Farm Assistant	-
• Field Assistant	3
• Fishermen	2
• Daily paid	-
• Driver	1

Training and capacity building has been identified as one of the major area of intervention. The area and scope of training programme for nodal department and other collaborating agencies have been described in report on Training and Capacity Enhancement.

### 3.14 Regulatory analysis to identify and regulations that have environment implications (negative or positive), and compliance with the same

Fisheries sector and cross sector policy and regulatory framework at State level shows the intent of the State Government to address identified issues. A list of policy and programme is given below:-

- National Water Policy 2002 and State Water Policy, 2005 (Draft)
- National Environment Policy (NEP), 2006
- National Wetlands Conservation Programme, 1986 updated in 2009
- Guidelines for National Lake Conservation Plan, 2008
- State Urbanization Policy, 2009
- EIA notification September 14, 2006 and subsequent amendments
- The Indian Forest Act, 1927
- HP Forest Sector Policy & Strategy, 2005
- Forest (Conservation) Act, 1980 and subsequent amendments
- National Afforestation Programme (NAP) Scheme
- Integrated Development of Wildlife Habitat.
- Catchment Area Treatment Plans (w.e.f. Aug 2009)
- Wetlands (Conservation and Management) Rules, 2010
- State Tourism Policy, 1991 / Tourism Policy – 2005 (Himachal Pradesh)

- Revised Policy on Development of Ecotourism in Himachal Pradesh, 2005
- Water (Prevention and Control of Pollution) Act 1974, Amended – 1986
- Environment (Protection) Act, 1986
- Himachal Pradesh Non-Biodegradable Garbage (Control) Act, 1995
- Himachal Pradesh Non-Biodegradable Garbage (Control) Rule, 1996
- Biological Diversity Act, 2002 and Biodiversity Rules, 2004
- The Wildlife (Protection) Act, 1972
- The Indian Fisheries Act, 1882
- The Indian Fisheries Act, 1897
- National Biodiversity Action Plan, 2008
- Himachal Pradesh Fisheries Act, 1976
- Himachal Pradesh Fisheries Rules, 1979
- Himachal Pradesh Fisheries (Fourth Amendment) Rules
- The Wildlife Protection Act, 1973 and Amendments
- Himachal Pradesh Fisheries (Sixth Amendment) Rules, 2008

## References

- State Biodiversity Strategy & Action Plan – 2008
- Department of Fisheries, HP
- Evaluation study on community fish pond report
- Manmade lakes & reservoirs planning and development, 11<sup>th</sup> Five Year Plan of HP
- Central Pollution Control Board
- Districts Statistical Abstract – 2000
- Statistical Outline of HP, 2009-10
- State Environment Report
- Department of Economic & Statistics, HP
- HP Aquaculture, Fishing and Marketing Society

## CHAPTER 4 AGRICULTURE

### 4.1 Resource inventory of existing assets of the sector

Agriculture is the largest occupation and source of livelihood to most people in Himachal Pradesh which is about 66.71% of the total population. The topography of the State is largely hilly where cultivation is mainly done on terraces. The cultivation in hills is subjected to soil erosion since crop cultivation is practiced on 5% to over 30% slopes. This also affects soil fertility status and changes in pH values. Cultivation is mainly (80.9%) rain dependent. The size of holdings of less than one or one ha covers 61.5% of the farming community. The small and marginal farmers put together, account for 82.1% and cover an area of 43%. The medium farmers with holdings ranging from two ha to ten ha cover an area of 47.2%. Approximately 80% of all holdings fall in the category of small and marginal farmers. The agricultural work force is 34.41% of the total population, of which 63.25% are cultivators. The ratio of agricultural labourers to total workers was only 2.66% as per 1991 census.

The prime land available for agriculture lies in Palam, Balh, Poanta valleys and small strips in Nalagarh, Kangra, Spiti and Saproon valleys which contribute to less than 5% of the total geographical area. Total area available for agriculture is less than 17%.

Important crops grown in the State are namely maize, wheat, rice and barley, pulses, oilseeds, buck wheat and minor millets; cash crop namely potato, ginger, tea, peas, kuth, hop and a variety of vegetables including out-of season and exotic vegetables and fruits particularly apple, prune, stone and dry fruits like chilgoza, walnut, pistachio, etc.

Agro-climatically, the State has been divided into four zones keeping in view the altitude, rainfall, temperature, humidity and topography. The salient features of the four agro-climatic zones (Fig. 1) are shown in Table 1. Table 1 indicates that, while maximum geographical area of the State falls under high hills and temperate dry zone (Zone-IV), the highest percentage of cropped area is in the mid hills and sub-humid zone (Zone-II). Likewise, the maximum precipitation is experienced in Zone II which ranges from 1,500 to 3,000 mm per annum. These four Agro-climatic zones indicate a vast potential for growing diverse crop plant species. The salient features of different zones have been briefly described below.

#### i. Sub-Montane and Low Hills Subtropical Zone

(Zone-I): The soils of this zone are productive, if fertilized. The texture of the soil varies from loamy to sandy loam. The average rainfall is 1100 mm of which 80 per cent is received during July to September. The farming is rain fed as only 16.6% of the total area is under irrigation. Table 2 describes crops grown in different Agro-climatic zones in the State.

ii. Mid-hills Sub-humid Zone (Zone-II): The texture of the soils in Zone II is loam to clay loam. These are deficient in nitrogen and phosphorus and have poor water and nutrient holding capacity. The area from Dharamshala to Jogindernagar in the foothills of Dhauladhar ranges receives rainfall as high as 3,000 mm most of which comes between mid June to mid September. In the remaining areas, it is around 1,500 mm. While maize, rice, wheat, potato, pulses and oilseeds are major field crops, stone and citrus fruits are important fruit crops (Table 2). The area under irrigation is only 17.5% and kuhls (gravitational flow channels) are the important source of irrigation.

iii. Mid-hills Temperate Dry Zone (Zone-III): The soils of this zone are shallow in depth, acidic in reaction and silt loam to loam in texture. These are deficient in nitrogen and phosphorus. The average rainfall is 1,000 mm most of which is received during the monsoon season. The zone is suitable for growing horticultural crops, particularly apple, plum and apricot. Cultivation of off-season vegetable crops like peas, cabbage, cauliflower and tomato has gained ground in some areas (Table 2).

iv. High Hills Temperate Dry Zone (Zone-IV): The soils of this zone are mainly sandy loam, neutral to alkaline in reaction and have low fertility. This zone has the highest percent of irrigated area (40.6%). The important crops include potato, barley, buck wheat, peas and minor millets (Table 2). The area is particularly suitable for growing off-season vegetables and seed production. In general, only one crop can be grown during the whole of the agricultural year because of heavy snowfall in winter from November to April. The details of the districts and Tehsils falling under different agro-climatic zones are given in Table 3.



Figure 1: Different Agro-Climatic Zones of Himachal Pradesh

Table 1: Salient features of Different agro-climatic zones of Himachal Pradesh

Particulars	Sub-montane low hills zone (Zone-I)	Mid-hills high humid zone (Zone-II)	High hills temperate wet zone (Zone-III)	High hills temperate dry zone (Zone-IV)
Geographical area (000 ha)	913.2 (16.4%)	1183.2 (21.3%)	1280.9 (23.0%)	2190.0 (39.0%)
Total cropped area	355.1 (38.0%)	383.4 (41.0%)	171.8 (18.4%)	24.0 (2.6%)
Elevation	Below 650 metres (above mean sea level)	650-1800 metres (above mean sea level)	1800-2200 metres (above mean sea level)	2200 metres and above (above mean sea level)
Soil pH	Neutral, coarse texture	Acidic, coarse texture	Acidic in reaction shallow in depth and slopy	Neutral reaction, coarse texture

Particulars	Sub-montane low hills zone (Zone-I)	Mid-hills high humid zone (Zone-II)	High hills temperate wet zone (Zone-III)	High hills temperate dry zone (Zone-IV)
Rainfall	About 1000 mm	1500-3000 mm	About 1000 mm	250 mm
Field crops	Rice maize, wheat and pulses	Rice, maize, wheat barley, pulses	Maize, potato and wheat, off-season vegetables	Barley, potato wheat and off-season vegetables
Fruits	Sub-tropical fruits	Apple, other temperate fruits, stone fruits, nuts and sub tropical fruits , particularly mango and litchi	Apple, other temperate fruits and nuts	Nuts, dry fruits and apple
Percentage of irrigated area	16.6	17.5	7.8	40.6

Source: National Agricultural Research Project, Report of the ICAR Review Committee, Indian Council of Agricultural Research, Krishi Bhavan, New Delhi

**Table 2: Suitable Crops under Agro Climatic Zones in State**

Agro-Climatic	Cereals	Pulses	Oil seeds	Cash Crops	Vegetable Seeds
Zone-1 Sub-Tropical Sub-Mountain & Low hills	Maize, Paddy Wheat	Gram, Lentil, Mash Moong	Rape seed, Toria, Sesamum, Mustard, Linseed,	Brinjal, Peas, Tomato, Potato, Cucumber, Okra, Cauliflower,	Okra, Onion, Cauliflower
Zone-II Sub-Temperate Sub-Humid Mid-Hills	Maize, Paddy, Wheat	Gram, Lentil, Mash Moong	Rape seed, Toria, Mustard, Linseed, Sesamum	Tomato, Beans, Peas Cauliflower, Potato, Cucumber pepper, French beans	Cauliflower, Turnip, Beet, Bell beans
Zone-III Wet Temperate High Hills	Maize, Wheat, Barley	Rajmah		Peas, Beet, Beans, Cauliflower, Potato, Cabbage, Radish, Turnip, Carrot,	Disease free potato seed
Zone IV Dry Temperate High Hills & Cold Deserts	Wheat, Barley, Minor Millets			Peas, Cole crops, Onion, Carrot, Radish, Tomato	Cabbage, Peas, Beet, Potato, Chicory, Turnip

Source: State Agriculture Plan Deptt. of Agriculture & H.P.

**Table 3: Districts and Tehsils in Different Agro-Climatic Zones**

Agro-climatic zones	Areas	Height above mean sea level (metres)
Sub-montane low hills sub-tropical (Zone-I)	Una, Bilaspur and Hamirpur districts and parts of Sirmaur, Kangra, Solan and Chamba districts.	Up to 650
Mid-hills sub-humid (Zone-II)	Palampur and Kangra Tehsils of district Kangra; Rampur Tehsil of Shimla district and parts of Mandi, Solan, Kullu, Chamba and Sirmaur districts.	651-1800
High hills temperate wet (Zone-III)	Shimla district ( except Rampur Tehsil) parts of Kullu, Solan, Chamba, Mandi, Kangra and Sirmaur districts.	1800-2200
High hills temperate dry (Zone-IV)	Kinnaur, Lahaul & Spiti districts and parts of Chamba district	Above 2200

In high hills characterized by temperate climate, the crops are grown mainly in the summer months. This offers opportunities for growing cash crops such as vegetables in off-season for supply to markets in the plain areas. Moreover, temperate vegetables and fruits can be other

options of growing. In Himachal Pradesh, the net cultivated area is only 17.2% of the total area. The cropping intensity was 170.9% during 2000-2001.

In the past, diversity in agriculture had been such that it fitted well in the prevailing agro-ecological conditions. For instance, cultivation, of crops and varieties with good tolerance of drought conditions in the rain fed agriculture ensured minimum production levels. Truly these were low yielding but were tolerant to particular soil conditions, insect-pest incidences, disease epidemics and climatic adversities and thus were rare complete crop failures. The description of area falling under

different soil quality in the State of Himachal Pradesh is given in Table 4.

At present, high yielding varieties demand high input, better crop protection and good agronomic management to deliver in accordance with their potential. Moreover, some crops or varieties not finding favour with the changed lifestyle of people have gone out of cultivation. The agriculture is expected to remain the mainstay of 66.7% of people in the years to come.

**Table 4: Details of soil quality and area**

Soil Unit	Area (ha)	Description
1.	2139 (3.8)	Rock outcrops covered with glaciers associated with shallow excessively drained sandy - skeletal soils with sandy surface, severe erosion and strong stoniness Lythic Cryorthents.
2.	293 (0.5)	Shallow E3 excessively drained sandy - skeletal soils very steep slopes with sandy surface, severe erosion and moderate stoniness ; Lythic Cryorthents associated with rock outcrops.
3.	16.0 (0.3)	Shallow excessively drained loamy - skeletal calcareous soils very steep slopes with loamy surface, severe erosion and moderate stoniness; Lythic Cryorthents associated with rock outcrops.
4.	24.7 (0.4)	Rock outcrops and valley glaciers associated with shallow excessively drained sandy - skeletal soils very steep slopes with sandy surface, severe erosion and moderate stoniness Lythic Cryorthents.
5.	1748 (3.1)	Mountain and valley glaciers and rock outcrops associated with medium deep excessively drained sandy - skeletal soils very steep slopes with sandy surface, severe erosion and moderate stoniness. Typic Cryorthents.
6.	2356 (4.2)	Rock outcrops associated with medium deep excessively drained loamy - skeletal calcareous soils very steep slopes with loamy surface, severe erosion and moderate stoniness. Typic Cryorthents.
7.	3401 (6.1)	Rock outcrops associated with shallow excessively drained loamy - skeletal soils very steep slopes with loamy surface, severe erosion and moderate stoniness. Typic Cryorthents.
8.	4502 (8.1)	Rock outcrops associated with medium deep excessively drained loamy - skeletal calcareous soil steep slopes with loamy surface, severe erosion and strong stoniness. Typic Cryorthents.
9.	2998 (5.4)	Rock outcrops associated with deep well drained mesic loamy-skeletal soils very steep slopes with loamy surface, severe erosion and strong stoniness. Typic Udorthents.
10.	972 (1.7)	Rock outcrops associated with shallow somewhat excessively drained coarse-loamy calcareous soils steep slopes with loamy surface, severe erosion and strong stoniness. Lythic Cryorthents.

*Source: State Environment Report*

**Present Status and Irrigation Potential:** Total geographical area of H.P. is 55.67 lakhs ha, of which only 5.83 lakhs ha is sown area while 98000 ha are the net irrigated area. Of the total irrigated areas, 7.14% is irrigated by canals, 7.14% by wells & 85.71% by other sources of irrigation like kuhls, tube wells, shallow wells, lift irrigation, check dams, storage tanks etc.

**Major Irrigation Projects:** A major irrigation project with Cultivable Command Area (CCA) of more than 100 km<sup>2</sup> is Shah Nagar Project located on river Beas in Kangra district has been initiated.



Medium Irrigation Projects: This covers CCA of more than 20 km<sup>2</sup> but less than 100 Km<sup>2</sup>. Some of these are:

- Giri Irrigation Project (52.63 km<sup>2</sup>)
- Bhabour Sahib Project – Phase – I (9.23 km<sup>2</sup>)

- Bhabour Sahib Project – Phase – II (26.40 km<sup>2</sup>)
- Balh Valley Project (24.10 km<sup>2</sup>)

Year wise irrigation from 1977-78 to 2000-01 is given in Table 5.

**Table 5: Irrigation in Himachal Pradesh (Km<sup>2</sup>)**

Item	End of		Achievement			Cumulative
	eight plan	1977-78	1998-99	1999-2000	2000-01	
Major & Medium Irrigation	109.36	3	1.5	1.5	2	117.36
Minor Irrigation	825.95	20	20	21.2	18	905.15
Kuhls & Others	927.96	-	-	-	-	927.96
Total	1863.27	23	21.5	22.7	20	1950.47

Source: 10<sup>th</sup> five year Plan, Himachal Pradesh

Year wise water supply and irrigated area through different water sources is summarized in Table 6.

**Table 6: Source of Water Supply and Area Irrigated**

Water Source	1994-95	1996-97	1998-99
Tube wells			
Government	12.75	16.29	4.32
Private	1.79	1.79	16.29
Total	14.54	18.08	20.61
No. of Kuhls			
Government	64.20	64.20	64.12
Private	104.75	104.75	104.75
Total	168.95	168.95	168.87
Lift Irrigation			
Government	2.43	2.43	2.43
Private	2.46	2.46	2.46
Total	4.89	4.89	4.89

Source: Annual Season & Crop Report, 1988-99, Commissioner Revenue (H.P.)

Year wise Net irrigated area in Himachal Pradesh through various sources is given in Table 7.

**Table 7: Net Irrigated Area in Himachal Pradesh (ha)**

Year	Canals	Tanks	Wells & Tube wells	Other sources	Total
1990-91	75.54	14.04	37.73	867.26	994.57
1991-92	-	6.63	37.11	953.62	997.36
1992-93	90.76	7.98	55.92	833.60	988.26
1993-94	-	1.22	51.20	944.04	996.46
1994-95	36.31	8.71	119.98	839.54	1004.54
1995-96	33.93	3.97	130.82	879.18	1047.90
1996-97	35.74	3.25	118.30	890.63	1047.92
1997-98	33.98	2.55	118.20	871.44	1026.17
1998-99	31.73	2.58	114.24	866.55	1015.10
1999-00	33.37	2.70	131.69	851.31	1019.07
2000-01	34.63	2.63	141.72	1,057.58	1236.56
2001-02	36.66	2.57	128.99	852.84	1021.06
2002-03	35.10	2.67	117.64	1083.77	1239.18
2003-04	35.20	0.03	135.69	879.89	1050.81
2004-05	33.79	0.28	155.12	855.71	1044.90
2005-06	36.45	6.54	218.74	778.54	1040.27

Source: Directorate of Land Records, Himachal Pradesh

Areas covered under HYV and other Cereal varieties from 1995 to 1999 is summarised in Table 8.

**Table 8: Irrigated areas covered under HYV and other cereal varieties (1995-99) (Km<sup>2</sup>)**

Crop	HYV			Others		
	Areas	Irrigated	Percent	Areas	Irrigated	Percent
Rice	139.6	109.1	78.15	681.7	395.8	58.12
Maize	886.8	103.4	11.66	2213	144.4	6.53
Wheat	1294.9	239.2	18.47	2502.3	463.8	18.53
Barley	30.6	8.5	27.71	237	33.4	14.09
Total	3251.9	460.20	19.57	5634	1037.4	18.41

Source: Annual Administrative Report, Department of Agriculture, H.P. 2001-02

#### 4.1.1 District wise Status of Agriculture

**1. Bilaspur:** Agriculture is the major occupation of 80% of the total population. The soil is mostly rausli- a light and somewhat sandy soil. This is intermixed with patches of stiff clay. The land is only moderately fertile. Kharif is the principal harvest and maize is the main crop and the staple food. Rice is produced both on irrigated and non- irrigated lands. Kulth is grown on inferior lands. Wheat and grams are the Rabi crops. These are mixed together and sown. The main cash crops are ginger and peas. Vegetables which are grown during the Kharif season are Tomato, Shimla Mirch, Brinjal and Ladyfinger. According to village papers, the total geographical area for the year 1999-2000 was 115,445 ha. Out of which 30,239 ha was net sown area and 57,622 ha was total cropped area sown. The average cropped area sown was 0.102 ha per person. According to District Statistical Abstract, the total cropped area was 56,714 ha during the year 1998-99. Out of which 26,305 ha of area was sown more than once. The net area sown was 30,409 ha. The area under food-grains was 54,597 which include 26,863 ha under wheat, 24,830 ha under maize, 2,068 ha under rice and 325 ha under barley, 4 ha under other crops and 196 under gram and 34 under other pulses. During the period 1998-99 there was a record production of principal crops throughout the district. During the referred period, 58,513 metric tonnes of food-grains including both cereals and pulses were produced which include 11,045 MT of wheat,

44,998 MT maize, 2,384 MT of rice, 22 MT of barley, 45 MT gram and 69 MT of other pulses. Regarding other food crops sugarcane (Gur) worth 518 MT and Ginger (Green) worth 341 MT were produced in the district. Areas under principal crops are given in Table 9 and Table 10.

**Table 9: Tehsil wise area under principal crops**

Sr. No.	Name of Tehsil	Area under principal crop (ha)
1	Bilaspur Sadar (T)	13,946
2	Ghumarwin (T)	21,720
3	Jhanduta (ST)	13,893
4	Naina Devi (ST)	6,849

**Table 10: Area under major crops for the year 1999-2000**

Sr. No.	Name of crop	Area (ha)	Production (MT)
1	Rice	2,740	2,740
2	Maize	26,710	51,200
3	Wheat	26,310	55,250
4	Barley	470	770
5	Gram	580	400
6	Ginger	100	125
7	Other Pulses	770	535
8	Tomato/Veg.	1,110	13,375

The area under cash crops like potato, onion, tomato, chilies, ginger, edible oilseeds is much less as compared to other crops.

**Table 11: Profile of Agriculture in Bilaspur District (Km<sup>2</sup>)**

Parameter	1996-97	1997-98	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
Nature of soil	Rausli- a light and somewhat sandy soil inter-mixed with patches of stiffclay.									
Nature of crops	Kharif is the principal harvest and maize is the chief crop. The staple food. Rice is produced both on ir- rigated and non-irrigated lands. Kulth is grown on inferior lands. Wheat and grams are the Rabi crops. These are mixed together and sown. The main cash crops are ginger and pea s. Amongst the vegetables which are grown during the Kharif season are tomato, capsicum, brinjal and lady's finger									
Geographical area by village papers (km <sup>2</sup> )	1154	1154	1155	1154	1118	1118	1118	1118	1118	1118
Unusable area (km <sup>2</sup> )	185	186	183	182	188	188	193	194	193	193
Other uncultivated land excluding fallow land (km <sup>2</sup> )	507	558	513	513	473	474	470	459	458	457.1
Fallow land (km <sup>2</sup> )	26	28	31	31	24	29	23	23	28	27.61
Gross cropped area (km <sup>2</sup> )	591	594	577	580	578	573	573	567	547	563.2
Net sown area (km <sup>2</sup> )	311	308	302	302	304	299	299	302	298	300
Area sown more than once (km <sup>2</sup> )	280	286	275	278	274	274	274	265	249	263.2
Area under principal crops (km <sup>2</sup> )				572.6	575	576.08	551.1	567.08	560.3	573.2
Production of principal crops (MT)			89210	53956	96632	42259	72684	97214	73335	99441
Area under fruits (km <sup>2</sup> )	96.1	58.6	60.43	62.63	64.74	56.03	57.17	60.1	63.23	49.22
Production of different fruits (MT)	3760	3419	3105	5160	4278	3189	2411	4472	4472	4459
Net irrigated area (Km <sup>2</sup> )	31.6	31.6	31.64	31.64	31.64	31.64	31.64	31.64	27.33	41.94
Fertilizer consumption (MT)	2184	2234	2234	1801	1825	2253	2383	2218	2383	2400

Source: Statistical Outline of Himachal Pradesh

**2 Chamba:** Agriculture is the mainstay of the majority of the population in the district. Around 70% workers fall in the category of cultivators/agricultural labourers. Though agricultural holdings do not provide full time work to agriculturists, and in majority of cases the production is not even sufficient to provide reasonable standard of living to the agricultural families, even then it has become a way of life. Generally, two crops are taken from the land. Main crops grown are given below.

Kharif Season: Paddy, maize, rajmah, mah, moong, ragi, sorghum, soybean etc. Rabi Season: Wheat, gram, lentil, barley, oats etc. Commercial Crops: Potato, vegetable crops, ginger etc.

**Types of Soil:** Different types of soil are found

in the district. However, two types viz. grey brown podzolic soils and brown forest soils are also found on the large area. In sub-mountain and low hills, the soils are neutral in reaction and coarse in texture. In mid hill soils are acidic and coarse in texture. In the high hills covering temperate dry zone, the soils are acidic in reaction, shallow in depth and slopy. Whereas in high hills covering temperate wet zone, the soils are neutral and coarse in texture.

**Cash crop grown:**Vegetables are mainly grown as cash crops. In low hills brinjal, khira, bhindi etc. are grown as cash crops. The cash crops of mid hills are tomato, french beans, capsicum, potatoes, ginger etc. The cash crops of high hills are peas, french beans, cauliflower, cabbage, radish, carrot, potatoes and sugar beet. Whereas, the cash crops of dry temperate zone are peas, potato, onion and cole crops.

**Potential for development:** The Agro-climatic conditions of the district are such that all four agro-climatic zones exist in the district and therefore there is a lot of scope for raising off season vegetable crops as well as other cash crops. The crops cultivated under assured irrigation conditions can be diversified to other vegetable crops. There is a scope for raising of crops for seed production in the areas which are far away from the road.

**Soil testing facility:** For testing the soil fertility at the farmer's fields, there is one soil testing laboratory at Chamba, where soil samples are analysed and fertilizer doses are recommended accordingly. There are two seed multiplication farms in Chamba district situated at Haripura and Thullet, which provide foundation seeds to the farmers. One Potato Development Station at Anla provides foundation seed potato to the

farmers of Chamba district. The data of land utilization in the district for the year 1997-98 as recorded by the District land record office of the Chamba is given in Table 12.

**Table 12: Land utilization statistics for the 1997-98**

Classification of Area	Land utilization in ha
Total Geographical Area	692,409
Forest	271,611
Barren and uncultivable land	17,127
Land put to non-agricultural uses	359,055
Cultural waste	2,477
Total cropped area	66,330

Source: District Statistical Abstract, 2000

Out of the total 66,330 ha cropped area, 18,743 ha were under double cropping pattern during 1997-98. The area under major crops and their production is given in Table 13.

**Table 13: Area and production of principal crops**

Crop	1995-96		1996-97		1997-98	
	Area (ha)	Production (MT)	Area (ha)	Production (MT)	Area (ha)	Production (MT)
A. Food Crops						
1. Cereals						
Rice	3013	4122	2899	3965	2924	7057
Wheat	16094	37206	20696	31251	20286	31544
Maize	28867	68027	28656	78131	27921	22359
Barley	3673	4948	3885	5233	3804	5124
2. Pulses	3267	1295	3606	1421	3661	649
3. Other	620	5075	659	2718	736	3188
Food Crops						
B. Non-Food Crops	2574	724	2745	796	2861	812
Linseed						

Source: District Statistical Abstract, 2000

**Table 14: Profile of Agriculture in Chamba District**

Parameter	1996-97	1997-98	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
Nature of soil	Different types of soil are found. However, two types viz. grey brown podzolic soils and brown forest soils are also found in the large area. In sub-mountain and low hills, the soils are neutral in reaction and coarse in texture. In mid hill soils are acidic and coarse in texture. The high hills covering temperate dry zone, the soils are acidic in reaction, shallow in depth and slo py. Whereas in high hills covering temperate wet zone, the soils are neutral and coarse in texture.									
Nature of crops	Vegetables are mainly grown as cash crops in Chamba district. In low hills brinjal, cucumber, lady's finger's etc. are grown as cash crops. The cash crops of mid hills are tomato, french-bean, capricorn, potatoes and ginger etc. The cash crops of high hill are peas, french-bean, cauliflower, cabbage, radish, carrot, potatoes and sugar beet. Whereas the cash crops of dry temperate zone are peas, potato, and onion.									

Source: Statistical Outline of Himachal Pradesh

**3 Hamirpur:** Hamirpur district falls under humid sub-tropical zone. The altitude of the district varies from 400 metres to 1,100 metres above mean sea level. Agriculture is the main occupation of 72% of the total population of the district. The soil is young, shallow and sandy loam in texture which is mixed with boulders in eastern & north eastern part of the district. Wheat & maize are the main crops of the district. These are followed by gram, paddy & other pulses. Besides this, barley, ragi, mustard, sesame and sugarcane are also grown. Out of the total 1101.62 km<sup>2</sup> geographical area, net cropped area is 348.28 km<sup>2</sup>, 343.27 km<sup>2</sup> is area sown more than once i.e. total cropped area is 691.95 km<sup>2</sup>. About 95% of the total cultivated area in the district is rain fed. Hence, the production of different crops depends entirely on rains. However, 70% of the rainfall in the district is received during monsoon. Most of the water is drained away. It also creates problems of soil conservation. Some efforts have been made for water harvesting by constructing water storages like small irrigation tanks, ponds, check dams etc. The farmers grow more than two crops in a year to get maximum production from the land. The crop rotation followed in district is (1) Maize-Toria-Wheat; (2) Maize-Potato-Potato; (3) Maize-Toria-Wheat-Baisakhi Moong. In addition to these rotations, farmers also follow Paddy-Wheat, Maize-Wheat Rotation. Improved high yielding varieties of seeds of maize, paddy, wheat, mah & moong have been introduced in the district and fertilizers are made available to cultivators. In addition to it, efforts are also being made to encourage the farmers for growing vegetables and improved varieties of seeds of vegetables like peas, radish, turnip, lady's finger, tomato, etc are being provided. A brief description of Rabi and Kharif crops grown in the district is given below.

- Wheat: Various varieties of wheat which have been found favourable to farmers are Sonalika, KSML 3 and L 421 etc.

- Maize: Vijay composite and improved varieties HIM 123 and Ganga 5 are being sown in the district.
- Paddy: Now IR 579, R 575, Him dhan, T 23, China 988 and Himalayan 1 and 11 are popular varieties of paddy grown in the district.
- Pulses: Among the pulses, the previous local varieties have been substituted by new variety known as C 235 improved variety and is grown successfully.
- Vegetables: Regarding seasonal vegetables; onion Nasik Red 53 being introduced in a big way as a cash crop of the rainy season. Arkal peas is also being popularized in the district.
- Sugarcane: Sugarcane varieties of Coj 1148 and Coj 64 being introduced in the district.
- Potato: It is an autumn cash crop. Seeds like Kufri and Chander Mukhi are being procured from the State farms.
- Oilseeds: In respect of oilseeds, Toria Dk 1 is being popularized and the farmers are also being encouraged to grow mixed crops like maize and mash, gram and wheat etc.

Land Use Pattern: The area of the district is 110,131 ha according to the village papers, out of which total net cropped area is 36,118 ha which constituted 32.80% of the total area during 1999-2000. The culturable waste land which can be reclaimed for cultivation is 7,998 ha forming 7.26%. The percentage of barren and culturable wasteland is 32.08% and land under forests constitutes 17.50% of the total area. According to village papers, 10.36% of the land is put to non-agricultural uses. Out of the total 36,118 ha cropped area, 34,630 ha were under double cropping pattern during 1999-2000 and therefore gross cropping area was 70,748 ha. The data of land utilization for the year 1999-2000 as recorded by the District Land Record Office of the Hamirpur district is given in Table 15.

**Table 15: Tehsil Wise Land Utilization Statistics for the Year 1999-2000 (ha)**

Classification of Area	Hamirpur	Bhoranj	Barsar	Nadaun	Sujanpur	Dhatwal	Total
Total Geographical Area	24737	15092	15342	24797	18037	12126	110131
Forest	2983	620	5102	5614	1127	3832	19278
Barren and unculturable	9723	5251	1482	10399	7180	1290	35325
Land put to non-agricultural uses	415	928	3195	304	3823	2550	11415
Culturable waste	2070	293	1295	974	2186	1180	7998
Total cropped area	9546	8000	4271	7306	3721	3274	36118

Source: District Statistical Abstract, Hamirpur

Major crop of the district is wheat, which occupies the largest area of 35,756 ha followed by maize (31,652) and rice (2,926). The production wise ranking of these crops was also the same during 1996-97 though yield of maize per ha is more than other crops as climatic conditions and soil are suitable for growth of this crop. The area under major crops and its production are given in Table 16 during the year 1996-97.

**Table 16: Area under different major crops and production, 1996-97**

Sr. No.	Name of crop	Area (ha)	Production (MT)
1	Rice	2,926	3834
2	Maize	31652	47268
3	Wheat	35756	47283
4	Barley	158	212
5	Other cereals	23	8
6	Pulses	473	148
7	Sugarcane	73	95
8	Potato	11	150
9	Onion	36	50
10	Edible oil	263	31

Source: District Statistical Abstract, Hamirpur-2001

**Table 17: Profile of Agriculture in Hamirpur District**

Parameter	1996-97	1997-98	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
Geographical area by village papers (km <sup>2</sup> )	1100	1100	1101	1102	1102	1102	1102	1102	1102	1102
Unusable area (km <sup>2</sup> )	379	387	349	309	309	330	323	337	334	333.4
Other uncultivated land excluding fallow land (km <sup>2</sup> )	62	62	112	169	153	156	163	147	159	159.2
Fallow land (km <sup>2</sup> )	88	86	79	77	79	81	80	79	77	77.79
Total cropped area (km <sup>2</sup> )	718	716	708	690	701	702	699	701	687	692
Net sown area (km <sup>2</sup> )	371	364	361	360	354	351	352	355	349	348.3
Area sown more than once (km <sup>2</sup> )	347	352	346	330	347	351	347	346	338	343.7
Area under principal crops (km <sup>2</sup> )			705.36	687.5	698.48	699.84	695.91	697.99	687.13	
Production of principal crops (MT)			106484		130662	89657	110082	84282	54818	
Area under fruits (km <sup>2</sup> )		59.4	62	49.63	49.4	50.26	45.16	46.87	49.31	53.14
Production of fruits (MT)		3265	2011	3153	2013.5	2286.7	2372	2394.5	5057.8	6342
Fertilizer consumption (MT)		2427	2616	2227	2204	2582	2854	2745	2745	2747
Net irrigated area (km <sup>2</sup> )	17.66	17.9	17.9	17.9	17.9	16.27	17.31	17.08	18.54	18.03

Source: Statistical Outline of Himachal Pradesh

**4 Kangra:** Agriculture is the main occupation of the population in the district. The agro-climatic conditions prevailing in the district are favourable for growing food crops such as wheat, paddy, maize, oilseeds, potato, sugarcane etc. Tea and potato are the two cash crops. There are two types of crops namely 'rabi' and 'kharif'. Rabi crop is sown before winter and harvested in the months of April and May. The popular rabi crops are wheat, barley, gram and oilseeds. The Kharif crop is sown before the monsoon and is ready for harvesting in September- October. The main kharif crops are maize, paddy, oil seeds, pulses, spices and potatoes. A brief description of rabi and kharif crops grown in the district are given below.

**Wheat:** Wheat is grown in all parts of the district but the areas of Tehsils of Dera Gopipur and Palampur are most suitable for the cultivation of wheat. Certain varieties of wheat like Kalyan Sona, VL-421, Sonalika and RD-1553 have found favour with the farmers due to high yield of these varieties. Cultivation of barley is done mostly in Dera Gopipur. It is sown with wheat or gram.

**Maize:** Maize is the major crop in the district and the staple food of majority of the people for almost half of the year.

**Paddy:** Paddy crop is grown in irrigated areas of Kangra only. There are number of varieties of paddy grown in the district. The popular varieties are namely Ramjain, No-100 Phul Patas No-72, China 988, Basmati T-23, IR-579, Norin-8, Norbin-78, and Him dhan.

**Potato:** Potato is the major cash crop of Palampur and Kangra Tehsils. The cultivation of potato has also been extended to other Tehsils where the irrigation facilities have been provided. It is grown in both Rabi and Kharif seasons. The more popular varieties of potato grown in the district are Kufrijyoti and Kufri Chandermukhi. With the introduction of improved varieties of seeds, chemical fertilizers, pesticides, improved agricultural implements and extension of irrigation facilities, the

agricultural production has increased in the district during the last two decades.

**Land Use Pattern:** Out of the total 221683 ha of cropped area, 103162 ha were under double cropping pattern during 1998-99. The data of land utilization in the district for the year 1998-99 as recorded by the District Land Record Office of the Kangra District is given in Table 18.

**Table 18: Land utilization statistics for the year 1998-99**

Sr. No.	Classification of Area	Land Utilization (ha)
1	Total Geographical Area	577,943
2	Forest	223,150
3	Barren and unculturable land	98,631
4	Land put to non-agricultural uses	126,905
5	Culturable waste	10,636
6	Total cropped area	221,683

Source: District Statistical Abstract, Kangra-2000.

In order to increase the production of crops, improved variety of seeds and fertilizers are being provided to the farmers at subsidised rates. Table 19 shows the area under major crops in ha and its production in metric tonnes during the year 1996-97.

**Table 19: Area under different crops and production**

Sr. No.	Name of crops	Area (ha)	Production (MT)
1	Rice	35,560	46,325
2	Maize	57,158	90,463
3	Wheat	92,758	130,112
4	Barley	2,784	3,738
5	Common millets	248	119
6	Pulses	5,040	1,662
7	Bajra	89	N.A.
8	Sugarcane	1,152	1,685
9	Potato	1,420	28,600
10	Onion	254	680
11	Tomato	46	N.A.
12	Chillies	11	3
13	Ginger	22	24
14	Edible oil seeds	5,467	1,176

Source: District Statistical Abstract, Kangra-2000.

**Tea plantation:** Tea plantation in Kangra District is done at an elevation ranging from 800 metres to 1,600 metres above the mean sea level. The cultivation is done on well-drained medium loam soil on the slopes of hilly land with annual rain varying between 175 cms. to 375 cms. Green and black teas are produced in the district. With the setting up of processing factory at village Bir in Palampur Tehsil, the quality of production has improved considerably. Himachal Pradesh Agriculture University at Palampur is engaged in research

work for the improvement of tea production in the State. Emphasis is also being laid on the mechanical farming. The equipments, fertilizers and pesticides are being supplied on subsidized rates. Table 20 shows the tea production during 1998 and 1999 in the district.

**Table 20: Tea Production 1998 -1999**

Sr. No.	Year	Green Tea	Black Tea	Total Tea (Kgs.)
1	1998	909,000	802,000	1,711,000
2	1999	526,000	696,000	1,222,000

Source: District Statistical Abstract, Kangra

**Table 21: Profile of Agriculture in Kangra District**

Parameter	1996-97	1997-98	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
Nature of soil	Soil in the district varies from sandy loam to clay.									
Nature of crops	The agro-climatic conditions prevailing in the district are favorable for the growing of food crops such as wheat, paddy, maize, oil seeds, potato, sugarcane, etc. Tea & potato are the two cash crops. There are two types of crops, 'Rabi' and 'Kharif'. Rabi crop is sown before winter and harvested in the months of April & May. The popular Rabi crops are wheat, barley, gram and oil seeds. The Kharif crop is sown before the monsoon and is ready for harvesting in September-October. The main Kharif crops are maize, paddy, oil seeds, pulses, spices & potatoes.									
Geographical area by village papers (Km <sup>2</sup> )	5778	5779	5780	5779	5780	5780	5780	5780	5780	5777
Unusable area (Km <sup>2</sup> )	1034	1034	907	917	956	956	946	931	931	939.8
Other uncultivated land excluding fallow land (Km <sup>2</sup> )	1248	1246	1226	1258	1224	1226	1240	1253	1252	1237
Fallow land (Km <sup>2</sup> )	87	90	105	97	112	110	111	107	119	120.5
Total cropped area (Km <sup>2</sup> )	2118	2226	2201	2172	2222	2160	2196	2179	2173	2139
Net sown area (Km <sup>2</sup> )	1193	1190	1175	1180	1166	1167	1166	1172	1158	1193
Area sown more than once (Km <sup>2</sup> )	985	1036	1026	992	1056	993	1030	1007	1015	976.2
Area under principal crops (Km <sup>2</sup> )							1969.6	2018.7	1912.1	2009
Production of principal crops (MT)							302590	322240	302160	3E+05
Area under fruits (Km <sup>2</sup> )				324.6	372.82	379.17	391.39	345.97	362.23	371.5
Production of fruits (MT)				13537	16128	17031	45408	115296	86308	40508
Net irrigated area (Km <sup>2</sup> )	321.9	321.9	321.94	321.9	321.94	321.94	321.94	321.94	321.94	321.9
Fertilizer consumption (MT)	7805		8213	7691	7461	8845	8902	8875	8875	

Source: Statistical Outline of Himachal Pradesh



**5. Kinnaur:** Kinnaur is predominantly an agricultural district. Agriculture in the hilly areas have peculiar problems in view of steep and difficult terrain, small and scattered holdings, depleting fertility of soil, by constant erosion & low crop yield. The crop season is limited to only six months due to the intensive cold and snowfall. However, the economy of the district is highly agro-pastoral. Land holdings are generally small and scattered. The soil generally consists of sand, sandy-loam, clay-loam, sandy and gravel.

Wheat, barley, maize, potato, vegetables and pulses are the main crops of the district.

Land use pattern: Out of the total 9,407 ha cropped area, 1,253 ha were under double cropping pattern while 348 ha were put under non-agricultural uses during 1999-2000. The data of land utilization for the year 1999- 2000 as recorded by the District Land Record Office of the Kinnaur district is given in Table 22.

**Table 22: Land utilization statistics for the year 2010-11**

Classification of Area	Tehsil wise Land Utilization (In Hectares)						Total
	Nichar	Sangla	Kalpa	Morang	Pooh	Hangrang	
Total Geographical Area	118,621	128,222	39,090	138,420	127,086	72,781	624,215
Forest	24,256	3,864	4,152	4,542	1,749	-	38,563
Barren and unculturable land	204	6,700	18,212	51,182	34,953	21,179	132,430
Land put to non-agriculture uses	2,008	65,520	8,259	16,422	25,080	588	1,17,877
Culturable waste land	910	429	394	1,185	362	50	3,330
Total cropped area	2,926	1,545	1,914	1,590	971	528	9,474

Source: District Statistical Abstract, Kinnaur-2010-11

The brief description of sowing and harvesting time of different crops are listed in Table 23.

**Table 23: Sowing and harvesting period of important crops**

Sr. No	Crops	Sown period	Harvesting period
1.	Maize	May-June	October
2.	Wheat	October/April	June/ Sept./ Oct.
3.	Potato	April/ June	October
4.	Edible oil seeds	Oct./Nov.	May/June
5.	Peas	April/June	August/ Oct.
6.	Rajmah	May/June	Sept./ Oct.

During the year 1999-2000, the area under major crops and its production are given in Table 24.

**Table 24: Production and Export of Potato (MT)**

Year	Production	Export
1991-92	12,125	12,000
1992-93	6,500	6,000
1993-94	6,600	3,960
1994-95	6,814	4,770
1995-96	6,256	4,066
1996-97	6,260	4,256
1997-98	6,408	4,357
1998-99	N.A.	N.A.
1999-00	N.A.	N.A.

Source: District Statistical Abstract, Kinnaur-2000

Potato is the main cash crop of Kinnaur district. Table 25 shows the production and export of potato to other areas.

**Table 25: Area and production of major crops during 1999-2000**

Sr. No.	Name of crops	Area (ha)	Production (MT)
1	Wheat	371	358.24
2	Maize	404	930.41
3	Rice	30	36.45
4	Barley	1,420	2,289.04
5	Pulses	1,340	790.23
6	Edible oilseeds	04	N.A.
7	Potato	244	2,110.60

Source: District Statistical Abstract, Kinnaur-2000

**Table 26: Profile of Agriculture in Kinnaur District**

Parameter	1996-97	1997-98	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
Nature of soil	Soil generally consists of sard, sandy loam, clay loam, stony and gravel.									
Nature of crops	The crop season is limited to only six months due to the intensive cold and snowfall. However, the economy of the district is highly agro-pastoral. There are two main crops in the year i.e. Rabi and Kharif. Wheat, barley, maize, potato, vegetables and pulses are the main crops of the district.									
Geographical area (Km <sup>2</sup> )	3229	4154	6238	6237	6237	6237	6237	6238	6243	6243
Unusable area (Km <sup>2</sup> )	778	1034	2557	2556	2555	2554	2555	2555	2559	2562
Other uncultivated land excluding fallow land (Km <sup>2</sup> )	1978	2251	3220	3217	3219	3214	3214	3211	3212	3212
Fallow land (Km <sup>2</sup> )	18	17	17	17	19	22	18	21	20	55.52
Total cropped area (Km <sup>2</sup> )	95	100	90	94	91	86	88	91	90	89.69
Net sown area (Km <sup>2</sup> )	76	76	78	76	76	73	75	75	76	75.53
Area sown more than once (Km <sup>2</sup> )	19	24	13	18	15	13	13	16	14	14.16
Area under principal crops (Km <sup>2</sup> )										49.57
Production of principal crops (MT)										
Area under fruits (Km <sup>2</sup> )				79.41	81.89	85.07	91.12	94.32	100.76	104.9
Production of fruits (MT)				21533	26343	31268	35692	37343	38013	37101
Net irrigated area (Km <sup>2</sup> )	43.37	43.35	46.5	44.59	45.3	44.18	44.87	44.82	47.68	46.76
Fertilizer consumption (MT)	137	139	153	94	137	185	187	172	172	196

Source: Statistical Outline of Himachal Pradesh

**6 Kullu:** The economy of the district is dependent on agriculture, and more than 80% of the workers are engaged in agricultural activities. The elevation of Kullu district ranges from 914 metres to 4,084 metres above sea level with varied agro-climatic conditions. The texture of soil ranges from sandy loam to clay loam and the colour of the soil also vary from brown to dark brown. Generally the sandy soil is acidic in nature and the terrain except the valley is all hilly. Depth of the soil varies from 50 to 150 cms. But despite this all the agro climatic conditions provide a range of potentialities for growing cash crops like off season vegetables, seed potatoes, pulses and temperate fruits apart from the cereals, millets

and oilseeds. Among the cereals, wheat, maize, paddy and barley are extensively grown.

The land holdings are small and cultivation is done by traditional techniques of farming to increase the production of crops. The mechanization of agricultural operation is not possible due to small size and terraced fields. Out of the total 61,024 ha cropped area, 24,500 ha were under double cropping pattern while 5,971 ha were put- under non-agricultural uses during 1998-99. The data of land utilization for the year 1998-99 as recorded by the district land record office of the Kullu district is given in Table 27.

**Table 27: Land utilisation statistics for the year 1998-99**

Sr. No.	Classification of Area	Tehsil wise Land Utilisation (In Hectares)							Total
		Kullu	Manali	Sainj	Banjar	Ani	Nermaid		
1.	Total Geographical Area	20,789	3,551	3,789	6,267	7,850	7,844	50,090	
2.	Forest	-	-	-	-	-	-	-	
3.	Barren and unculturable land	1,080	50	-	-	-	-	1,130	
4.	Land put to non-agricultural uses	1,836	379	603	1,024	952	1,177	5,971	
5.	Culturable waste	2,197	496	590	758	1,447	977	6,465	
<b>Total Cropped Area</b>		<b>26,884</b>	<b>3,658</b>	<b>4,612</b>	<b>6,881</b>	<b>9,110</b>	<b>9,879</b>	<b>61,024</b>	

Source: District Statistical Abstract, Kullu-2000

The major crops of the district are cereals followed by pulses and other crops. Table 28 shows the area under main crops in each Tehsil/ sub-Tehsil of the district during 1998-

99. Potato is the main cash crop of Kullu district and area under this cash crop was 950 ha during 1998-99. Table 29 shows the production and export of potato to other areas.

**Table 28: Tehsil wise area under Main Crops (ha)**

Sr No.	Name of the crop	Tehsil wise Area ( 1998-99 )						Total
		Kullu	Manali	Sainj	Banjar	Ani	Nermad	
1	Cereals	18,573	2,562	3,424	5,667	6,804	8,492	45,522
2	Pulses	1,157	153	269	364	339	562	2,844
3	Others	834	59	209	179	418	133	1,512

Source: District Statistical Abstract, Kullu-2000.

**Table 29: Production and Export of Potato (MT)**

Year	Production	Export
1996-97	5,950	5,225
1997-98	6,580	5,450
1998-99	6,220	5,162
1999-2000	5,310	4,500

Source: District Statistical Abstract, Kullu-2000.

Table 30 shows the area under major crops (in Ha.) and production of major crops (Metric Tonnes) during the year 1996-97.

**Table 30: Crop Coverage area and Production of District Kullu**

Sr. No.	Name of Crop	Area (ha)	Production in (MT)
1	Rice	2,166	2,165
2	Maize	17,047	31,615
3	Wheat	20,458	47,652
4	Barley	2,938	1,815
5	Common Millets	1,771	690
6	Pulses	3,101	549
7	Potato	1,014	7,500
8	Onion	24	4
9	Tomato	220	N.A.
10	Chillies	174	36
11	Ginger	1	1
12	Edible oil	636	364

**Table 31: Profile of Agriculture in Kullu District**

Parameter	1996-97	1997-98	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
Nature of soil	The texture of soil ranges from sandy loam to clay loam and the colour of the soil also vary from brown to dark brown. The soil is acidic in nature and terrain is hilly except the valleys. The soils of the district have been classified into three groups. First group is comprised of Orthents-Ochrepts soils and are recently formed soils having shallow black, brown and alluvial characteristics. These soils cover major areas of the district composing western, central and south-eastern parts of the district. Udalfs and Udalfs-Ochrepts types of soils are found in northern and southern fringes of the district. The glaciated and snow cap type of soils are found in very high altitude areas of western Kullu and Manali Tehsils.									

Parameter	1996-97	1997-98	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
Nature of crops	There are range of potentialities for growing cash crops like off season vegetables, seed potatoes, pulses and temperate fruits apart from the cereals, millets and oilseeds. Among the cereals, wheat, maize, paddy and barley are extensively grown.									
Geographical area by village papers (km <sup>2</sup> )	501	501	500	501	501	501	501	501	501	501.2
Unusable area (Km <sup>2</sup> )	70	67	70	71	71	72	72	72	72	72
Other uncultivated land excluding fallow land (km <sup>2</sup> )	36	40	36	34	34	32	32	33	33	34
Fallow land (km <sup>2</sup> )	27	28	29	25	26	30	34	34	34	30.06
Total cropped area (km <sup>2</sup> )	593	631	575	668	614	606	650	649	649	654.7
Net sown area (km <sup>2</sup> )	368	366	366	372	371	367	363	362	362	368.9
Area sown more than once (km <sup>2</sup> )	225	265	210	296	243	239	287	287	287	288.8
Area under principal crops (km <sup>2</sup> )										550.65
Production of principal crops (MT)										
Area under fruits (km <sup>2</sup> )				220.1	223.92	226.03	230.66	245.79	252.52	261.3
Production of fruits (MT)				69100	52374	87656	123542	178832	151249	78547
Net irrigated area (km <sup>2</sup> )	26.9	25.02			27.9	29.78	28.78	28.78	28.44	
Fertilizer consumption (MT)	1870		2132	1658	2655	3233	3795	3983	3983	3028

Source: District Statistical Outline of Himachal Pradesh

**7 Lahaul & Spiti** Agriculture in Lahaul & Spiti district is the predominant occupation of the population. The traditional crops used to be barley and buck wheat and pulses like peas, oilseeds etc. These are still the cash crops grown even today. However, with the opening of the roads, etc, the people have shifted from cereal crops to commercial crops like seed potatoes, hops, kuth, etc. Lahaul sub-division produces disease free seed potatoes and are popular throughout the country. In order to help the farmers with the latest technology and techniques of producing disease free seed potatoes, the Government has started seed farm at Gorma in Pattan valley to aid and advise the farmers. There are two experimental farms in Lara and Kyulling in Spiti sub division for seed multiplication.

The cropped area in the district during the end of the year 1999-2000 was 4,619 ha. 141 ha were covered under wheat, 38 ha under maize, 592 ha under barley and 160 ha under kuth. As many as 1,437 ha were covered under pulses, 1,415 ha were covered under peas, 818 ha under seed potatoes and 18 ha under edible oilseeds. The cash crops like seed potatoes, peas and herbs are mainly exported to Delhi, Amritsar and the States of Gujarat, Tamil Nadu, West Bengal etc. Kuth being a medicinal plant is also exported to countries like France, Germany, England and Japan where the extract of its roots is used as an ingredient for producing quality perfumes. Hops is also exported and it is mainly used for the manufacturing of beer. The valley located on the lower elevation of the region produces

vegetables like cabbage, cauliflower and tomatoes which are marketed at Keylong, Kullu and Delhi. Hops is turning out to be the big money spinner after the potato seed and green peas. Table 32 shows the Tehsil/sub-Tehsil wise area under main crops in Lahaul and Spiti district during 1999-2000.

**Table 32: Tehsil wise area under main crops in Lahaul & Spiti District during 1999 -2000**

Name of crop	Tehsil wise Area (1999-2000) ha			Total area
	Lahaul (T)	Udaipur (S.T)	Spiti (T)	
'A' Cereals				
1 Wheat	19	56	66	141

Name of crop	Tehsil wise Area (1999-2000) ha			Total area
	Lahaul (T)	Udaipur (S.T)	Spiti (T)	
2 Maize	-	38	-	38
3 Barley	33	53	506	592
4 Kuth	10	150	-	160
'B' All Pulses	634	335	468	1,437
'C' Other Crops				
1 Potato	595	188	35	818
2 Peas	629	324	462	1,415
3 Edible oil seeds	-	1	17	18

Source: District Land Record Office, Keylong (District Statistical Abstract, Lahaul & Spiti, 2000)

**Table 33: Profile of Agriculture in Lahaul & Spiti District**

Parameter	1996-97	1997-98	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
Nature of soil	District is comprised of sand, stones, shells, slates, Phyllites, quartzite and limestone and the depth of the soil cap is generally shallow in the upland areas. The soil at any place is derived from the rocks, which crop out in its neighbourhood and varies as rapidly as its parent rocks. The mica schist's most commonly gives a stiff reddish loam or stiff red clay. This type of soil is mainly siliceous and aluminous. It is poor in lime, magnesia, phosphorus and nitrogen but fairly rich in potash, in some parts it is quite rich in potassium.									
Nature of crops	The traditional crops used to be barley and buckwheat and pulses like peas, oil seeds, etc. However, with the opening of the vehicular roads, etc, the people have shifted from cereal crops to commercial crops like seed potatoes, hops and Kuth etc. Lahaul sub-division produces seed potatoes which are known for their disease freeness and popular throughout the country.									
Geographical area by village papers (km <sup>2</sup> )	8981	9111	9112	9112	9112	9112	9112	9111	9112	
Unusable area (km <sup>2</sup> )	5482	5404	5516	5513	5516	5516	5515	6515	5515	
Other uncultivated land excluding fallow land (km <sup>2</sup> )	2110	2320	2207	2208	2208	2208	2208	2208	2208	
Fallow land (km <sup>2</sup> )	2	2	1	1	1	1	4	1	1	
Total cropped area (km <sup>2</sup> )	34	33	35	36	34	34	32	35	35	
Net sown area (km <sup>2</sup> )	32	32	34	35	33	33	31	33	33	
Area sown more than once (km <sup>2</sup> )	2	1	1	1	1	1	1		2	
Area under principal crops (km <sup>2</sup> )										
Production of principal crops (km <sup>2</sup> )										
Area under fruits (km <sup>2</sup> )										
Production of fruits (km <sup>2</sup> )										
Net irrigated area (km <sup>2</sup> )	32.08	33.18						32.92	32.92	
Fertilizer consumption (MT)		255	268	225	359	309	322	405	405	

Source: Statistical Outline of Himachal Pradesh

**8 Mandi:** The major occupation of the district is agriculture covering about 80% of the population engaged in it as their occupation. The district is however deficient in cereal production. Balh valley of Sundarnagar block and Sandhol areas along the Beas river of Dharmpur block and Jogindarnagar valley are the only major areas in producing cereals in the district which cater to the demand of sizeable population of the district. The main reason for the low agricultural production is lack of adequate irrigation facilities, uneconomical small land holdings, traditional technique of farming in hilly tract, rocky and undulating terrains. Mechanized farming is by and large confined to the Balh valley. The climate and soil in higher altitudes are much suitable for horticulture production. The district can be divided into three distinct regions from agricultural point of view like foothills, mid hills and high hills. There are two types of soils in the district. The sub- mountainous soil of Seraj and Karsog block is high in organic carbon, low in phosphorus and medium in potash. The brown hill soil in the remaining area is medium in nitrogen and potash and deficient in available phosphorus. The soil reaction is slightly acidic to neutral and texture in general varies from loam to sandy loam except in low valley areas being heavy textured.

The main cash crops of the district are potato, off season vegetables and ginger. Among the vegetables, cultivation of peas, tomato, brinjal, cauliflower, cabbage, radish, turnip, spinach, carrot, ladyfinger and cucumber is very popular. Potato is the only surplus agricultural produce in the district, which is exported for seed purposes. There are agricultural workshops functioning at Bhangrotu where facilities for

designing and testing of improved agricultural implements and service and repair of all types of farm machinery are available. There are four potato development stations and five seed multiplication farms in the district. The research station is being handled by the Agriculture University. To meet the seed requirements of the farmers, these farms also serve as demonstration centres for improved farm technology to the cultivators. Seeds of improved variety of farm crops like maize, wheat and paddy are being distributed. Two Mexican varieties of wheat were introduced in the district during the sixties. In order to boost the production of pulses and oilseeds, efforts are being made to popularize the seeds of improved varieties. Soil conservation and water management measures were taken on a large scale to check the soil erosion. At the end of the year 1997-98, a total area of 163,669 ha was sown in the district. Out of which, 148,618 ha were covered under edible grains and pulses and 949 ha under the millets and other cereals (Table 34). The remaining sown areas were used for the production of potato, sugarcane, ginger, chilly and oilseed products. There were 136,696 holdings of different sizes and types in the district during 1995-96 covering the total area of 129590 ha. Table 35 shows the area and number of land holdings in Mandi district.

**Table 34: Sown area and area under major crops in Mandi district during the year 1997-98**

Sown area (ha)	Net sown area	91,612
	Sown more than once	72,057
	Total sown area	163,669
Area under major crops (ha)	Wheat	68,218
	Rice	22,118
	Maize	47,476
	Barley	4,516
	Millets	949

**Table 35: Type and number of holdings in ha 1995-96**

Personal Holdings		Institutional Holdings		Total Holdings	
Number	Area	Number	Area	Number	Area
136,506	129,126.28	190	464.01	136,696	129,590.29

Source: District Statistical Abstract of Mandi, 2000

**Table 36: Profile of Agriculture in Mandi District**

Parameter	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
Nature of soil	Soils of the district are mainly orthents–orchrepts type. Soils in southern and north–western parts of the district are categorized as Udalts– Ochrepts and Ochrepts–Orthents Ustalfs. This soil can be classified into brown hill and sub-mountain soil. The brown hill soil occurs in Chauntra, Drang, Mandi Sadar, Rewalsar, Dharpur, Gopalpur, Chachyot and Sundernagar development blocks whereas the sub-mountain soil predominantly occurs in Seraj and Karsog blocks. The sub-mountain soils are rich in organic carbon, poor in availability of phosphorus and medium in potash contents. The brown hill soils are medium in the organic carbon, normal in potash but deficient in phosphorus contents. The former are too acidic in soil reaction and loamy in texture whereas the later are slightly acidic in soil reaction and sandy loom in texture.										
Nature of crops	The range of cultivation lies between 2,000 to 9,000 feet and hence both the crops are grown. The district can be divided into three distinct regions from the cultivation point of view. Balh valley, Baldwara and Sandhol valley in the foot hills, Nagwin, Gohar, Rewalsar area and part of Jogindarnagar and Karsog Tehsils under mid hills and the area of Janjehli, Gada-Gossain, Chuhar valley, Seri, Kothi and Pangana in the high hill s. Balh valley is known for producing quality wheat, paddy and vegetable crops where the water drainage system and sprinkler system and irrigation have been adopted. Moisture land is practically confined to plain areas where floods from Suketi and its main affluent often cover a considerable area. The system of rotation shows great variations in different parts of the district according to the class of soils. Below 5,000 feet altitude double cropping on the best land is almost continuous. The fields near to the homesstead, which receive a plentiful supply of manure, can stand cropping to an extent without deterioration and for land a little distance away which gets manure in less quantity, it is usual to allow fallow one harvest in year. The main cash crops of the district are potato, off season vegetables and ginger. Among the vegetables, cultivation of peas, tomato, brinjal, cauliflower, cabbage, radish, turnip, spinach, carrot, ladyfinger and cucumber are very popular. Potato is the only surplus agricultural produce in the district, which is exported for seed purposes.										
Geographical area by village papers (km <sup>2</sup> )	3969		3969	3976	3976	3978	3978	3978	3978	3978	
Unusable area (km <sup>2</sup> )	239		250	251	251	250	250	250	245	252	
Other uncultivated land excluding fallow land (km <sup>2</sup> )	1016		1005	1013	1010	1012	1011	1012	1011	1010	
Fallow land (km <sup>2</sup> )	38		61	118	114	90	99	106	107	97	
Total cropped area (km <sup>2</sup> )	1629		1636	1604	1577	1564	1598	1604	1585	1564	

Parameter	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
Net sown area (km <sup>2</sup> )	939		911	852	858	873	864	857	856	867	
Area sown more than once (km <sup>2</sup> )	690		725	752	719	691	734	747	729	697	
Area under principal crops (sq. km.)											
Production of principal crops (km <sup>2</sup> )											
Area under fruits (km <sup>2</sup> )							300.71	309.01	315.15	321.1	328.04
Production of fruits (km <sup>2</sup> )							14024	16337	24274	43084	48121
Fertilizer consumption (MT)			5271	5764	4625	5782	6645	6161	6428	6428	
Net irrigated area (km <sup>2</sup> )	137.3		131.39								

Source: Statistical Outline of Himachal Pradesh

**9 Shimla:** The soil texture in the district varies from light sandy to heavy clay and in the deep valleys and basins it is generally sandy and sandy loam. Type of soil and climatic conditions are the main factors responsible for the proper development of agriculture. The district is having different types of soils and agro-climatic conditions which are quite suitable for growing various types of cereals, off season vegetables, temperate and stone fruits and other cash crops. The climate in the district varies from extreme hot in the lower elevations to extreme cold in the higher ones. While the areas in the lower elevations are suitable for the growing of cereal crops, stones and citrus fruits, places in the higher regions are most suitable for the growing of seed potatoes, off season vegetables and temperate fruits especially apples. From the agricultural point of view the district can be divided into three regions viz. (1) valley and basin areas (2) mid hills, and (3) high hills.

The low lying areas of Rampur, Kumharsain, Seoni, Shimla, Jubbal, Kotkhai, Chaupal, Theog and Rohru Tehsils/sub-Tehsils are suitable for the growing of cereal crops. In the mid area of these Tehsils, there is a great potentiality for growing of cereals, vegetables and horticultural products. However, the area on higher altitudes

are suitable for growing of apples, cherry, walnuts, almonds and seed potatoes.

The total geographical area of the district according to village paper during the year 1998-

**Table 37: Land utilisation pattern in Shimla district during the year 1998-99 (ha)**

Total geographical area by village paper	491,901
Area under forest	118,240
Barren and unculturable land	51,526
Land put to non-agricultural uses	10,621
Permanent pastures and other grazing land	292,631
Land under misc. tree crops and groves	5,321
Culturable waste	11,390
Other fallows	2,172
Total cropped area	104,386
Net area shown	78,782
Area sown more than once	25,604
No. of operational holdings	90,112
Area covered in these holdings	125,917.20
Average size of the holdings	1.4

Source: Statistical Abstract Shimla District- 2000.

The area and production under major crops during the year 1998-99 in the district is given in Table 38. The data shows that an area of 62,038 ha was covered for the growing of total



food grains while another area of 7314 ha was covered for production of potato, chillies, ginger and edible oilseeds. About 2889 ha were covered to produce rice, 17,284 ha for maize, 24,277 ha for wheat, 5,234 for barley, 6,267 ha for common millets and 6,087 ha for pulses. The district produced 12,105.39 metric tonnes of total food grains during the same period. Besides, the production of 49,419 metric tonnes of potato, 82 metric tonnes of chillies, 99 was 491,901 ha. Of this, an area of 118,240 ha was covered under forest, 51,526 ha under barren and unculturable land, 10,621 ha under non-agricultural uses, 292,631 ha under permanent pastures and other grazing land, 5,321 ha under groves etc., 11,390 ha under culturable waste and 2,172 ha under other fallows. Out of a total of 104,386 ha, cropped area in the district during the year 1998-99, net area sown was 78,782 ha while the area sown more than once was 25,604 ha respectively. Table 37 shows the land utilization pattern in Shimla district during the year 1998-99 (ha).

184 metric tonnes of ginger and 1,101 metric tonnes of edible oilseeds was achieved. It is interesting to note that the production of potato alone is almost four times higher than the production of total food grains. The district has produced 4,351 metric tonnes of rice, 1,847 metric tonnes of maize, 2,021 metric tonnes of wheat, 476 metric tonnes of barley, 2935 metric tonnes of common millets and 475.39 metric tonnes of various pulses during the year 1998-99.

Besides the major crops, off season vegetables are being grown in the district since long. Off season vegetables like green peas, cauliflower, cabbage, spinach, beans, ladyfinger, tomatoes etc. are sown. This district is known for chillies and the biggest chilli growing Tehsils are Theog, Chaupal, Shimla and Seoni. Rice, maize, wheat, barley, common millets, pulses, potato, chillies, ginger and edible oil seeds are the major crops in the district.

Seed multiplication farms play a vital role in the development of agriculture by making quality seeds available to the cultivators. Seed multiplication farms are functioning at Prala, Annu, Datnagar, Gantholi, Basa and Rautan. The improved varieties of cereals and vegetable seeds are also provided to the growers on their demands by the National Seed Corporation and by the registered growers. Apart from seeds, adequate supply of chemical fertilizers and pesticides are being ensured by the Agriculture Department through their distributing agencies. Improved implements are also being supplied by the Agriculture Department on subsidised rates and emphasis is being laid on the use of mechanical farming. There were 90,112 operational holdings covering an area of 125,917.16 ha with the average size of 1.40 ha per holding in the district during 1995-96.

**Table 38: Area and production under major crops in Shimla district during the year 1998-99**

Name of crops	Area (ha)	Production (MT)
Rice	2889	4351
Maize	17284	1847
Wheat	24277	2021
Barley	5234	476
Common Millets	6267	2935
Pulses	6087	475,39
Total food grains	62,038	12105.39
Potato	5947	49419
Onion	-	-
Chillies	82	97,2
Ginger	184	470.3
Sugarcane	-	-
Edible Oil seeds	1101	149.05

Source: Statistical Abstract Shimla District – 2000 (Pages 27-53)

**Table 39: Profile of Agriculture of Shimla District**

Parameter	1996-97	1997-98	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
Nature of soil	The soil texture in the district varies from light sandy to heavy clay and in the deep valleys and basins it is generally sandy and sandy loam.									
Nature of crops	Areas in the lower elevations are suitable for the growing of cereal crops, stones and citrus fruits, places in the higher reaches are most suitable for the growing of seed potatoes, off season vegetables and temperate fruits especially apples. From the agricultural point of view, the district can be divided into three regions viz. (1) valley and basin areas (2) mid hills, and (3) high hills. The low lying areas of Rampur, Kumharsain, Seoni, Shimla, Jubbal, Kotkhai, Chaupal, Theog and Rohru Tehsils/sub -Tehsils are suitable for the growing of cereal crops. In the mid area of these Tehsils there is a great potential for growing of cereals, vegetables and horticultural products. However, the area on higher altitudes are suitable for the growing of apples, cherry, walnuts, almonds and seed potatoes.									
Geographical area by village papers (km <sup>2</sup> )	4381	4381	4926	5080	5070	5074	5083	5090	5090	
Unusable area (km <sup>2</sup> )	239	246	634	286	271	274	269	317	317	
Other uncultivated land excluding fallow land (km <sup>2</sup> )	1016	2140	2247	2692	2667	2661	2684	2622	2622	
Fallow land (km <sup>2</sup> )	127	139	149	138	155	174	165	174	174	
Total cropped area (km <sup>2</sup> )	1052	1071	996	940	974	935	958	943	943	
Net sown area (km <sup>2</sup> )	727	711	704	725	693	673	677	679	679	
Area sown more than once (km <sup>2</sup> )	325	360	293	215	281	262	281	264	264	
Area of principal crops (km <sup>2</sup> )										
Production of principal crops (MT)										
Area under fruits (km <sup>2</sup> )										
Production of fruits (MT)										
Fertilizer consumption (MT)		4623	5879	5783	8032	9070	9550	10353	10353	
Net irrigated area (km <sup>2</sup> )	40.12	25.09								

Source: Statistical Outline of Himachal Pradesh

**10 Sirmaur:** The district can be divided into three distinct regions from the agricultural point of view. First are the hilly parts of Tehsils Pachhad, Rajgarh, Renuka and Paonta Sahib. Second is Nahan Tehsil which can be divided into Dharthi range and valley of Nahan and Paonta Sahib and the third part of this district is Kiardadun valley. In high elevations, maize is the predominant crop. Apart from this, ginger and turmeric are grown in summer. Still in higher elevations, potato and wheat are grown. The Kiardadun valley is known for wheat and quality rice. At one time poppy used to be grown in the district which has been banned by the Government by law.

Agriculture is the main occupation of the district and about 80% of the population is mainly dependent on the agriculture. Sirmaur district has about 85% small and marginal

farmer families and the holdings are very small and scattered. The yield of crops has been reported to be low. Major food crops are grouped in three categories namely cereals, pulses and other food crops like chillies, ginger, sugarcane and turmeric. Non food crops are of two types viz. oilseeds and other crops such as cotton, tobacco and fodder etc. During the decade 1991-2001, the agricultural production of various crops has increased two to three folds. Maize, potato and off season vegetable crops have become popular in the district. With a view to increase the production of wheat, maize, paddy, gram, lentil, sugarcane, soybean, sunflower, toria, til, etc., their high yielding varieties have been introduced in the district. The cultivation of vegetables like peas, tomato, cabbage, cauliflower and potato has become more popular in the district. Improved varieties

of peas, tomato and potato have been introduced. Besides, various schemes have been taken up for insect and pest control. The district has earned a name for itself as producer and supplier of ginger. In order to encourage the cultivation of sugarcane in the district, the State Government has started a Khandsari plant at Paonta Sahib so as to provide market for the sugarcane product and also regulated marketing committee which was established at Paonta Sahib in 1973 to ensure fair return to the cultivators.

The district has been experiencing changes in the area under agriculture over the last two decades. Except for Rajgarh, Pachhad, Dadahu, Renuka and to some extent Nohra Tehsils, other areas show more land being put under agriculture. Tehsils like Nahan, Shalai, Kamrau, Ronhat and Paonta sahib have shown a decrease in area under agricultural use. The reason may be attributed to the increase in mining and industrial activities in the Tehsils. There are five seed multiplication farms at Bhagani and Dhaula Kuan in Paonta Sahib Block, Bagpashog in Pachhad block, Andheti in Sangrah block and Hubi in Nahan block. In Shimla district, there are two Potato Development Station at Khwagadhar and Thiambagh in Pachhad and Renuka blocks respectively.

The total area sown in the district during the year 1999-2000 is 77,464 ha. The net area sown is 41,626 ha constituting 53.73% of the total

area sown in the district. Another 35,835 ha are sown for more than one time. There is 14,405 ha of land, which were irrigated during the year 1999-2000. The production of wheat during 1999-2000 has been 45,739 metric tonnes, maize (77,137 MT), rice (8,199 MT), barley (2,916 MT), millets and ragi (251 and 317 MT respectively), pulses (2,343 MT) potato (24,298 MT), sugarcane (44,990 MT), ginger (1,842 MT), chillies (125 MT) and 345 metric tonnes of edible oilseeds like til, toria and mustard ( Table 40).

**Table 40: Land use classification and crop production during the year 1999-2000**

Land Classification (in Ha)	
Net area sown	41,626
Area sown more than once	35,838
Total area sown	77,464
Culturable area	45,520
Percent to net area sown to total area sown	53.74
Crop Production (in MT )	
Wheat	45,739
Maize	77,137
Rice	8,199
Barley	2,916
Millets	251
Ragi	317
Pulses	2,343
Potato	24,298
Sugarcane	44,990
Ginger	1,842
Chillies	125
Edible oilseeds	345

Source: District Statistical Abstract, Sirmaur-2001

**Table 41: Profile of Agriculture of Sirmaur District**

Parameter	1996-97	1997-98	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
Nature of soil	The soil in the district varies from light sandy to heavy clay and in Paonta Sahib valley, it ranges from sandy to sandy loam. Soils vary from deep black soils in the river valleys to maroon red or grey in the hilly areas. Reddish brown soils are found on hilly slopes and in undulating areas in heavy rainfall region of the district. These are residual soils and are usually structure less and sandy loamy in texture. Deep black soils occur particularly in areas having assured rainfall. This is clayey texture and granular to crumb structure. These are fertile soils highly retentive of moisture and yield good crops. Medium deep soils occur in the areas where the rainfall is low. They are reddish brown in colour and have clayey texture and granular in blocky structure. Shallow soils are light brown to reddish brown in colour. They are loamy sands to sandy clay in texture and usually structure less. Deep soils occur in low rainfall areas. They are dark brown in colour and have a sandy loamy texture and block structure.									

Parameter	1996-97	1997-98	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
Nature of crops	Maize, wheat and paddy are main crops. Ginger is main cash crop. High quality of paddy, wheat and sugarcane are the main crops grown in this region on commercial scale. The agro – climatic conditions are quite suitable for tropical and sub tropical fruits.									
Geographical area by village papers (km <sup>2</sup> )	2248	2248	2248	2248	2248	2247	2248	2247	2247	2247
Unusable area (km <sup>2</sup> )	178	179	188	190	190	191	192	192	190	191.5
Other uncultivated land excluding fallow land (km <sup>2</sup> )	1109	1107	1100	1102	1101	1099	1098	1093	1100	1093
Fallow land (km <sup>2</sup> )	52	54	58	52	57	76	67	67	69	67.05
Total cropped area (km <sup>2</sup> )	777	784	775	767	765	729	747	757	746	757.5
Net sown area (km <sup>2</sup> )	424	422	416	421	414	397	408	412	405	412.2
Area sown more than once (km <sup>2</sup> )	353	362	358	346	351	332	339	345	341	345.3
Area under principal crops (km <sup>2</sup> )										
Production of principal crops (MT)										
Area under fruits (km <sup>2</sup> )								152.02	130.06	130.1
Production of fruits (MT)								12804	13812	16648
Net irrigated area (km <sup>2</sup> )	140.7	141.2					136.79	141.2	141.2	141.2
Fertilizer consumption (MT)	2090		2309	3298	2810	3766	2948	3317	3317	

Source: Statistical Outline of Himachal Pradesh

**11 Solan:** Agriculture is the largest single main occupation of the people in the district. It provides direct employment to the major chunk of the working population. Maize, wheat, rice and pulses etc. are the main crops of the district. Cash crops such as sugarcane in Nalagarh Tehsil and potato in Kandaghat Tehsil are grown. Besides, vegetable cultivation has also been taken up in a big way. Despite hilly topography of the district, additional area has been brought under cultivation. Rainfall is indispensable for the cultivation in the hilly areas. This is because irrigation facilities could not be created here to the extent possible in plains. Due to unfavourable climatic conditions, only higher elevation area with a facility of irrigation provided a good scope for vegetable cultivation in the district. The district is suitable for growing off season vegetables like tomato, capsicum, peas etc. The cauliflower seed is also grown in the district and exported to plains. The major crops grown in the district and area covered are shown in Table 42. A brief

description of Rabi and Kharif crops grown in the district are given below:

- Wheat High yielding of wheat HD-2380, HS-240, HS-295 are very popular with the cultivators. Recently, Aradhana and Surbhi varieties have been introduced. Total cultivated area in the district under wheat during the year 1999-2000 was 23631 ha.
- Maize: High yielding varieties of maize PSCL-3438, KH-517, KH-101 and KH-581 are very popular with the cultivators in the district. Sartaj and Naveen varieties are grown in lower belts. Total cultivated area in the district under maize is 23797 ha.
- Paddy: Paddy is mostly confined to the area having assured irrigation facilities. The latest high yielding varieties such as PR-108, Himalaya – 2216 are grown in the district. PR-111 is also going to be introduced. Total cultivated area in the

district under paddy is 3957 ha.

- Gram: The crop is mainly sown in Nalagarh Tehsil and lower areas of Solan and Arki Tehsils. The varieties of C-235 and SPG-17 are popular in the district. It is cultivated in 768 ha.
- Pulses: Mash-Pant U-19 LANTHA 9-12 and SESAMUM PB-1 are the major pulses grown in the district. Total cultivated area in the district. Total

cultivated area in the district under pulses in 1999-2000 was 4507 ha.

- Off season Vegetables: Vegetables are mostly grown in Saproon valley and Kandaghat Tehsil of the district. Farmers grow high yielding hybrids of tomatoes, peas, cauliflower, capsicum, beans etc. Total area in the district under vegetables is 2717 ha.

**Table 42: Tehsil wise cultivated area under the major crops in Solan district in the year 1999-2000 (ha)**

Crops	Arki	Kandaghat	Kasauli	Krishan-garh	Nalagarh	Ramshehar	Solan	Total
1 Paddy	992	40	166	188	2036	464	51	3937
2 Maize	5994	1348	1963	1716	8743	1770	2063	23797
3 Wheat	4093	756	2946	1698	10774	2175	1989	23631
4 Barley	752	437	140	256	9	99	372	2063
Total Cereals	12631	2581	4315	3858	21729	4506	3775	53448
1 Gram	-	-	149	1	596	13	4	768
2. Peas	5	331	66	38	-	14	652	1091
3. Arhar	-	-	23	-	259	-	-	282
4. Mash	-	87	161	-	875	23	192	1662
5. Kulath	324	79	16	38	23	14	38	559
6. Masoor	-	-	-	-	-	-	3	354
7. Other pulses	47	-	-	74	9	-	-	124
Total pulses	727	497	415	153	1262	64	889	4507
1. Sugarcane	-	-	27	-	217	-	7	305
2. Potato	27	42	8	3	53	2	4	138
3. Tomato	146	408	215	104	20	169	765	1877
4. Onion	9	1	14	1	10	1	-	36
5. Cabbage	26	15	2	4	2	1	14	64
6. Other vegetables	64	189	43	27	82	21	176	584
Total vegetables	272	655	281	199	167	184	959	2717

Source: Statistical Abstract Solan District, 2000

Mushroom Cultivation: Solan is named as the Mushroom city. A large number of cultivators in the district are growing mushrooms on a commercial scale, as the climatic conditions in the district are most conducive for growing mushroom. Special incentives are being offered to small and marginal farmers, Scheduled Castes and Scheduled Tribes and unemployed youths for undertaking this activity. In order to boost the production and to encourage

mushroom cultivation, the Government of India has established National Research Centre for Mushroom at Chambaghat. Besides this, a composting unit of the Government of Himachal Pradesh under Horticulture Department is also located at Chambaghat. Apart from the above, twelve private units are also functioning in the district for manufacturing of mushroom compost.

**Table 43: Profile of Agriculture in Solan District**

Parameter	1996-97	1997-98	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
Nature of soil	The soil in the district varies from light to sandy heavy clay and in the valley areas, it is sandy and sandy loam.									
Nature of crops	District may be divided into three district regions viz. valley area of Nalagarh, Saproon and Kunihar, mid hills and higher hills of Solan, Kasauli and Kandaghat Tehsils, the valley area of Nalagarh and Kunihar is most suitable for growing cereal crops, potatoes, mangoes and citrus fruits. The valley area of Saproon is most suitable for growing offseason vegetables like tomatoes, peas, capsicum, cauliflower, cabbage, radish turnips etc. Stone fruits and temperate fruits are grown in the higher regions of the district.									
Geographical area by village papers (km <sup>2</sup> )	1806	1809	1809	1809	1809	1809	1809	1809	1809	1809
Unusable area (km <sup>2</sup> )	226	230	243	250	240	240	250	243	243	
Other uncultivated land excluding fallow land (km <sup>2</sup> )	933	924	906	905	917	917	914	919	925	
Fallow land (km <sup>2</sup> )	41	57	58	62	68	56	54	50	55	
Total cropped area (km <sup>2</sup> )	643	656	649	637	641	617	639	650	630	
Net sown area (km <sup>2</sup> )	405	394	398	390	405	393	389	394	383	
Area sown more than once (km <sup>2</sup> )	238	262	251	247	236	224	250	256	247	
Area under principal crops (km <sup>2</sup> )										
Production of principal crops (km <sup>2</sup> )										
Area under fruits (km <sup>2</sup> )										
Production of fruits (km <sup>2</sup> )										
Fertilizer consumption (MT)		3034	3264	2396	2339	2739	3691	3855	3855	
Net irrigated area (km <sup>2</sup> )	116.2	116.2								

Source: Statistical Outline of Himachal Pradesh

**12 Una:** Agriculture is the main occupation of the people in this district. The agro-climatic conditions prevailing in the district are favourable for growing crops. The land holdings of the farmers in the district are small. The farmers grow more than two crops in a year so as to get maximum production from the land.

Soil in the district varies from sandy loam to clay. Agricultural activities in the district are carried out in two spells i.e. spring and autumn. The spring crops are called “Rabi” and the autumn crops are known as “Kharif”. The main “Rabi” crops are Wheat, Barley, Gram and Oilseeds. The “Kharif” crops are Maize, Paddy, Oilseeds, Pulses and Potatoes. The crop rotations followed in the district are Paddy-Wheat, Maize-Wheat, Maize-Potato, Maize-

Wheat, Baisakhi Moong etc. Maize tops the list of agricultural produce, followed by wheat, rice, oilseeds, pulses, potatoes and sugarcane. In addition, efforts are also being made to encourage the farmers for growing vegetables like cauliflower, tomato, kalitori, tinda, potato, lady’s finger etc. Almost about 43% of the cultivated area is under double cropping.

The elevation of this district varies from 332 metres to 1,162 metres above the mean sea-level. The district receives heavy rainfall during monsoon season. Some efforts have been made for water harvesting by constructing water storages like irrigation tanks, ponds, check dams etc. The Department of Agriculture is supplying improved high yielding varieties of seeds of maize, paddy, wheat, pulses, oilseeds, potato, sugarcane, sunflowers etc. to increase

the yield of crops. The use of high yielding varieties of seeds, advanced agricultural machinery, fertilizers, pesticides, has increased agriculture production per ha, as given in Table 44.

**Table 44: Crop Yield (Kg/ha) During 1993-94 to 1995-96**

Sr. No.	Name of crops	1993-94	1994-95	1995-96
1	Maize	1,751	1,809	2,080
2	Rice	2,265	2,460	2,285
3	Wheat	1,505	2,077	1,975

Besides, efforts are also being made to encourage the farmers for growing vegetables like cauliflower, tomato, kalitori, tinda, potato, lady's fingers, etc. The seed multiplication farm Pakhubella is functioning in the district which serves the purpose of demonstration in farming to the farmers. The Department of Agriculture has a detailed programme to conduct training camps in each block headquarters. The department provides special incentive to farmers for attending these camps. The pressure of population is increasing on the land and effort is being made to bring more land under cultivation by reclaiming agricultural wasteland. The Department of Agriculture has established 17 sub-divisions in the State for undertaking soil conservation work on agriculture farming land.

As per District Statistical Abstract, out of the total 71,550 ha cropped area, 30,921 ha were under double cropping during 1999-2000. The data of land utilization for the year 1999-2000 as recorded by the District Revenue Officer, Una is given in Table 45.

**Table 45: Land utilization statistics for the year 1999-2000**

Classification of Area	Tehsil wise land utilization (ha)				
	Una	Amb	Bangana	Bharwain	Haroli Total
Total geographical area	33,477	49,657	41,850	10,055	19,883
Forest	1,158	4,062	8,731	4,570	18,521
Barren and unculturable land	11,148	17,084	13,001	2,520	8,322
Land put to non-agricultural uses	8,109	12,316	12,416	1,474	4,614
Culturable waste	1,205	311	1,680	226	1,396
Total cropped area	21,747	25,281	11,249	2,550	10,672

Source: District Statistical Abstract-2001

Major crops of the district are cereals, the area under different cereals were 64,291 ha, 863 ha under pulses and 3,420 ha under other crops in the district. Table 46 shows the area under main crops in each Tehsil/ sub-Tehsil of the district during 1999-2000.

**Table 46: Tehsil wise area under main crops (ha) during 1999-2000**

Sr. No.	Name of Crop	Tehsil wise Area (1999-2000)					Total
		Una	Amb	Bangana	Haroli	Bharwain	
1	Cereals	19,016	23,255	10,296	9,338	2,386	64,291
2	Pulses	178	356	137	157	35	863
3	Others	1,125	948	661	643	43	3,420

Source: District Statistical Abstract, Una-2001

In terms of area, wheat is the major crop of the district which occupied 32,096 ha which produced 38,711 metric tonnes during 1999-2000. However, quantity of maize produced was 56,153 tonnes in the area of 29,519 ha during the same period. Third position is occupied by rice followed by sugarcane, potato and oilseeds. Table 47 shows the area under major crops (in ha) and production of major crops (in MT) during the year 1998-99 and 1999-2000.

**Table 47: Area under different crops and production**

Sr. No.	Name of Main Crops	1998-99		1999-2000	
		Area (ha)	Production (MT)	Area (ha)	Production (MT)
1.	Maize	28,084	22,130	29,519	56,153
2.	Rice	2,592	3,227	2,627	5,769
3.	Wheat	33,083	19,729	32,096	38,711
4.	Pulses	919	261	864	391
5.	Potato	582	1,463	613	3,745
6.	Sugarcane	655	8,853	602	9,924
7.	Oilseeds	2,162	703	2,192	940

Source: District Statistical Abstract, Una 2001

**Table 48: Profile of Agriculture in Una District**

Parameter	1996-97	1997-98	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
Nature of soil	Soil in the district varies from sandy loam to clay									
Nature of crops	The spring crops are called “Rabi” and the autumn crops are known as “Kharif ”. The main “Rabi” crops are namely wheat, barley, gram and oilseeds. The “Kharif ” crops are namely maize, paddy, oilseeds pulses and potatoes. The crop rotations followed in the district are 1.Paddy - Wheat, 2. Maize -Wheat, 3. Maize -Potato, 4.Maize-Wheat and Baisakhi Moong									
Geographical area by village papers (km <sup>2</sup> )	1542	1542	1549	1549	1549	1549	1549	1549	1549	
Unusable area (km <sup>2</sup> )	432	434	521	512	513	511	523	553	510	
Other uncultivated land excluding fallow land (km <sup>2</sup> )	222	223	389	412	406	395	436	419	428	
Fallow land (km <sup>2</sup> )	196	197	48	44	43	50	40	58	69	
Total cropped area (km <sup>2</sup> )	729	752	715	689	689	756	708	717	715	
Net sown area (km <sup>2</sup> )	406	403	406	400	405	411	369	368	370	
Area sown more than once (km <sup>2</sup> )	323	349	309	289	284	345	339	349	345	
Area under principal crops (km <sup>2</sup> )									669.61	1476
Production of principal crops (MT)									93807	147519
Area under fruits (km <sup>2</sup> )									52.56	52.56
Production of fruits (MT)									5750	5750
Fertilizer consumption (MT)		4182	4742	4819	5210	6077	6011	6624	6624	
Net irrigated area (km <sup>2</sup> )	78.32	77.62								

Source: Statistical Outline of Himachal Pradesh

#### 4.1.2 Area and production of cash crops

The production of cash crops has increased in the State of Himachal Pradesh. The production of vegetables in 1985-86 was 280,000 MT, which increased to 991,400 in 2006-07. Potato production has increased from 27800 MT (1960-61) to 155300 MT (2007-08). The trend of production of cash crops is given in Table 49. The highest production of potato was found in district Shimla between 2000-01 & 2005-06, while between the year 2006-07 & 2007-08, the highest production was found in Kangra district (Table 50). Area under

vegetables has increased from 341.50 to 520.53 in the years of 2000-01 to 2006-07 respectively (Table 51). The area under potato cultivation decreased from 15500 ha. (2000-01) to 14083 ha. in the year 2007-08. The highest area under potato cultivation is found in Shimla District (Table 52). Highest income from Asparagus vegetables was found to be 1,20,000 per ha followed by Leek (70,000 per ha), Celery (60,000 per ha) and Brussel’s sprouts (50,000 per ha). The per ha income from other vegetables were less than 50,000. Details of income, yield, time of sowing and time of availability is given in Table 53.

**Table 49: Year wise production of cash crops**

Year	Vegetable (000 MT)	Potato (000MT)	Year	Vegetable (000 MT)	Potato (000 MT)
1960-61	NA	27.8	1993-94	385.0	100.0
1970-71	NA	85.9	1994-95	400.0	120.0
1980-81	NA	83.2	1995-96	425.0	130.0
1985-86	280.0	49.0	2000-01	NA	160.0



Year	Vegetable (000 MT )	Potato (000MT )	Year	Vegetable (000 MT)	Potato (000 MT )
1986-87	301.0	37.8	2001-02	627.4	108.2
1987-88	350.0	80.0	2002-03	621.9	143.4
1988-89	370.0	110.0	2003-04	731.4	155.4
1989-90	370.0	135.0	2004-05	832.4	151.9
1990-91	365.0	115.0	2005-06	930.0	162.6
1991-92	368.0	125.0	2006-07	991.4	163.2
1992-93	374.0	130.0	2007-08	1060 (P)	155.3

Source: Potato Statistics: India and World by Sabri N. K. Pandey and others of CPRI. & Directorate of Agriculture, Himachal Pradesh

**Table 50: District and Year Wise Production of Potato (MT)**

District	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08
Bilaspur	200	70	130	360	320	310	360	350
Chamba	6100	6276	6877	6,560	3,010	6,010	5,990	5300
Hamirpur	100	86	80	250	280	440	430	410
Kangra	9400	12182	15322	18,750	17,300	30,240	47,120	42140
Kinnaur	7500	1000	1579	6,500	5,870	1,670	2,600	2600
Kullu	6200	8113	11124	6,430	8,000	15,970	1,933	10450
Lahaul & Spiti	19500	11738	11136	27,780	11,500	19,700	20,000	12300
Mandi	17600	20439	33692	21,980	16,260	17,179	34,484	19079
Shimla	76000	32593	34168	44,160	67,000	42,841	27,481	35519
Sirmaur	10400	11817	20537	15,450	15,270	17,200	17,830	17500
Solan	3400	851	908	1,560	1,600	1,600	3,845	1500
Una	3600	3042	7801	5,620	5,500	9,390	780	8120
Total	160000	108207	143354	1,55,400	1,51,910	1,62,550	1,63,213	155268

Source: Department of Land Record & Directorate of Agriculture, Himachal Pradesh

**Table 51: Year wise area of cash crops**

Year	Potato Area(Km <sup>2</sup> )	Other Vegetables Area (Km <sup>2</sup> )
2001-02	138.69	341.50
2002-03	146.32	352.20
2003-04	150.36	442.74
2004-05	148.08	462.13
2005-06	162.01	498.58
2006-07	143.13	520.53
2007-08	140.83	530.0 (P)

Source: Directorate of Agriculture, Himachal Pradesh

**Table 52: District and year wise area of potato (ha)**

District	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08
Bilaspur	20	9	13	24	19	30	30	30
Chamba	490	604	680	684	680	456	600	600
Hamirpur	10	11	8	7	4	42	44	41
Kangra	1120	1566	1584	1503	1640	2520	2740	2680
Kinnaur	330	199	239	169	183	160	200	200
Kullu	700	1023	1349	1453	1293	1625	150	1450
Lahaul & Spiti	1030	813	813	807	759	1360	1400	742
Mandi	2180	2342	2398	2439	2453	1776	2419	1591
Shimla	7720	5308	5166	5667	5429	5509	3979	4339
Sirmaur	1270	1495	1509	1540	1472	1600	1710	1400
Solan	420	109	91	104	84	151	251	130
Una	210	390	782	639	792	972	790	880
Total	15500	13869	14632	15036	14808	16201	14313	14083

Source: Department of Land Records, H.P.

**Table 53: Production potential of exotic vegetables**

Vegetables	Yield (qt/ Ha.)	Income ( / Ha)	Time of sowing			Time of availability
			High Hills	Mid Hills	Low Hills	
Asparagus	80	120000	Mar-Nov	Mar-April (Seeds)	Oct-Nov	March
Celery	250	60000	Mar-Apr	Aug-Sep	Oct	Sept-Oct March-April
Parsley	120	40000	Mar-Apr	Aug-Sep	Oct	May-June Nov-Jan
Broccoli	100	40000	Mar-Apr	Aug-Sep	Sept-Oct	Sep-Oct Feb-March
Brussels Sprouts	100	50000	Feb-April	Aug-Sept	Oct	Sep-Oct Feb -March
Red Cabbage	150	45000	April-May	Aug-Sept	Oct-Nov	Sep-Oct, Feb-March
Globe	80	40000	-	March	June-July Aug-Oct	April- March
Leek	200	70000	Mar-Aug April-Oct			Sep-Oct March-Aug
Swiss Chard	120	20000	Mar-June	Sep	Oct	Feb-Aug Sep

### 4.1.3 Land holding size

Agriculture is considered to be the premier source of State income (GSDP). About 18% of the total GSDP comes from agriculture and its allied sectors. Out of the total geographical area of 55.67 lakhs ha, the area of operational holdings is about 9.79 lakhs ha and is operated by 9.14 lakhs farmers (Table 54). The average holding size comes to 1.1 ha. Distribution of land holdings according to Agricultural Census

2000-2001 shows that 86.4% of the total holdings are of small and marginal farmers. 13.2% of holdings are owned by semi medium/medium farmers and only 0.4% by large

farmers (Table 55). As per Agriculture Census 2001, the highest average land holding size (0.0214 km<sup>2</sup>) was found in district Sirmaur and the lowest (0.0068 km<sup>2</sup>) in district Kullu (Table 56).

**Table 54: Number & area of operational holdings by size class of holding 2000-01**

Size class (ha)	Number of Holdings	Percentage	Area (Km <sup>2</sup> )	Percentage
<0.05	404553	44.3	1006.94	10.3
0.5-1.0	210389	23.0	1510.78	15.4
Marginal Farmers	614942	67.3	2517.72	25.7
1.0-2.0	174230	19.1	2446.29	25.0
Small Farmers	174230	19.1	2446.29	25.0
2.0-3.0	63119	6.9	1519.01	15.5
3.0-4.0	26754	2.9	914.15	9.3
Semi-Medium Farmers	89873	9.8	2433.16	24.8
4.0-5.0	13604	1.5	607.14	6.2
5.0-7.5	12863	1.4	773.99	7.9
7.5-10.0	4432	0.5	377.66	3.9
Medium Farmers	30899	3.4	1758.79	18.0
10.0-20.0	3439	0.3	440.22	4.5
>20.0	531	0.1	191.38	2.0
Large Farmers	3970	0.4	631.60	6.5
<b>Total</b>	<b>913914</b>	<b>100</b>	<b>9787.56</b>	<b>100</b>

Source: Agriculture Census, Directorate of Land Records H.P.

**Table 55: Distribution of land holdings**

Size of Holdings (ha)	Category (Farmers)	No. of Holdings (Lakhs)	Area (Lakhs ha)	Av. Size of Holding (ha)
Below 1.0	Marginal	6.15 (67.3%)	2.52 (25.8%)	0.4
1.0-2.0	Small	1.74 (19.1%)	2.45 (25.0%)	1.4
2.0-4.0	Semi-Medium	0.90 (9.8%)	2.43 (24.8%)	2.7
4.0-10.0	Medium	0.31 (3.4%)	1.76 (18.0%)	5.7
10.0-Above	Large	0.04 (0.4%)	0.63 (6.4%)	15.7
<b>Total</b>		<b>9.14 (100%)</b>	<b>9.79 (100%)</b>	<b>1.1</b>

Source: Economic Survey Report, H.P., 2009-10

**Table 56: District wise operational holdings and area-2005-06**

District	Number	Area (Ha.)	Area (Sq. Km)	Average size of holding (Ha)
Bilaspur	56097	51727	517.27	0.92
Chamba	70012	55090	550.90	0.79
Hamirpur	72926	73541	735.41	1.01
Kangra	230416	203921	2039.21	0.89
Kinnaur	10507	14442	144.42	1.37
Kullu	67753	42401	424.01	0.63
Lahaul & Spiti	4152	6410	64.10	1.54
Mandi	149654	128932	1289.32	0.86
Shimla	109868	124618	1246.18	1.13
Sirmaur	49046	99182	991.82	2.02
Solan	50145	86921	869.21	1.73
Una	62807	81160	811.60	1.29
Himachal Pradesh	933383	968345	9683.45	1.18

Source: - Directorate of Agricultural Census, H.P.

#### 4.1.4 Mushroom Farming

The first mushroom farm was established at Solan in 1965. Another farm was established in 1968 at Chail. Three different organizations at Solan, National Centre for Mushroom Research and Training, Mushroom Research Laboratory and Dr. Y.S. Parmar University of Horticulture are actively engaged in different research and developmental programmes on Mushrooms. About 4000 farmers have been imparted training so far.

In some areas temperature increases beyond 32°C where paddy straw mushroom is grown. The different types of mushroom species which grow in temperature between 80-30°C are given in Table 57.

**Table 57: Suitable Temperature for Mushroom Farming**

Botanical Name	Common Name	Temp. Required
Agaricus bisporus	Common button mushroom	14-25°C
Agaricus bitorquis	Hot weather button mushroom	24-30°C
Pleurotus sajor-caju	Oyster mushroom	20-32°C
Pleurotus ostreatus	Oyster mushroom	8-25°C
Flammulina velutipes	Winter mushroom	10-25°C
Lentinula edodes	Shiitake	10-25°C
Auricularia polytricha	Black ear mushroom	20-30°C

## 4.2 Pattern of Planning and Development in Sector

The economy of Himachal Pradesh is largely dependent on agriculture which still occupies a significant place in the State's economy. It accounts for 18% of the total State Domestic Product in 2008-09 and any fluctuations in the production of food grains affect the economy significantly. During the Eleventh Five Year Plan 2007-12, emphasis has been laid on production of off-season vegetables, potato, pulses and oilseeds besides cereal crops through timely and adequate supply of inputs, bringing more area under irrigation, approach of watershed development, demonstration and effective dissemination of improved farm technology etc. The year 2008-09, agriculturally remained a lean year. During

the year 2008-09, the food grains' production was 14.00 lakhs MTs against 14.41 lakhs MTs during 2007-08. The production of potato was 1.45 lakhs MTs in 2008-09 as against 1.55 lakhs MTs in 2007-08. The production of vegetables during the year 2008-09 was 10.90 lakhs tonnes as against 10.41 lakhs MTs in 2007-08.

Agriculture continues to be a major source of livelihood for majority of the people in Himachal Pradesh. Share of agriculture and animal husbandry in the Net State Domestic Product (NSDP) has come down from 34.95% in 1980-81 to 19.61% in 2005-06. However, still about two-thirds of the population in the State is dependent on agriculture for its living. The growth trends of the NSDP in the State indicate that except for the second half of 1980s, agriculture sector fared poorly throughout the decades of the 1980s and 1990s. It is only during the period 2000-01 to 2005-06 that this sector registered a significant growth of 6.97%. Furthermore, a decomposition of the gross value of output in this sector revealed that horticulture sector is emerging as a prime mover of the growth in agriculture in the last few years. This is amply borne out by the fact that its share in gross value of output has gone up from 25.21% in 1999-2000 to 40.67% in 2006-07. The share of crop production, on the other hand, has come down from 42.60 to 29.22% during the same period. The contribution of livestock sector has remained almost stagnant at 30.0% level. The increasing contribution of horticulture in the State also becomes evident from the fact that the Gross Value Added (GVA) in this sub sector increased from `843.76 Crores in 1999-2000 to `2244.97 Crores in 2006-07 registering a highly significant growth rate of 13.7% per annum. Planning is an act or process of preparing or carrying out a focused activity with goals, procedures and policies for economic emancipation of a social or economic unit in a given time frame. The plan document containing goals, targets and policies to

accomplish plan targets is defined as plan. Planning in the context of district agricultural plans is an exercise of preparing an integrated plan considering available resources and encompassing all sectoral activities and schemes being carried out by the government or non-government organisations in a local government area such as panchayat, taluka or district. Accordingly, the plan thus prepared is called panchayat or taluka or district plan.

The process of democratic decentralised planning in India dates back to the First Five-Year Plan (1951-1956) which underlined the need to break up the planning exercise into national, state, district and community levels. Two new elements, namely, establishment of District Development Council and drawing up of village plans and people's participation in planning process through democratic decisions were added in the Second Five Year Plan following the recommendations of Balwant Rai Mehta Committee in 1957. Several new elements have been added to strengthen the process of decentralized planning in the subsequent plans. The importance of preparing panchayat/ block / district plan lies in involving the people at the grassroots/stakeholders level and those who are responsible for implementing these plans. The Administrative Reforms Commission in 1967 highlighted that planning needed to be focused in those areas where local variations in pattern and process of development were likely to yield quick results. The Planning Commission issued guidelines to the State Governments for formulating district plans in 1969. These guidelines provided details regarding the concept and methodology for drawing up these plans in a framework of annual, medium and perspective plans. The recommendations of several other Committees, namely, Dantwala (1978), Hanumantha Rao (1984) and GVK Rao (1985) were instrumental in the concretisation of the idea and concept of District Plans.

The preparation of these plans assumed special significance after the 73<sup>rd</sup> and 74<sup>th</sup> constitutional amendments which conferred constitutional status to panchayats at district and sub-district levels and local self-government in urban areas. Article 243 ZD of the Constitution provides the procedure for the constitution of District Planning Committee (DPCs) at the district level to consolidate the plans prepared by the panchayats and municipalities and prepare draft development plan for the whole district. The important functions proposed for the DPC include, inter alia, to (i) consolidate plans prepared by the panchayats at different levels of the rural, local and urban bodies; (ii) assess the development disparity that exists between or amongst village panchayats, District panchayats and municipalities and identify the basic reasons for these disparities; (iii) identify and prioritise the schemes for the development of district conforming to the objectives of the State and Central governments; (iv) formulate objectives and strategies for the identification and prioritisation of the schemes for the district. As per the guidelines, the preparation of district level plans have to be preceded, amongst others, by the complete assignment of the activities to be undertaken by different levels of local government, formation of District Planning Committees (DPCs).

The current crisis in agricultural sector has once again brought up the importance of preparing District Agricultural Plans taking into account agro-climatic niches, problems and potentials in each of the districts in the country. Indian agriculture has witnessed sharp deceleration during the last decade or so. The growth rate has plummeted from a 3.62% per annum during the period of 1984-85 to 1995-96 to less than 2% in the subsequent period of 1995-96 to 2004-05. Agricultural growth was slightly above 2% during 2006-07 but much lower than the target growth rate of 4%. It is evident from declining plan outlay, declining public sector capital formation, dwindling credit supply which is manifested in the fact that the growth rate of institutional credit to agriculture has

declined from about 6.64% during 1981-91 to 2% during 1991-99. Other trends observed are decrease in the use of critical inputs, increase in the cost of production, faulty price policy in terms of mismatch between Minimum Support Price (MSP) and cost of cultivation and coverage of commodities under MSP scheme. Neglect of agricultural research and extension, technology fatigue manifested in stagnation/deceleration in growth of yields of important crops like wheat, practically no increase in area under irrigation despite launching AIBP in 1996-97. Between 1995-96 and 2003-04, both Central and State Governments have spent nearly `35,000 Crores but the net irrigated area has remained static at around 53 to 55 million ha. The poor growth in surface irrigation has obliged farmers to depend heavily on ground water exploitation thereby depleting ground water resources and increasing cost of production and fall in the rate of growth of employment opportunities. While the overall employment growth declined from 1.74% between 1983-84 and 1993-94 to 1.08% between 1993-94 and 2003-04, in agriculture, it decreased from 1.41% to 0.63%. The net result has been dwindling incomes of the farmers.

The Eleventh Five Year Plan (2007-2012) has set a growth target of 4% for agricultural sector and 9% for the economy as a whole. To accomplish this rate of growth, Centre has emphasized fast and inclusive growth, especially of agricultural sector

The Eleventh Five -Year Plan (2007-2012) has set a growth target of 4% for agricultural sector and 9% for the economy as a whole. To accomplish this rate of growth, Centre has emphasised fast and inclusive growth, especially of agricultural sector, so that the benefits of growth percolate to the most vulnerable sections of the society like landless labour, marginal and small farmers, Scheduled Caste, Scheduled Tribes, women, etc. A number of new initiatives have been launched to revive growth in agriculture. One such important innovation that has been introduced in the

Eleventh Five Year- Plan is Rashtriya Krishi Vikas Yojna (RKVY) with an outlay of ` 25,000 Crores to give States more flexibility and autonomy in planning and executing programmes for agriculture, achieve goals of bridging the yield gaps in important crops, maximise returns to the farmers, incentivise them to spend more on agricultural sector and address the agriculture and allied sectors in an integrated manner. The funds under this scheme would be provided to the States as 100% grant by the Central Government. An outlay of ` 1500 Crores has been approved for 2007-08. The financial assistance provided to the State Governments from this Centrally Sponsored Scheme is subject to fulfillment of certain conditions. First, the expenditure on agriculture by the State Governments is higher than the base period, which is defined as the moving average of the expenditure of the preceding three years. Second, the preparation of district and State Agricultural Plans is mandatory. The areas like integrated development of food crops including coarse cereals, minor millets and pulses, agricultural mechanisation, soil health and productivity, development of rain-fed farming systems, integrated pest management, market infrastructure, horticulture, animal husbandry, dairying and fisheries, completion of projects that have definite time lines, support to institutions that promote agriculture, horticulture and organic and bio-fertilisers, etc. are given priority. The District Agricultural Plan (DAP) should determine each district's resources, its production plan and the associated input plan. It has also been emphasised to integrate these district level agricultural plans with the State plans.

As a result of irrigation facilities, significant shift has taken place in cropping pattern in district Bilaspur, Hamirpur, Kangra, Sirmaur, Shimla & Solan reportedly. Major shift is from cereal crops to vegetables. In addition, multiple cropping has been introduced in irrigated areas (Table 58).

**Table 58: Change in Cropping Pattern**

Sl. No.	Pre Project		Post Project	
	Crop	% area	Crop	% area
<b>Rabi Crop</b>				
1	Wheat	75	Wheat	65
2	Barley	8	Barley	3
3	Mustard & Oilseeds	2	Oilseeds including Toria	3
4	Vegetable	3	Vegetable	18
5	Gram & Lentil	8	Rabi pulses	5
6	Fodder, Berseem, Sugarcane	4	Fodder & other crops	6
<b>Kharif Crop</b>				
1	Maize	65	Maize	55
2	Paddy	20	Paddy	15
3	Pulses	5	Pulses	5
4	Vegetable	5	Vegetable	18
5	Other crops such as Fod-der, Soybean Sunflower etc & fallow	5	Other crop	7

Source: State of environment report of H.P. 2011

Progress of Department of Agriculture: During the last 50 years the Agriculture Department has made tremendous progress in terms of crop production. It can be tabulated as follows:

**Table 59: Progress in Production of Crops**

Crop Production	1951-52	2008-09
Food-grain	200 Thousand tonnes	1399.56 Thousand tonnes
Maize	67.3 Thousand tonnes	676.64 Thousand tonnes
Rice	28.3 Thousand tonnes	118.28 Thousand tonnes
Wheat	61.2 Thousand tonnes	531.49 Thousand tonnes
Vegetable	25 Thousand tonnes	1090.33 Thousand tonnes
Ginger	1.24 Thousand tonnes	3.50 Thousand tonnes
Potato	1.60 Thousand tonnes	182 Thousand tonnes

Area and production of High Yielding Varieties crops: The area of maize and paddy crops has increased in the State while area under wheat crop has decreased from 345.85 ha in 1997-98 to 325.22 ha in the year 2008-09 (Table 60). New opportunities emerging for cultivation include flowers, medicinal and aromatic plants and new fruits like kiwi and hazel nut. The farmers of district Lahaul and Spiti cultivate more cash crops, so this district has the lowest HYV crop area. The year wise status of area under HYV crops are given below:

**Table 60: Year wise area under High Yielding Variety crops**

Year	Area (Thousand ha)		
	Maize	Paddy	Wheat
1997-98	166.99	73.95	345.85
1998-99	191.61	80.55	378.26
1999-00	193.74	74.31	366.52
2000-01	219.68	73.83	329.77
2001-02	231.58	74.53	346.72
2002-03	192.1	64.73	313.23
2003-04	222.19	78.9	364.07
2004-05	242.76	75.21	353.29
2005-06	273.14	70.94	346.15
2006-07	280.61	72.65	349.6
2007-08	280.31	73.56	332.09
2008-09	280.51	74.61	325.22
2009-10	296.50	76.00	328.00
2010-11	278.65	75.20	327.00

Source: Directorate of Agriculture, Himachal Pradesh

Growth in Food Grains Production: There is limited scope of increasing production through expansion of cultivable land. Like the whole country, Himachal Pradesh too has almost

reached a plateau as far as cultivable land is concerned. Hence, the emphasis has to be on increasing productivity levels besides diversification towards high value crops. Due to an increasing shift towards commercial crops, the area under food grains is gradually declining as the area which in 1997-98 was 853.88 thousand ha is likely to decline to 789.01 thousand ha in 2008-09.

According to the Economic Survey Report, 2009-10, the food grain production targets for 2009-10 are to be around 16.50 lakhs MTs. The Kharif production mainly depends upon the behaviour of South West monsoon, as about 81.5% of the total cultivated area is rain fed. During the year 2009 against the Kharif target of 9.16 lakhs MTs, it is expected that about 8.14 lakhs MTs of food grains will be achieved. Due to deficient rainfall during October to December 2008, the production fell short of target. The production of food grains and commercial crops in the State during 2006-07 to 2007-08, 2008-09 likely anticipated achievement for 2009-10 and target for 2010-11 are shown in Table 61.

**Table 61: Food grains production (In '000 tonnes)**

Crop	2006-07	2007-08	2008-09 (Likely)	2009-10 (Anti. Ach.)	2010-11 (Target)
<b>I. Food grains</b>					
Rice	123.49	121.45	118.28	50.98	130.00
Maize	695.38	628.61	676.64	331.67	785.00
Ragi	3.16	2.49	3.1	1.48	4.50
Milllets	5.08	5.46	5.09	1.9	6.60
Wheat	596.49	562.01	531.49	523.85	687.00
Barley	33.87	30.68	26.4	27.11	37.00
Gram	1.02	1.37	1.6	0.62	4.00
Pulses	17.998	34.59	36.96	18.77	16.50
Total	1476.488	1386.66	1399.56	956.38	1670.6
Food grains	1,476.49	1,440.66	1,399.56	956.38	1,670.60
<b>II. Commercial Crops</b>					
Potato	163.21	155.26	145.6	61.08	185.00
Vegetables	991.44	1,040.49	1,090.33	1130.00	1250.00
Ginger (Dry)	2.06	2.55	4.16	2.00	5.20

Source: Economic Survey Report, H.P., 2009-10

**Watershed Development:** Nearly 70-75% rain occurs during monsoons, which flow as run-off without conservation. As a result, all areas without assured irrigation suffer from water stress and low productivity. So, development of

watersheds has been emphasized for water conservation. District wise number of watershed is given in Table 62.

**Table 62: List of Watershed Identified for Tenth five Year Plan**

District	No. of watershed	Arable land (Km <sup>2</sup> )	Non arable (Km <sup>2</sup> )	Total (Km <sup>2</sup> )
Bilaspur	6	20.62	14.10	34.72
Hamirpur	3	11.13	8.40	19.53
Kangra	14	51.78	54.01	105.79
Kullu	7	21.29	4.01	25.30
Mandi	20	54.56	76.51	131.07
Shimla	2	3.46	6.87	10.33
Sirmaur	8	21.88	32.61	54.49
Solan	10	25.92	33.70	59.62
Total	70	210.64	230.21	440.85

Source: Work Plan for Accelerated Growth, Himachal Pradesh 2002-03

The State Government is laying emphasis on production of offseason vegetables, potato, ginger, pulses and oilseeds besides increasing production of cereal crops, through timely and adequate supply of inputs, demonstration and effective dissemination of improved farm technology, replacement of old variety seeds, promoting integrated pest management, bringing more area under efficient use of water resources and implementation of waste land development projects.

**Agricultural Inputs (Seed):** Seed is the most important determinant of agricultural potential. The State has no well defined seed production programme as there is no Seed Corporation. Also private seed organizations are not helping in seed production/distribution programme. State Government relies on the seed production / multiplication of the important crop varieties by the farmers of the State, which is insufficient and without any quality determinants. Department of Agriculture procures about 60,000 quintals of wheat seed every year from registered growers of the State, out of which 15000-18000 quintals of seeds are procured from farmers of Una district only. About 50,000 quintals of certified seeds are distributed among farmers and about 42,000 quintals are produced within the State.

Construction of Market Yards: Taking into consideration the need to develop the markets all over the State, the Board is undertaking State level planning and execution of construction work of market yards to create infrastructural facilities likeshop-cum-godowns, auction platform, farmer's rest houses, internal roads, compound wall, drinking water facilities, canteen banking facilities etc. The efforts are being made to provide marketing facilities to the growers near their farms.

Modernization and Expansion of Existing Market Yards: Most of the principal market yards/sub yards constructed by the Board/Market Committees lack the modern marketing facilities and are congested. There is an urgent need to expand the handling capacity and provide modern marketing facilities. The H.P. State Agricultural Marketing Board has already taken initiatives to expand and modernize the different marketing yards in the State. The principal market yard, Dhalli (Shimla) is being taken up in the first phase.

Construction of Link Roads: In the absence of proper roads, farmers are compelled to sell their produce to local traders or they have to carry it to road heads on head or by mules, which substantially increases the marketing cost. To overcome this obstacle, the Board is constructing link roads so that farmers could bring their produce to the market throughout the year under all weather conditions.

Construction of Ropeways: Due to difficult terrain the construction of road is very difficult and more expensive in hilly areas. The Board is constructing ropeways to link these areas to road head. The ropeways require less time and money to install. There is a proposal for taking up this activity on a large scale as there is a lot of scope for this activity in hilly areas of Himachal Pradesh.

Centrally Sponsored Schemes implemented by Ministry of Agriculture

1. Integrated Scheme of Oilseed, Pulses, Oil Palm and Maize (ISOPOM): The Government of India launched this scheme during the year 2004-2005. Only maize crop has been included in Himachal Pradesh. The main component of the scheme are block demonstrations, IPM demonstrations, distribution of HDPE pipes for carrying water from the source to field, involvement of private sector in seed production, supply of input extension support, etc. and publicity regarding development of maize, etc. The scheme is being implemented on 75:25 basis except for the component of publicity where Central Government share is 100%.

2. Biogas Development Programme: This is 100% Centrally Sponsored Scheme under which ` 4,000 is provided as subsidy on Biogas Plants up to 1 cubic metre and for more than 1 cubic metre, the subsidy is `10, 000.

3. Work Plan for Accelerated Growth of Agriculture: The Government of India has launched this programme during the year 2000-2001 on 90% Centre share and 10% State share basis. In this, States have to identify their constraints and propose schemes for funding through Work Plan. Flexibility has also been given to State Level Coordination Committee to make changes in allocation, if required from one scheme to other. For the year 2009-2010, Work Plan of Rs.1353.33 lakhs has been prepared and approved by the Government of India.

Name of Scheme	Amount (Rs. in lakhs)
Crop Improvement programmme	370.14
Scheme for Farm Mechanizations	376.00
Scheme for Balance & Integrated Nutrients Management	241.00
Implementation of National Watershed Development Project for Rain fed Area	150.00
Scheme for Agriculture Extension (Innovative)	36.65
Scheme for on Farm Management & Soil Conservation (Innovative)	144.48
Scheme for Farm Women Empowerment Gender component (Innovative)	27.37
Scheme for Organic Farming	10.00
Total	1355.64



4. Promotion and Strengthening of Agricultural Mechanisation through Training, Testing and Demonstration: This scheme was launched in the year 2003-2004. Under this scheme, demonstrations of newly developed agricultural equipments are being conducted in the farmer's fields every year. During 2010-2011, a sum of Rs. 26.95 lakhs has been released by the Government of India for conducting demonstrations of newly developed agricultural equipments like rotavator, multicrop planter, zero till seed-cum-fertilizer drill, power tiller operated till plant machine, self propelled reaper, vegetable transplanter, manual seed drill and grain cleaner etc, which have been incurred for these activities.

5. Restructured Scheme for Development and Strengthening of Infrastructure Facilities for Production and Distribution of Quality Seeds: Under this scheme, the Department of Agriculture started strengthening Seed Testing Laboratories, Palampur, Solan and a new Seed Testing Laboratory at Mandi is being set up.

6. Seed Village Programme: Government of India has started a novel programme known as "Seed Village Programme" by which sufficient seed multiplication can be achieved in order to meet local seed requirement besides facilitating supply of seeds at reasonable cost and ensuring quick multiplication of new varieties in a shorter time. Under this programme, areas of better seed production will be identified and a compact area approach will be followed. 50 to 150 suitable responding/willing farmers for the same crops will be identified/ selected preferably in compact area/cluster approach. Foundation/certified seed at 50% cost will be made available to these identified farmers. Seeds for half an acre per farmer will be allowed. Training on seed production and seed technology will be imparted to the identified farmers for the seed crops grown in the seed villages. Besides this, assistance @ 33% on seed storage bins of 2.1 quintal capacity is also available.

7. Rashtriya Krishi Vikas Yojna (R.K.V.Y): Government of India has launched Rashtriya Krishi Vikas Yojna (RKVY) during 2007-2008. The RKVY aims at achieving 4% annual growth in the agriculture sector during the 11th Plan period, by ensuring a holistic development of agriculture and allied sectors. The main objectives of the scheme are; to incentivise the States so as to increase public investment in agriculture and allied sectors, to provide flexibility and autonomy to States in the process of planning and executing agriculture and allied sector schemes, to ensure the preparation of agricultural plans for the districts and the States based on agroclimatic conditions, availability of technology and natural resources, to maximize returns to the farmers in agriculture and allied sectors and to bring about quantifiable changes in the production and productivity of various components in agriculture and allied sectors by addressing them in a holistic manner.

This scheme has commenced during the year 2007-2008 and an amount of `8.82 Crores has been spent by Agriculture Department against the outlay of `8.85 Crores. During the financial year 2008-2009, an amount of `16.29 Crores has been proposed under this scheme.

8. Kisan Call Centre: Under this scheme, farmers can get any information on agriculture by dialing the toll free number 1800-180-1551 or 1551. The service is available from 6.00 A.M. to 10.00 P.M. on all days.

9. Farm Women Empowerment: The Department of Agriculture has taken up Farm Women Empowerment Programme in a big way in 73 blocks of the State covering 11,800 women farmers. 8 women groups have been constituted in each block. The objectives of the programme are; assessment of needs of women farmers, prioritization of activities, providing package of technical training to women farmers in agriculture and allied areas, to provide organization and financial support to women groups to make Self help Thrift Groups, to develop their managerial, organizational,

entrepreneurial and decision making skills so as to enable them to develop them into a viable unit to start their own economic activities. These women groups are also being exposed to various parts of the State and country. The Government closed this scheme in December 2005 and new concept of gender budgeting has been introduced by the Government from the financial year 2006-2007 under which 30% of the budget is to be spent on women specific programmes.

10. Support to State Extension Programmes for Extension Reforms: This programme is a major initiative towards revitalizing agricultural extension to make the extension system decentralized and demand driven. The scheme has been conceptualized on the basis of the policy framework for agricultural extension and experiences with the innovations in the technology dissemination component of the National Technology Project implemented in the 7 States including Himachal Pradesh. Following key reforms are being promoted under the scheme;

Providing innovative restructured autonomous bodies at the district level (ATMA) and at block level (FAC, BTT), which are flexible, promote bottom up and participatory approaches, are farmer driven and facilitate public-private partnership.

- Convergence of line department programmes and operating on gap filling mode by formulating SREP and Annual Work Plans.
- Encouraging multi-agency extension strategies involving inter-alia public/ private extension service providers.
- Moving towards integrated, broad-based extension delivery in the line with farming systems approach.
- Adopting group approach to extension (operating through FIGs and SHGs).
- Addressing gender concerns (mobilizing farm women into groups, capacity building etc.)
- Moving towards sustainability of extension services (e.g. through beneficiary contribution).

During 2009-2010, an expenditure of `572.03 lakhs has been incurred against approved outlay of `800.03 lakhs. This scheme has been extended to all the 12 districts of the State. The approved outlay for 2010- 2011 is `685.03 lakhs.

11. Mass Media Support To Agriculture Extension: The primary objective of the scheme is to use television and radio with their massive penetration, as a vehicle for agricultural extension. Basically, the scheme is focusing on two initiatives: (a) Doordarshan: The first is the use of Doordarshan for infrastructure for providing agricultural related information and knowledge to farming community. It has two components (i) Narrowcasting using high/ low transmitters of Doordarshan (ii) Regional and National Agricultural Programmes in terrestrial mode of transmission. Presently, Doordarshan Shimla is telecasting Krishi Darshan Programme between 6.00 P.M. to 6.30 P.M. five days in a week (b) All India Radio: This component of scheme envisages the use of FM transmitters of AIR to broadcast area specific agricultural programmes with 30 minutes radio transmission six days a week. Presently, half an hour, Krishivani programme is being broadcast, six days a week from FM Dharamshala and Hamirpur.

12. National Project on Organic Farming: Government of India has launched a National Project on Agriculture in order to promote organic farming. Under this project, financial assistance is being provided for setting up of Model Farms, training of farmers, setting up of worm hatcheries and service providers. For 2008-2009, the Government of India has released `38.05 lakhs. The proposed outlay for the year 2009-2010 is `133.00 lakhs. For promoting organic farming further, a project has been taken up in Shimla district in collaboration with Morarka Foundation and District Rural Development Agency, Shimla. Under the scheme, 48 clusters consisting of 5800 farmers have been registered. The

Department of Agriculture is providing assistance @ `1500 per farmer. This assistance would be provided in three years for documentation, data base management, training and capacity building, organic certification, linkage and value addition. Besides this, training of farmers regarding organic farming is also organised. One Cert Asia Agriculture Certification Pvt. Ltd., Jaipur has been engaged for the certification of organic produce. After the certification, this company will explore the market for this produce by entering into agreement with the interested companies. This programme of organic farming promotion has also been extended to other districts by involving local NGOs/ KVKs in the districts for promotion of organic farming and registration of farmers. Up to 2008-2009, 5240 additional farmers have been registered under organic farming through NGOs. During 2009-2010 a target of 4,000 farmers has been fixed to register under Organic farming. Upto 2010-11, 24000 and 12000ha area is covered / assistance of `3750 per unit is being provided to farmers to set up vermicomposting. 376000 vermicomposting units have been set up in the State upto 2010-11.

#### **State Sponsored Schemes implemented by Department of Agriculture**

1. Quality Seed Multiplication and Distribution: The Agriculture Department owns 25 Seed Multiplication Farms where foundation seeds of Kharif and Rabi crops are produced. Annually about 3500 to 4000 quintals seed of cereals, pulses and vegetables are produced. Further about 1,00,000 quintals of Certified Seeds of various crops are distributed to the farmers in the State.

2. Soil Testing: The Agriculture Department has 11 soil testing labs. Besides 2 mobile soil testing labs to provide free soil testing facilities to the farmers. About 1,00,000 samples are analyzed annually.

3. Crop Protection: The Agriculture Department keeps vigil on pest situation. To overcome this, about 60 MT of pesticides through 991 sale centres are being supplied to the farmers. For quality control, pesticide testing laboratory has been set up with an analysing capacity of 500 samples per year. One bio control laboratory has been set up at Palampur where conservation pest situation augmentation, rearing and multiplication of bio-agents and training to extension staff and farmers are being done. The plant protection material including equipments are supplied to the SCs/ STs/ IRDP families and farmers of the backward areas at 50% cost.

4. Seed Potato Development: The Agriculture Department owns 14 Potato Development Stations where foundation seed potato is produced. More area is being diversified towards cash crops to market maximum potato as they produce only that much seed potato which can easily be marketed outside the State.

5. Vegetables Development Project: Annually more than 11.00 lakhs tonnes of fresh vegetables are produced. The Agriculture Department owns three Vegetable Seed Farms where quality seed is produced.

6. Ginger Development: For production of disease free ginger, the Agriculture Department is providing training, demonstrations and quality seed. Annually, about 35,000 tonnes of Green ginger is produced which is marketed to the neighbouring States. The Agriculture Department owns two ginger farms where quality seed is produced.

7. Agricultural Marketing: At present, 10 Market Committees are functioning and 45 markets have been made functional. Market fee @ 1% is levied on buyers. Information on daily market rates is also disseminated through All India Radio/ Doordarshan/ Agrimarket.

8. Farmer's Trainings and Education: The Agriculture Department runs two training Centres, one at, Mashobra, District Shimla and the other at Sundernagar, District Mandi. Besides these, farmer's training camps are organized at village, block and district level.

9. Agricultural Economics and Statistics: Under this programme, three Centrally Sponsored Schemes viz. (i) Timely Reporting Schemes (TRS) for estimation of area and production of crops (ii) Improvement of Crop Statistics (ICS) for bringing quality in the land record data at grass root level and (iii) Estimation of Production of Commercial crops like Potato and Ginger. The estimation is done according to statistical techniques. Production estimates on principal crops like wheat & barley of Rabi season and maize, paddy, potato and ginger crops of Kharif are released on the basis of results of crop cutting experiments conducted according to Random Sampling Method. The Director of Land Records is the agency in the State responsible for collection and release of area estimates, forecast report etc.

10. Tea Development: Total area under tea is 2,312 ha. The Department is disseminating the latest production technology of tea cultivation to the tea growers.

11. Rashtriya Krishi Bima Yojna (RKBY): The State Government has adopted this Scheme from Rabi 1999-2000 season. Crops covered are wheat, barley, maize, paddy and potato. Fifty percent subsidy in premium was allowed to small and marginal farmers on sunset basis. The scheme is compulsory for loanee farmers and optional for non-loanee farmers. The scheme provides comprehensive risk insurance against yield losses viz. drought, hailstorm, floods and pests disease, etc. The Agriculture Insurance Company of India (AICI) is implementing the scheme. The farmers of the State can get benefit out of this programme. The State and Government of India share the losses equally. The subsidy on premium has been raised from 10% to 50% for small and

marginal farmers. From Kharif, 2008 season, ginger crop of district Sirmaur has also been taken up on Pilot basis for coverage under the Crop Insurance Scheme. Besides this, tomato and potato in Solan and Kangra/Una respectively have been covered under Weather Based Crop Insurance Scheme (WBCIS).

12. Rural Infrastructure Development Fund (RIDF): The Department of Agriculture is participating in RIDF for creation of irrigation potential through minor irrigation/WHS. The Agriculture Department got funds under RIDF-V during 1999-2000 where NABARD sanctioned 157 FIS amounting to `14.85 Crores which has created irrigation potential of 3,560 ha. These schemes are being executed through Water Users Associations who will also maintain them after their completion. Under RIDF-VI, 140 flow irrigation schemes were posed to NABARD which have been sanctioned for `11.37 Crores covering an area of 3,031 ha. Under RIDF-VII, 126 schemes worth `7.84 Crores have been sanctioned, which will create CCA of 2,395 ha. Besides, 90 water harvesting projects have been sanctioned for Hamirpur, under RIDF-VII with cost of `6.78 Crores. Under RIDF-IX, 200 minor irrigation schemes amounting to `8.32 Crores have been executed creating CCA 7,161 ha. Under RIDFXII, 150 minor irrigation schemes amounting to `9.01 Crores have been executed creating CCA 1333.62 ha during 2006-2007. During the year 2007-2008, an amount of `9.58 Crores has been incurred creating CCA 1821.71 hs. During 2008-2009, an amount of `12.00 Crores has been incurred by creating CCA 1104.22 ha. During 2009-2010 an amount of `7.50 Crores has been proposed for minor irrigation/ water harvesting projects.

13. Pandit Deen Dayal Kisan Bagwan Samridhi Yojna: The Department of Agriculture has launched

Pt. Deen Dayal Kisan Bagwan Samiridhi Yojna with the assistance of NABARD under RIDF-XIV Tranche. The project is being implemented in all districts of the State with an outlay of `353.01 Crores. This project

comprises two parts i.e. production of cash crops through adoption of precision farming practices through poly house cultivation for ₹154.92 Crores and project on diversification of agriculture through micro-irrigation and other related infrastructure for ₹198.08 Crores. For poly house and micro irrigation 80% subsidy is available, whereas, for creation of water source, 50% subsidy is available. This project has been launched in January 2009 and the project period is 4 years.

## **Other Schemes/ Programmes**

**1. High Yielding Varieties Programme (H.Y.V.P.):** In order to increase the production of food grains, emphasis has been laid on distribution of seeds of high yielding varieties to the farmers.

There are 25 seed multiplication farms where foundation seed is produced for further multiplication.

In addition, there are 3 vegetable development stations, 14 potato development stations and 2 ginger development stations in Himachal Pradesh.

**2. Plant Protection Programme:** In order to increase the production of crops, adoption of plant protection measures is of paramount importance. During each season, campaigns are organized to fight the menace of crop disease, insects and pest etc. The Scheduled Castes/Scheduled Tribes, IRDP families, farmers of backward areas and small and marginal farmers are provided plant protection chemicals and equipments at 50% cost. From October, 1998 the State Govt. has allowed 30% subsidy on such material to big farmers also.

**3. Soil Testing Programme:** In order to maintain the fertility of the soil during each season, soil samples are collected from the farmer's field and analysed in the soil testing laboratories. Soil testing laboratories have been established in all the districts, whereas two mobile soil testing vans out of which one

exclusively for the tribal areas has been purchased for testing the soil samples at the sites. These laboratories have been strengthened with latest equipments. During 2009-10, three laboratories have been strengthened including processing of one mobile laboratory in January 2010. Apart from this a proposal to strengthen five more laboratories, four mobile laboratories and set-up GPS in the State have been sent to Govt. of India for this funding. About one lakh soil samples are collected for soil analysis in a year. About one lakh twenty five thousand soil samples are expected to be analysed during 2010-11. It has also been ensured to provide Soil Health Cards to every eligible farmer by the end of 2011-12 in the State which will help the farmers to know the soil status and nutrient requirement, etc. in their fields.

**4. Organic Farming:** The organic farming is becoming popular being suitable, environment friendly and healthy. Organic farming is being promoted in the State in a systematic manner by providing trainings, laying out demonstrations, organizing fairs/seminars for the farmers. It has also been decided to set-up vermi-composting units at every house by the end of 2010-11. To cover these activities, 12,897 trainings, 15,040 (5,500 ha of area) farmers have been covered under organic farming through five NGOs, 20 vermiculture hatches 2,87,426 vermi-composting units have been set-up in the State during 2009-10.

**5. Biogas Development Programme:** Keeping in view depleting sources of conventional fuel i.e. firewood, biogas plants have assumed great importance in the low and mid hills in the State. Till March, 2009 since inception, 42,913 biogas plants have been installed in the State. Out of the total biogas produced in the Himalayas, about 90.86% is being produced in Himachal Pradesh alone. During 2008-09, 200 biogas plants were installed in the State against the target of 150 and it was proposed to install 150 biogas plants during 2009-10, against which 60 plants have

been installed up to December, 2009. During 2010-11, it is proposed to install 200 numbers of such biogas plants. This programme is at a saturation stage.

#### **6. Fertilizer Consumption and Subsidy:**

Fertilizer is a single input, which helps in increasing the production to a great extent. Starting from demonstration level in the late fifties and early sixties when fertilizer was introduced in Himachal Pradesh, the level of fertilizer consumption is constantly increasing. The level of fertilizer consumption in 1985-86 was 23,664 tonnes. This has increased to 57,363 tonnes (in 2008-09). The State Government is providing 100 % subsidy on transport of all kind of fertilizers to retail sale points thereby bringing the uniform sales rates of fertilizer in the State. The State Government has allowed subsidy on cost of Urea and Ammonium Sulphate at ` 200 per MT, and on complex fertilizers N.P.K. 12:32:16, 10:26:26 DAP and N.P.K. 15:15:15 at ` 500 per MT.

**7. Agriculture Credit:** Traditionally, non institutional sources of finance have been the major source of finance for the rural households due to various socio-economic conditions. Some of them have been lending at exorbitant rate of interest and since the poor own few assets, it is unviable for the financial institutions to secure their lending with collateral. However, the Government has taken measures to ensure timely and adequate supply of institutional credit to the rural households at reasonable rate of interest. In view of the propensity of the farmers to borrow money, most of whom are marginal and small farmers, credit flow for purchase of input is being made available by the banks. Institutional credit is being extensively disbursed, but there is scope to increase the same particularly in respect of the crops for which insurance cover is available. Providing better access to institutional credit for small and marginal farmers and other weaker sections to enable them to adopt modern technology and improved agricultural practices has been one of the major objectives

of the Government. The banking sector prepares crop specific credit plans and the credit flow is monitored urgently in the meetings of the State level Banker's Committee.

**8. Kisan Credit Card (K.C.C):** The scheme is under successful operation for the last ten to twelve years in the State. More than 1,329 bank branches are implementing the scheme. As on September, 2009 about 3, 81,641 Kisan Credit Cards were issued by the banks. The bank has disbursed a total credit of `1,103.05 Crores since the inception of KCC Scheme up to June 2009.

**9. Seed Certification Programme:** Agro-climatic conditions in the State are quite conducive for seed production. In order to maintain the quality of the seeds and also ensure higher prices of seeds to growers, seed certification programme has been given due emphasis. Himachal Pradesh State Seed Certification Agency registered growers in different parts of the State for seed production and certification of their produce.

**10. Agriculture Marketing:** Himachal Pradesh Marketing Board has been established at the State level. The whole of H.P. has been divided into ten notified market areas. Its main objective is to safeguard the interest of the farming community. The regulated markets established in different parts of the State are providing useful services to the farmers. A modernised market complex at Solan is functional for marketing of agricultural produce. The market fee has been reduced from 2% to 1% for the benefit of the farmers. The revenue generated under this Act, is utilized for raising infrastructure needs for ensuring remunerative marketing of the agriculture produce. The H.P. Agriculture Produce Market Act has also been amended on the lines of Model Act circulated by Government of India. With this, a provision has been made to set up private markets direct marketing and contract farming with a single point levy of entry fee. The markets are also

being computerized. All the activities have been taken up by the Marketing Board through their own funds and no plan assistance is being provided.

**11. Tea Development:** Total area under tea is 2,312 ha with a production level of 17.11 lakh kgs. Small and marginal tea planters are provided agriculture inputs on 50% subsidy. It is envisaged to give impetus for effective and remunerative returns of this commodity to the producers. Focus would also be on result and demonstration.

**12. Macro Management Approach for Agriculture Development:** This scheme by the Govt. of India in the part was uniformly structured and in most of the cases the components were not in connectivity with the State conditions. The State Govt. had taken up this constraint with the Govt. of India for providing greater flexibility in the implementation of the centrally sponsored programme and also projection of new innovations for accelerated agricultural development in the State. Under this approach, the work plans submitted by the State from the year 2000-01 get 90% central support (80% Grant and 20% loan) and 10% share from the State plan. Under the scheme, major emphasis is being laid on improvement of cereal crops, transfer of technology, and construction of water storage tanks, development of off-season vegetables, spices, and promotion of quality seed production and integrated nutrient management balance, use of fertilizers besides active involvement of women in agriculture.

**13. Soil and Water Conservation:** During 2009-10, 271 tank irrigation schemes, 60 water harvesting schemes and 770 sprinkler irrigation schemes shall be executed where 25% subsidy shall be provided to individual farmers. Besides this, 40 watershed development projects have been sanctioned covering an area of 3,200 ha with an estimated cost of `4.00 Crores. In these projects, major thrust would be on soil and water conservation and creation of employment

opportunities at farm level. During the year, 32 minor irrigation schemes under RIDF will be completed with a budget provision of `7.36 Crores. Additional irrigation potential of 800 ha shall be created during 2009-10. The schemes are being executed through Krishak Vikas Sangh and the operation and maintenance are being entrusted to them.

**14. Poly House Cultivation Project:** Department of Agriculture has prepared a project on production of cash crops by adoption of precision in farming practices through Poly House Cultivation. The objectives of the project are higher productivity and income per unit area, judicious use of natural resources like land and water, year round availability of vegetables, assured production of quality produce and increased efficiency of monetary inputs. The NABARD has sanctioned this project under RIDF XIV amounting to `154.92 Crores which shall be implemented in 4 years starting from the financial year 2008-09.

**15. Japan International Cooperation Agency (JICA) Project:** Crop Diversification Project being supported by JICA through ODA loan is likely to commence from 2010-11. Total project cost is `267 Crores spreading over 5 years. Annually `50 Crores would be spent under this project. The flow of funds from ODA shall be on the basis of reimbursement. Therefore, provision has to be made for this project in the Annual Plan Budget for the year 2010-11 to the extent of minimum `5 Crores under crop husbandry. Major thrust would be on increasing area and production under cash crop, grading, packaging, value addition and marketing of cash crop. Besides, ODA loan project has also been proposed on Diversified Agriculture for Enhanced Farm Income for JICA funding which has been included in the rolling plan of Govt. of India.

**16. Pandit Deen Dayal Kisan Bagwan Smridhi Yojna:** 5047 applications have been received, out of which 4,146 number of cases

have been sanctioned after evaluation/ field visit by DNO. 1,223 Poly Houses have been completed so far, under this project. Under Micro Irrigation System 1,420 sanctions covering area of 1,109 ha. have been issued by the field officers for installation of micro irrigation system. 30 systems have been completed and the remaining work is under progress. For creation of water resources under micro irrigation project (Phase-II) 585 sanctions have been issued by the field officers and the work on 417 water resources are under progress.

### 4.3 Technology/schemes adopted in sector along with any change in technology

Due to recent trends in modernization of agriculture, some practices have become alarming to the environment. These are the application of chemical pesticides, fungicides, antibiotics, acaricides, nematocides, herbicides, NPK fertilizers, use of dust powders such as DDT, BHC, and Sevin for treating stored grains or CELPHOS fumigation. The other pollutants are tractors replacing bullock cultivation, diesel pumps or gensets. The farmers still use traditional implements like plough, harrows and spade etc. Due to small size of holdings and lesser means of irrigation, it is difficult to use modern implements. However, the Department of Agriculture is making all possible efforts to popularize the modern implements to the local requirements. Besides, providing improved technology to the farmers of the district, adequate and timely supply of agricultural inputs like improved seeds, fertilisers, plant protection materials and improved agricultural implements is also arranged by the department. Under the 20 point programme, emphasis is being laid on the technology of dry land farming, development of oilseeds and pulses, installation of biogas plants as an alternative source of energy in the district. Moreover, for adopting soil conservation measures on agriculture land, the

State Government provides 50% subsidy and 50% loan to the farmers. Present Method of Irrigation: The four common methods being used for irrigation in Himachal Pradesh are flooding, furrow, border and basin. Flooding and border irrigation method are mostly used by the farmers (Table 63).

**Table 63: Present Method of Irrigation**

Method	Crop Irrigated
Flooding	Rice, Maize, Fodder
Furrow	Vegetables
Border	Wheat, Oilseeds, Pulses
Basin	Orchards

**Agriculture Mechanisation:** Under this scheme, new farm implements / machines are popularized among the farmers. Testing of new machines is also done under this programme. The department proposes to popularize small power tillers and implements suited to hilly conditions.

**Farm Mechanization:** The mechanization of the hill farms is on the rise as has been revealed by the field survey (Table 64). The most noticeable change has been the use of threshers in the State. Understandably, the extent of use of the threshers got reflected in the overall topographic conditions of the districts. For instance, it varied from 46.1 to 52.0 per cent in the high hill districts of Shimla, Sirmaur and Lahaul & Spiti to 92.0 to 96.0% in the low hill districts of Hamirpur and Bilaspur. As regards to the maize sheller, the use varied from 26.0% in Shimla to 65.0% in Hamirpur. The use of iron plough was also fairly high in all the districts. The use of tractors was also quite high in the districts of Hamirpur, Bilaspur and Chamba as compared to Shimla and Kullu. The use of power tillers is still to break ground in the State. Understandably, the use of spray pumps was quite high in the horticultural districts such as Kullu and Shimla as compared to Hamirpur and Mandi which are non-horticultural districts. The use of chaff cutters is quite prevalent in Hamirpur, Bilaspur and Chamba districts where buffaloes dominate the livestock production system.



Strengthening of Farmer Through Market Information: To establish a nation-wide information network for speedy collection and dissemination of market information and data for its efficient and timely utilization and to facilitate collection and dissemination of information related to better price realization by the farmers, Ministry of Agriculture, Govt. of India, has launched the ICT based Central Sector Scheme of Agricultural Marketing Information Network (AGMARKNET). Market information is needed by farmers in planning production and marketing, and equally needed by other market participants in arriving at optimal trading decisions. The existence and dissemination of complete and accurate marketing information is the key to achieve both operational and pricing efficiency in the marketing system. Over 300 plus markets are regularly reporting price related data which is being disseminated through the portal. 14 nodes of Himachal Pradesh are also sending the data to this portal. Any farmer/orchardist can access the rates of their produce in the markets of the country by clicking on this website.

The AGMARKNET portal serves as a single window for accessing websites of various organizations concerned with agricultural marketing. It provides weekly trend analysis for important markets in respect to major commodities. It is also linked with Online Commodity Exchange of India Limited, providing future prices in respect to oilseeds, fiber crops etc. International price-trends of various agricultural commodities available on FAO website are also accessible through the portal. The portal is constantly being updated. In order to facilitate market access of farm produce to larger markets, the proposed

scheme will additionally provide information on market requirements in terms of quality, packing, standards, sanitary and phyto-sanitary conditions, etc.

The scope of data collection and dissemination will be enlarged to provide farmers information regarding pack-size, packaging material and marketing charges in a market where goods are to be delivered, facilities available to farmers in a buying market, re-handling of the produce, if necessary, in the destination market to suit the requirements of the market buyers and rules and regulations of the destination market, if located outside the State. Promotion of nationally and internationally acceptable standards of grading and standardization, packaging and labelling, storage and warehousing and sanitary and phyto-sanitary requirements and quality certification in farm sector will enable trade and processing sector to undertake large scale agricultural marketing operations in domestic as well as international markets.

The information relating to the schemes in respect to agricultural marketing implemented by Governmental Departments and central agencies viz. Commerce, Food and Public Distribution, Consumer Affairs, Health and CCI, JCI, NCDC, NAFED, NTGF, TRIFED, NCCF, NDDB, NHB, APEDA, MPEDA will also be disseminated in user-friendly manner. An e-directory of AGMARKNET nodes will be published over the portal to facilitate effective and timely exchange of information among markets and other users. Once the farm produce is standardized and labelled, backed by quality certification, it can be directly offered for sale on website in national and international markets.

**Table 64: District-wise farm machinery use and gap in Himachal Pradesh**

Particulars	Parameter	Bilas-pur	Chamba	Hamir-pur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmaur	Solan	HP
	% Use	14.53		65			6		39	2.6	17		
Maize sheller	Existing	1922		2634	2100		83		4048	388	1881		13056
	Requirement	2316		3136	3187		150		17958	10141	2600		39488
	Gap	394		502	1087		67		13910	9753	720		26433

Particulars	Parameter	Bilas-pur	Cham-ba	Hamir-pur	Kan-gra	Kin-naur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sir-maur	Solan	HP
Thresher	% Use	92.22	58	96			59	52	77	46.1	48		
	Existing	2448	69	2375	2891	7	383	0	6554	2722	2285	160	19894
	Requirement	2571	126	2566	3790	11	516	0	6869	5553	3700	205	25907
	Gap	123	57	191	899	4	133	0	315	2831	1415	45	6014
Iron plough	% Use	36.98	76	38			50	55	80	55.9	55		
	Existing	14611	1215	14366	34019	4227	32156	139	131190	13582	37131	3449	286084
	Requirement	17533	1787	17365	47045	6105	49110	239	102395	72271	49921	5800	369571
	Gap	2922	572	2999	13026	1878	16954	100	28795	1311	12789	2351	83698
Spray pump	% Use	30.77	63	26			74	60	34	59.1	41		
	Existing	2964	519	1755	18349	6888	26216	2724	10822	69365	25426	38	165066
	Requirement	3705	787	50365	37889	9138	33491	618	15940	64740	52949	84	269706
	Gap	741	268	48610	13540	2250	7275	0	5118	4625	27523	46	109996
Chaff cutter	% Use	43.92	65	67			1		17	2.81	17		
	Existing	17977	808	5532	30195	789	244	1262	10439	17040	17675	2020	103981
	Requirement	22472	1349	52565	46347	2381	1486	1353	42440	40358	35381	3300	249432
	Gap	4495	541	47033	16152	1592	1242	231	32001	23318	17706	1280	145591
Power tiller	% Use	0.12	1	0			0	2	3	0.5	1		
	Existing	18	62	51	273	5	110	800	428	114	247		2108
	Requirement	77	86	525	2012	17	874		1713	2044	632		7980
	Gap	59	24	474	1739	12	764		1285	1938	385		6680
Tractor	% Use	56.37	46	66			10	27	24	5.6			
	Existing	442	39	1165	2342		644	183	2395	112			7322
	Requirement	465	104	1374	3719		890	245	2348	829			9974
	Gap	23	64	209	1377		246	62	47	717			2745

Source: District Agriculture Plans for the respective districts, 2009

#### 4.4 Stakeholder involvement in environment preservation & restoration

Stakeholders including farmers are engaged as beneficiary and catalyst of various programmes/ schemes / projects. The role of various departments and involvement of stakeholders is listed below.

Stakeholder Name	Role/Involvement
Farmers	Helps to procure seeds for Agriculture Department
Himachal Pradesh State Cooperative Marketing and Consumer's Federation Ltd. (HIMFED)	Provides fertilizers to fruit growers.
	Impart latest technology to farmers for increasing agricultural production.
	<ul style="list-style-type: none"> <li>• Ensure timely supply of agricultural inputs.</li> <li>• Educate farmers about soil &amp; water conservation technologies</li> </ul>
Agriculture Department	<ul style="list-style-type: none"> <li>• Impart training regarding Integrated Pest Management and use of farmers friendly bio-fertilizers.</li> <li>• Create irrigation facilities through minor/tank irrigation schemes to obtain maximum returns from their land.</li> </ul>
Horticulture Department	Provides Fertilizers & Pesticides
	Helps in marketing fresh fruits and vegetables, processing the unmarketable surplus and marketing the processed products. In near future, H.P.M.C. is planning to link its offices with internet to help farmers to sell their fruits directly to various markets in India.
HPMC	
ATMA	Involved for Sustainable Agriculture Development

#### 4.5 Critical Environment Issues/ Hotspots Associated With Sector

Agriculture in the State of Himachal Pradesh has made good progress but faces several challenges. For instance, the workers of the agriculture department laid much stress on using high yielding varieties (HYVs) and use of fertilizers and pesticides resulting in loss of area under crops like gram, mash, bean, moong, horse gram (Kultha), etc. and highly drought resistant crop varieties such as Rohru dhan, Ridley wheat and there was significant reduction in diversity at crop and variety levels.

**Table 65: District-wise Rainfall (in mm)**

District	2005	2006	2007	2008	2009(P)
Bilas pur	724.8	1069.4	786.6	867.9	811.1
Chamba	1,952.7	1583.7	706.4	857.2	1019.0
Hamir-pur	1,162.4	1570.0	1448.2	1414.6	1179.2
Kangra	1,765.1	1930.0	1756.3	1947.9	1386.0
Kinnaur	1316.4	348.6	310.9	354.1	269.4
Kullu	992.2	814.8	886.6	1215.3	825.1
Lahaul & Spiti	795.4	490.8	336.0	411.6	706.3
Mandi	1309.0	1313.3	1169.7	1173.8	775.0
Shimla	1133.8	1177.1	967.4	1211.4	825.6
Sirmaur	1244.4	1299.1	1	1	905.9
Solan	921.6	829.8	1076.4	1368.2	862.8
Una	956.8	69.2	1131.0	1437.4	1329.8
HP	1189.6	1	1	1	907.9

**2. Shift in cropping system by market driven forces and climatic change:** Though, soil productivity has declined, however, 18% area increase under vegetables and fruits has been recorded. According to a report published in 2000, the field studies in districts of Bilaspur, Hamirpur, Kangra, Sirmaur, Shimla and Solan

The major issues in agriculture are discussed below.

**1. Predominant rainfed agriculture:** Rainfall is a crucial factor in the success of crop production. In Himachal Pradesh 81.3 % of the area is still not irrigated and is totally rain dependent. The abnormal pattern of rainfall over the past few years has caused great fluctuations in crop production. The performance of crops is directly related to rainfall received during the crop season. The rainfall has shown variation in different districts, in some it was excess while in other it was deficient. Table 65 describes district wise rainfall pattern.

reported that, with the provision of irrigation, there are clear cut shifts in the cropping pattern. The major shift is from cereal crops to vegetable crops. Besides, multiple cropping has been introduced in irrigated areas. The crops which are replacing traditional crops are generally cash crops and have become a predominant factor in small farm management to earn cash in order to meet their input requirements and family monetary needs. However, in certain situations this trend may be detrimental to meet food demands. Challenges in practicing and maintaining traditional mixed cropping and mixed farming is due to the growing trend of raising single crop (mono-cropping) which is good for commercial interests but not for sustainable farming. Since traditional cropping practices and animal husbandry tradition is on the decline, it is challenging to sustain farm income and achieve self sufficiency. This will have an overall long term repercussion on farm income and employment and farm based livelihoods. Season wise, shift in cropping pattern is described in Table 66.

**Table 66: Season-wise shift in cropping pattern**

S. No.	Traditional crop	% area	Replacing crop	% area	Trends in shift
(a) Kharif Season					
1.	Maize	65	Vegetable	10	Area reduced to 55% in the mid hill zone
2.	Paddy	20	Vegetable	5	Yield of paddy crop increased by about 75% to 100%.
3.	Pulses	5	-	5	No change.
4.	Vegetables	5	Vegetable	18	Considerable increase in area, Crops grown include tomato, beans, capsicum, aubergine, ginger.
5.	Cereals	5	Green forage	7	The increase in area was due and soybean to replacement of cereals again. The area under Soybean has increased.
(b) Rabi Season					
1.	Wheat	75	Vegetables	10	Potato, peas, aubergine are becoming popular.
2.	Barley	8	Pea	3	Barley cultivation in traditional areas may be considerably reduced.
3.	Rape seeds and mustard	2	Toria	3	Small increase in area may further rise as a cash crop
4.	Vegetables	3	Vegetables	18	The replacing crops are mainly due to the rise in area under cabbage, cauliflower, peas and radsh
5.	Gram and Lentil	8	Gram and Lentil	2	Area decreasing
6.	Fodder and Berseem	4	Fodder and Berseem	6	Area is increasing because pastures abandoned.

**3. Inadequate soil and water conservation**

**measures:** Agriculture in the Himachal hills is practiced on 5% to over 30% slopes coupled with heavy rainfall resulting in severe soil erosion. Little effort has been made to conserve water in streams, rivers or rivulets. Inundation of forest areas and inadequacy of vegetation cover in catchment areas is increasing the problems of low productivity of soils as well as observation of natural water sources. Almost all areas in the State are subject to sheet erosion but the foothills and valleys are subject to the formation of severe gullies. The upper fertile soil is rained away and the underlying layers slowly become unfit for cultivation. The intensity of soil erosion ranges from 14.7% to 24% and occurs both in arable & non arable lands. Inadequacy of soil and water conservation measures is also manifested in loss of soil fertility and growing flood menace which is leading to deteriorating soil and water conditions. Impact of ineffective soil and water conservation impact is visible in silting of hydroelectric dam lakes and reduction in cultivable area which are indicated by reduction

of projected dam life, decline in agricultural production and harvest failures due to drought spells.

**4. Use of Agro Chemicals in agriculture:**

Widely used chemicals in agriculture include agriculture fertilizers (N+P+K), chemical pesticides fungicides and herbicides or weedicides. These are playing havoc because of their indiscriminate use, excessive quantities and substandard quality or quantity. For pesticides, toxicity level is hardly taken care of. Substandard fungicides and pesticides are on sale because of their cheap rates and used by farmers in large amounts. The use of fertilizers has increased production in the State to a great extent since the late fifties and early sixties when fertilizer was introduced in HP. Then onwards the use of fertilizers has been constantly increasing. The consumption of fertilizers in 1986-86 was 23,664 tonnes and increased to 55,133 MT in 2010-11 which indicates that the consumption of fertilizers has doubled. The trend in the use of fertilizers is depicted in Table 67 given below.

**Table 67: Consumption of Fertilizer (MT)**

Year	Kharif (N+P+K)	Rabi (N+P+K)	Total
2004-05	18244	28009	46253
2005-06	19197	28776	47973
2006-07	18592	30389	48981
2007-08	20597	29361	49958
2008-09	23768	33595	57363

Source: Statistical Outline- HP,2008-09

The use of pesticides has shown a sharp rise particularly in vegetable crops. There is also more use of herbicides or weedicides. The use of pesticides brings in two concerns (i) sub standard or outdated pesticides act as booster and not as killer and (ii) toxic residual effects remains unnoticed. Higher use of pesticides causes pollution both during manufacturing & process of handling and application in the field. Average use of pesticides is low in Himachal Pradesh but their use is high in areas where cash crops are grown. The trend indicates that cropping area decreased from 8% to mere 2% under gram and lentil and rise of fertilizer and pesticides consumption.

Pesticides residues in food in Himachal Pradesh are increasing because the use of pesticides has increased at the rate of 10-15% per annum. In 1977-78, 50630 kgs pesticides were used which went up to 260000 Kg in 1995-96. In 1990, fruits & vegetables were grown on 1, 93, 490 ha of land and 97,500 kgs pesticides were sprayed of which 65,000 kgs was Mancozeb. Residues of various pesticides have been recorded in milk, milk products & various fruits from the fields in Shimla, Solan, Sirmaur, Bilaspur, Hamirpur, Una, Kangra, Kullu, Lahaul, Kinnaur & Chamba districts for organochlorine, organophosphorus, carbamate, docrine etc.

Besides, the chemicals are washed by rainwater and taken to water sources as well as absorbed by fodder and feed sources. From all these sources, the residues enter the body of animals and human beings when they are fed with

contaminated food items. It has been found that 70% of the vegetables sold in the market are contaminated with pesticides and the toxic residues contained in them are higher than the safe limits. For instance onion contained toxic residues in over 92% samples, lady's finger contained in 78% samples, potato and tomato had residues in over 51% samples, and 74% samples of aubergine (brinjal), 62% samples of cabbage, 58% samples of cauliflower and 48% samples of spinach contained toxic residues in the market which enter human bodies every day. In one study, it was found that sixteen sample of flour from the branded companies contained toxic residues of DDT, Aldrin and Lindane beyond safe limits. The chemical load in fruits may also be found, as fruits like apple receive a heavy schedule of sprays in the orchards.

**5. Threat from Obnoxious weeds:** In the recent year, crop growing has faced a serious threat from rogues. These are *Lantana*, *Ageratum conyzoides*, *Parthenium hysterophorus* among plants and wild animals. Their population has increased tremendously but no data is available.

**6. Low adoption of latest technology by the farmers:** Hi-tech Agriculture is on account of the development of modern technology, which is capital intensive, less environment dependent, having capacity to improve the productivity and quality of produce. Hi-tech interventions in agriculture are not new. The sector, by itself is highly technology driven, needs deployment of modern technologies like micro propagation, micro irrigation, protected cultivation, organic farming etc. which require skilled manpower as well as instruments. While the Indian Council of Agricultural Research (ICAR) and State Agricultural Universities (SAUs) have been addressing the research and training aspects of hi-tech applications, some of them are introduced at the farmers' fields by the Department of Agriculture and Cooperation (DAC) since VIII Plan. Prominent among these include micro propagation, drip

irrigation, greenhouse cultivation, plastic mulching, low tunnels, shading nets etc. The areas of hi-tech agriculture having scope for adoption are fertigation, use of biofertilizer, vermiculture, organic farming, Hi-tech mechanisation, soil-less culture, biological control.

Besides this, The Department of Agriculture is also taking steps to introduce essential new technologies the development of agriculture. Introduction of technologies like micro-irrigation, protected cover cultivation, use of bio-fertilizer in agriculture, improved agriculture tools, implements and machinery and field diagnostic facilities for diagnosing pathological and nutritional disorders are being promoted.

**7. Dwindling soil health:** The State soils not only show deficiency of NPK (low to medium) but also of secondary nutrients (Sulphur, Calcium and Magnesium) and micro nutrients (Boron, Zinc, Copper and Iron etc.) in most parts of the State. Besides the three primary nutrients (N, P, K), deficiency of Sulphur and micro nutrients like Zinc and Boron have been observed in many district areas like Shimla, and Bilaspur (Block-Jukhala). Intensive farming practices leave little time between harvesting of one crop and sowing of the next. As a result soils do not get adequate rest to replenish its

lost fertility in a natural process while increasing food production, has caused second generation problems in respect of nutrient imbalance. Some such problems include:

- Emerging deficiencies of secondary and micronutrients,
- Decline of water table and its quality of water,
- Decreasing organic carbon content, and
- Overall deterioration in soil health

For the benefits of farmers, the Department of Agriculture has established 12 soil-testing labs and has also deployed 3 mobile soil-testing vans. During the 11th Five year plan, the Department of Agriculture proposes to cover all the farmers in the State with soil health cards and it is proposed to distribute 125,000 number of soil health cards during Rabi and Kharif Season 2010-11.

8. Suffering of farmers due to losses of crops on account of weather risk: Himachal Pradesh is a mountainous State comprising large Himalayan ranges with complex geological structures. The topography and climatic conditions make it particularly prone to natural disasters caused by avalanches, floods, cloudbursts/flash floods, and glacial lake bursts etc. (Table 68).

**9. Inadequate marketing and post harvest infrastructure:** The agro-climatic conditions of Northwestern Hilly Region of India are conducive for cultivation of various fruits and vegetables which gives very high returns to farmers as compared to traditional crops. But all these fruits and vegetables are highly perishable and require immediate disposal especially in absence of cold storages (Table 69). This calls for elaborate arrangements for marketing of these perishables. Due to the increasing volume of production the marketing problems are aggravating. As regards the post harvest facilities such as packing and grading houses and cold storage facilities, these appear

**Table 68: Damage Due to Drought Conditions in Himachal Pradesh**

During the year 2000-01 (Rabi Season)		
Main Affected Crops	Qty. in (MT)	Estimated Value (₹ Crore)
Damage of Agriculture Crops	411.00	238.79
During the year 2002-03 (Kharif Season)		
Damage of Agriculture Crops	612393	366.00
During the year 2002-03 (Kharif Season)		
Damage of Agriculture Crops	356.02	235.00

Source: State Environmental Report-HP

to be not only awfully short but highly skewed as well. For example, total packing and grading (combined) houses capacity in the State stood at 25,000 metric tonnes. Of this, while 80% capacity was found in Shimla district, main production area, another 20% was located in Kullu district. Here it is worth mentioning that though Shimla is the major apple producing district, this fruit crop is grown in eight other districts of the State. In addition to this, grading houses with capacity of 6,000 metric tonnes with more equitable spread across apple producing areas also existed in the State. Another crucial component of infrastructural support for the production of fruits and

vegetables is the existence of cold storage facilities. Of the total cold storage capacity of 16,250 metric tonnes, 50% lies outside the State in distant places such as Delhi, Chennai and Mumbai. If one excludes the exit point cold storage facility (18.46%) at Parwanoo in Solan district, then only about thirty per cent of the total cold storage is within the State. Further, whatever is within the State 80% of that lies in Shimla district only while nearly one-fifth is found in Kullu district. Thus, the fact that cold storage facilities are not only short to a large extent but also non existing in areas other than Shimla bring home the point of lacking infrastructure.

**Table 69: Distribution of Post Harvest Facilities in Himachal Pradesh, 2005-06**

Particulars	Total capacity (metric tonnes)	Capacity distribution (percent)						
		Shimla	Kullu	Sirmaur	Mandi	Kinnaur	Exit points	Outside State
Packing and grading houses	25,000	80.00	20.00	-	-	-	-	-
Grading houses	6,000	16.67	16.67	16.67	33.33	16.67	-	-
Cold storages	16,250	24.62	6.15	-	-	-	18.46	50.77

Source: - State Agriculture Plan- HP

10. Increasingly small holdings may lead to noncultivable land: Agriculture is the main occupation of the people of HP. It has an important place in the economy of the State. It provides direct employment to 69% of the total workers of the State. About 18.15 % of the total GSDP comes from agriculture and its allied sectors. Out of the total geographical area of 55.67 lakh ha, the area of operational

holdings is about 9.79 lakh ha and is operated by 9.14 lakh farmers. The average holding size comes to 1.1 ha (Table 70). Distribution of landholdings according to 2000-01 Agricultural Census shows that 86.4% of the total holdings are of small and marginal farmers. 13.2% of holdings are owned by semi medium/medium farmers and only 0.4 % by large farmers.

**Table 70: Distribution of Land Holdings**

Size of Holdings (ha)	Category (Farmers)	No. of Holdings in (Lakh)	Area (lakh ha)	Av. Size of holding(ha)
Below 1.0	Marginal	6.15 (67.3%)	2.52(25.8%)	0.4
1.0-2.0	Small	1.74(19.1%)	2.45(25.0%)	1.4
2.0-4.0	Semi Medium	0.90(9.8%)	2.43(24.8%)	2.7
4.0-10.0	Medium	0.31(3.4%)	1.76(18.0%)	5.7
10.0-Above	Large	0.04(0.4%)	0.63(6.4%)	15.7
Total		9.14	9.79	1.1

Source: - Economic Survey of HP-2008-09

The majority of people suffer scarcity of resources and that too when about 81.5% of the total cultivated area is rainfed. Resource scarcity prevents them to invest in agriculture and taking full advantage of modern agriculture. The small holdings have become non-profitable due to high input costs in the present situation. Further, progressive fragmentation of agricultural lands is leading to non-subsistence farming and increase in unemployment. It has caused 5% rise in unemployment during 1999 to 2003 and 105% increase from 1990 taken as base year. This is driving away rural people to search for alternate occupations. Inheritance laws have promoted further fragmentation which is also responsible for migration of rural people in search of job to urban areas.

11. Impact of Climate change on agriculture: Studies by the Himachal Pradesh Agricultural University give some indications of higher than average impacts of climate change in the Himachal Pradesh uplands than on the lowlands. From the studies covering over 30 years of records, average air temperatures were found to be 0.7 to 2.4°C higher than that in the 1980s, as against the global average of 0.5°C; the Himachal Pradesh trend indicates an increase of 0.06°C per year. An analysis of rainfall data over the period 1976 to 2006 show increasing trends of rainfall in Lahaul & Spiti, Chamba and Kangra but decreasing trends in Solan and Kinnaur. Other districts showed no significant trends. Crops are showing shorter periods of flowering and maturity. The changes in climate are now affecting farmers. Low rainfall and reduced snowfall are affecting crops. Planting of winter crops is frequently delayed and affected by erratic rainfall. Higher temperature in cold-season may lead to earlier ripening of annual crops, diminishing yields per crop, but would allow locally for the growth of more crops per year due to lengthening of growing season.

Winter kill of pest is likely to be reduced at high latitudes, resulting in greater crop losses and

higher need for pest control. Higher temperature will allow for more plants growth at latitudes and altitudes. Soil, as a medium for plant growth, would be affected in several ways. Increased temperatures could lead to denitrification and more decomposition of soil organic matter.

#### **4.6 Environment initiatives taken by the sector to address critical environment issues**

Department of Agriculture entrusted the task of preparing District Agriculture Plans (DAPs) and State Agriculture Plan (SAP) to the Himachal Pradesh Agricultural University as per the guidelines issued by the Planning Commission. The implementation of District Agriculture Plans (DAPs) shall go a long way in transforming the agriculture in Himachal Pradesh. The plan when implemented will also strengthen and improve the physical and institutional infrastructure in the State which is crucial for the development of agriculture sector. Implementation of the plan shall lead to ensuring ecological sustainability and economic viability of the agricultural production systems, thus contributing towards the improvement in the living conditions of the peasantry in this hilly State. The DAP and SAP have been prepared based on the guidelines that entail collection and analysis of data on parameters such as land utilisation, farming systems, cropping pattern, horticulture, inputs use, farm machinery, yield and input gaps, issues in livestock management, fisheries, women drudgery, livelihoods of local population, different ongoing irrigation and watershed programmes/schemes, potential for new schemes, women drudgery, post harvest operations, market infrastructure, etc. at the village/panchayats levels. The methodological framework to prepare these plans got evolved in a series of consultations with the officials of the line department like agriculture and horticulture and the scientists working at different KVKs and regional research stations.



- Department of Agriculture is experimenting with bio-fertilizers produced by bio-fertilizer lab at Shimla having capacity of 50 metric tonnes per year.
- Integrated Pest Management (IPM) has been adopted at State level. Area covered under IPM activities is 233.11

km<sup>2</sup> till January 2002 and crops covered are paddy, tomato, cabbage, peas, cauliflower, beans, apple, plum, pear, etc.

- Various Biogas plants have been set up in all the districts details of which are given in Table 71.

**Table 71: List of Bio-gas Plants in State**

District	1994-95	1995-96	1996-97	1998-99	1999-00	2000-01	2001-02	2003-04	2004-05	2005-06	2006-07	2007-08
Bilaspur	193	201	170	104	93	95	67	35	25	7	5	5
Chamba	10	5	4	5	5	6	10	3	5	-	0	-
Hamirpur	150	150	155	110	106	105	75	35	25	6	5	7
Kangra	208	190	181	115	141	122	110	33	41	19	13	10
Kinnaur	-	-	-	-	-	-	-	-	-	-	0	-
Kullu	105	42	56	30	21	31	22	11	10	6	4	3
Lahaul & Spiti	-	-	-	-	-	-	-	-	-	-	0	-
Mandi	513	390	420	203	211	154	147	54	30	7	12	10
Shimla	19	9	43	23	26	20	15	5	5	-	0	-
Sirmaur	120	112	101	64	62	49	42	100	74	25	101	100
Solan	100	103	122	60	61	41	30	10	15	3	5	5
Una	48	29	90	80	75	69	50	20	20	6	10	10
Himachal Pradesh	1466	1231	1342	794	811	692	568	306	250	79	155	150

Source: Directorate of Agriculture, Himachal Pradesh

National Project on Organic Farming: Government of India has launched a National Project on Agriculture in order to promote organic farming. Under this project, financial assistance is being provided for setting up of Model Farms, training of farmers, setting up of worm hatcheries and service providers. For 2008- 2009, Government of India has released `38.05 lakhs. The proposed outlay for the year 2009-2010 is `133.00 lakhs. For promoting organic farming further, a project has been taken up in Shimla district in collaboration with Morarka Foundation and District Rural Development Agency, Shimla. Under the scheme, 48 clusters consisting of 5800 farmers have been registered. The Department of Agriculture is providing assistance at `1500 per farmer.

Pesticide residue screening programme was started in 1988 by Indian Council of Agricultural Research. Under this project

residues of various pesticides were determined in milk, milk products and various fruits from the fields in Shimla, Solan, Sirmaur, Bilaspur, Hamirpur, Una, Kangra, Kullu, Lahaul & Spiti, Kinnaur and Chamba districts for Organochlorine, Organophosphorus, Carbamate, Dodine etc.

Construction of Collection Centers: Due to a hilly terrain, the producing areas are scattered in small units. Generally the means of transport are not readily and easily available in such areas. Farmers bring their produce to the roadside and have to wait for the transport and traders. Since there is no facility for the protection of agricultural produce, it remains open to vagaries of weather, theft etc. To save the farmer from such losses, a scheme to construct collection centres at strategic points has been started.

Farmer's awareness Camps: Farmers are not getting adequate yields and returns in relation to their hard work due to inadequate knowledge about post harvest handling and marketing. Thus, farmer's awareness camps are being organized to make them aware of post harvest management, agricultural marketing, market regulation etc. Each training camp comprises 100 farmers. The officials of H.P. Marketing Board, Market Committees, Agriculture and Horticulture Departments, Agriculture/Horticulture University etc. also participate in these camps as resource personnel.

Farmer Exposure Visits: Agricultural universities and related institutes are developing improved and scientific techniques of post harvest management. By and large, the farmers in the adjoining areas of these institutes/organizations are availing these opportunities. Not only has their crop yield increased but their income has also increased significantly. But those located at distant places are not able to reap the benefits of technology advancement. Keeping in view these facts, the Board has started organizing Farmers Exposure Visits with the help of National Horticulture Board.

Distribution of Plastic Crates: Fruits and Vegetables are highly perishable in nature. The post harvest losses to fruits and vegetables are estimated to the extent of 8 to 37%. Use of improper packaging material is one of the reasons for these losses. In general, bamboo baskets, gunny bags or wooden boxes are used for packaging, which not only affects the quality of the produce adversely, but also puts pressure on the forests. It is, therefore, necessary to encourage farmers to adopt new packaging material. Keeping in view these facts, plastic crates are distributed among farmers on subsidized rates with the help of National Horticulture Board. These crates are light in weight; occupy less space, sturdy, durable and smooth surface. These can be used for collecting, grading and for temporary storage.

Market News Service: Market news helps the farmers to take decisions about when and how much of a commodity to produce, when and where to sell it etc. Mostly the farmers in the State are poor with meager resources and are not aware of market information. They have to depend upon local traders, commission agents etc. for market information who purchase their produce below the prevailing market rates. In order to avoid the exploitation of farmers, daily market rates of 24 agricultural commodities prevailing in 10 markets of the State are being collected by the market committees and are being broadcasted through AIR, Shimla Doordarshan.

Initiatives taken in Kinnaur district: For the development of the district in the agricultural front, intensive agriculture aimed at increasing the yield per unit of area is being given the highest priority by adopting various programmes, measures like seed distribution of high yielding varieties, potato development scheme, control of pests and diseases, development of vegetables and seed production programme, use of improved implements, development of oilseeds and pulses, development of local manure resources, subsidy in fertilizers and soil conservation. The farmers of this area are reputed for producing quality off season vegetables of tomato, cauliflowers, peas, cabbage, etc. The seed production programme is picking up and the area is supplying large quantity of seed to the rest of the State.

The following initiatives were taken by the Central and State Government through various schemes and programme for the protection of environment and development in agriculture sector. Detailed description of those programmes/schemes is given in section-II (Patterns of planning and development in the sector). Some of the major schemes and programmes are given below.

- Soil testing programme
- Crop/ plant protection
- Farmer’s trainings and education
- Biogas development programmes
- Promotion and strengthening of Agricultural Mechanization through training, testing and demonstration
- High Yielding Varieties Programme (H.Y.V.P.)
- Soil and Water Conservation Scheme

#### 4.7 Environment related studies carried out in the sector

Department of Agriculture and CSK Himachal Pradesh Agriculture University, Palampur has prepared State Agriculture Plan and District Agriculture Plan which covers environmental aspect related to Agriculture and allied sectors of HP.

Department of Agriculture and Japan International Cooperation Agency has worked on Diversified Agriculture for Enhanced Farm Income in the State of Himachal Pradesh. The project preparatory exercise also included environmental review of the project.

#### 4.8 Environment monitoring (key parameters such as air and water pollution) carried out for activities related to the sector

Agriculture Department monitors soil quality from the point of appropriateness of soil suitability of any given crop. It monitors utilization of fertilisers and pesticides, and pesticide residues in food.

**Soil Testing:** The Agriculture Department has 11 Soil Testing Labs & 2 Mobile Soil Testing Labs to provide free soil testing facilities to the farmers. About 1, 00, 000 samples are analyzed annually.

Monitoring trend of use of chemicals in agriculture: Widely used chemicals in agriculture include chemical fertilizers (NPK), chemical pesticides, fungicides, and herbicides or weedicides. These are damaging because of their indiscriminate use, excessive quantities and substandard quality. For pesticides, toxicity level is hardly taken care of. Substandard fungicides and pesticides are on sale because of their cheap rates and are used by farmers in large amounts.

The use of fertilizers has increased production in the State to a great extent since the late fifties and early sixties when fertilizer use was introduced to Himachal Pradesh. Then onwards the use of fertilizers has been constantly increasing. The consumption of fertilizers in 1985-86 was 23,664 tonnes increased to 46,808 tonnes in 2003-04. That is, the consumption has almost doubled. The trend in the use of fertilizers is depicted in the Table 72.

**Table 72: Consumption of Fertilizers (in metric tonnes)**

Year	Nitrogenous	Phosphorus	Potash	Total
1997-98	27002	4382	3468	34852
1998-99	29140	5219	4198	38557
1999-00	27593	5762	3988	37343
2000-01	24418	6540	4594	35552
2001-02	27503	7043	5610	40156
2002-03	25645	7916	6160	39721
2003-04	30909	8706	7193	46808

*Source: State Environment Report, H.P.*

Regarding the use of fertilizers, three serious concerns have been brought out. These are (i) unbalanced use, (ii) excessive use of urea or other nitrogenous fertilizers, and (iii) reduced application of FYM. An input survey 1991-92 revealed that urea was the most widely used nitrogenous fertilizer in respect to non irrigated areas in the State and same is the situation in irrigated lands. Thus, urea is used to the maximum by all types of farmers irrespective of their holding sizes. Super Phosphate is used in small area and Potash sources are rarely used, though fertilizer mixture (15N:15P:15k) is used

on about 20% of the area yet the users were mainly marginal and small farmers under both irrigated and rainfed conditions of farming. Table 73 clearly shows the excessive use of nitrogenous fertilizers being almost three times more than phosphorus and potash fertilizers.

Trends of district wise utilisation (during 2006-2009) of fertilizers in terms of nutrients (MT) shows that utilisation of fertilisers in Kharif has been on rise in all districts. In Rabi some districts reported decline in utilisation of fertilisers during the same period as given in Table 74.

**Table 74: District Wise utilisation of fertilizers in terms of Nutrients (MT)**

District	Kharif (N+P+K)			Rabi (N+P+K)			Total	
	2006-07	2007-08	2008-09	2006-07	2007-08	2008-09	2007-08	2008-09
Bilaspur	952	1122	1321	956	867	984	1,908	2305
Chamba	873	887	1046	465	235	409	1,338	1455
Hamirpur	1,572	1769	1944	1,025	976	921	2,597	2865
Kangra	3,126	3454	4591	6,079	5421	6202	9,205	10793
Kinnaur	51	61	77	147	111	222	198	299
Kullu	931	1110	1182	2,718	2873	3187	3,649	4369
Lahaul & Spiti	193	122	190	161	283	229	354	419
Mandi	2,708	2923	3153	3,895	3505	3348	6,603	6501
Shimla	1,842	1893	2251	7,330	8460	10201	9,172	10353
Sirmaur	1,487	1735	1838	1,672	1582	1717	3,159	3555
Solan	2,174	2273	2487	1,863	1582	2213	4,037	4700
Una	2,683	3248	3688	4,078	3376	3962	6,761	7650

Source: Department of Agriculture, Himachal Pradesh

Year wise utilisation of fertilizers in terms of nutrients (MT) is given in Table 75. The utilisation trend shows an increase except during 2002-2003.

**Table 75: Year wise utilisation of fertilizers in terms of Nutrients (MT)**

Year	Kharif (N+P+K)	Rabi (N+P+K)	Total
2000-01	17,292	18,260	35,552
2001-02	16,464	23,691	40,156
2002-03	15,640	24,081	39,721
2003-04	18,297	28,511	46,808
2004-05	18,244	28,009	46,253
2005-06	19,197	28,776	47,973
2006-07	18,592	30,389	48,981
2007-08	20,597	29,361	49,958
2008-09	23768	33595	57363

Source: Department of Agriculture, Himachal Pradesh

In comparison to fertilizers, the use of FYM or compost organic manures is progressively decreasing because of the fact that service class farmers having nucleus families are hardly engaged in rearing cattle or domestic animals.

**Table 73: District-Wise Fertilizer Consumption per ha (MT)**

Sl. No.	District	1981-82	1991-92	1996-97	1997-98
1	Bilaspur	0.02	0.035	0.037	0.036
2	Chamba	0.01	0.008	0.015	0.014
3	Hamirpur	0.02	0.039	0.036	0.033
4	Kangra	0.019	0.032	0.034	0.035
5	Kinnaur	0.016	0.011	0.014	0.013
6	Kullu	0.0117	0.03	0.026	0.029
7	Lahaul & Spiti	0.122	0.09	0.067	0.076
8	Mandi	0.013	0.03	0.032	0.032
9	Shimla	0.027	0.045	0.045	0.043
10	Sirmaur	0.013	0.029	0.027	0.026
11	Solan	0.022	0.053	0.053	0.055
12	Una	0.022	0.053	0.053	0.055
	Total	0.421	0.441	0.43	0.438

Source: Department of Economics & Statistics

Pesticides Consumption: The consumption of pesticides in 1977-78 was 50.63, MT increased to 232 MT in 2000-01. Data clearly indicates that the, pesticide consumption has increased to four and half times from the 1977-78. The trend in the use of fertilizers is depicted in Table 76.

**Table 76: Pesticide Consumption in Himachal Pradesh**

Year	Pesticides Consumption (MT)
1977-78	50.63
1990-91	97.5
1995-96	260
1998-99	150
1999-2000	196
2000-01	232
2001-02 (Provisional)	222
2002-03 (Yearly, Provisional)	210
	200

Source: State of Environment Report, H.P. & Annual Administrative Report, Deptt. of Agriculture, H.P.

The use of pesticides has shown a sharp rise particularly in vegetable crops. There is more use of herbicides or weedicides. The use of pesticides brings in two concerns (i) sub standard or outdated pesticides act as booster and not as killer and (ii) toxic residual effects remain unnoticed (Table 77 and Table 78). Higher use of pesticides causes pollution both during manufacturing and process of handling and application in the field. Average use of

pesticides is low in Himachal Pradesh but their use is high in areas where cash crops are grown. Status of Pesticides Residues in Food in Himachal Pradesh: In 1990 fruits and vegetables were grown on 1,93,490 ha of land in Himachal Pradesh and 97,500 kgs pesticides were sprayed of which 65,000 kgs was Mancozeb. Use of pesticides is increasing at the rate of 10-15% per annum. In 1977-78, 50630 kgs pesticides were used which went up to 260000 kgs in 1995-96.

**Table 77: Pesticide Residue in H.P.**

Crop	Year	Samples contaminated (violating)/analyzed				
		OC	OP	MBC	EBDC	COPPER
Apple	1988	0(0)/32	-	4(0)/32	-	-
	1989	1(0)/18	-	4(0)/32	-	-
	1990	-	-	-	15(3)/50	-
	1991	-	-	-	12(2)/15	-
	1992	-	7(0)/10a	-	10(4)/26*	-
	1993	14(0)/24	1(0)/24b	-	0(0)/24*	-
	1994	14(0)/20	5(0)/21*	5(0)/20	2(0)/20	-
Tomato	1990	-	-	-	28(6)/50	-
	1992	-	-	-	16(2)/22*	-
	1993	-	-	-	0(0)/7*	-
	1994	3(0)/30	0(0)/30	4(0)/30	24(0)/31	-
	1995	-	-	-	11(0)/16	-
Capsicum	1992	-	-	-	6(4)/8*	-
	1994	-	-	-	2(0)/6	-
Cabbage	1995	0(0)/7	-	-	4(0)/12	7(6)/37
Honey	1995	2(0)/9	-	-	9(0)/14	-
Fresh Milk	1994	56(0)/58	-	-	-	-
Baby Milk Powder	1991	11(11)/11	-	-	-	-
Desi Ghee	1991	9(9)/9	-	-	-	-
Desi Ghee	1991	11(11)/11	-	-	-	-

OC = DDT/BHC/Captafol/Endosulfan; OPa =Methyl parathion; OPb = Chlorpyriphos; MBC= Carbendazim; EBDC= Ethylenebis-dithiocarbamate; EBDC \* = Ethylenethiourea non detectable.

**Table 78: Status of Pesticide Residues in Food**

Crop	Pesticide	MRL (ppm)	Residue range (ppm)	Method of estimation
Apple	BHC	3	0.007-0.191	GC (Ref 1)
	Chloropyriphos	0.5	0.032-0.325	GC (Ref 1)
	Endosulfan	2	0.136	GC (Ref 1)
	Methyl parathion	0.2	0.008-0.159	GC (Ref 1)
	Captafol	5	0.0670-0.222	GC (Ref 2)
	Carbendazim	5	0.089-1.555	UV (Ref 3)
	Mancozeb	5	0.024-1.930	C (Ref 4)
Tomato	BHC	3	0.013-1.930	GC (Ref 1)
	Carbendazim	5	0.040-1.957	UV (Ref 3)
Capsicum	Mancozeb	3	0.478-12.812	C (Ref 4)
	Co Fungicides	20	2.359-74.360	AAS (Ref 5)

Crop	Pesticide	MRL (ppm)	Residue range (ppm)	Method of estimation
Honey	Aldrin	NA	0.002-0.005	GC(Ref 6)
	BHC	NA	0.001-0.026	GC(Ref 6)
	DDT	NA	0.003-0.060	GC(Ref 6)
	Endosulfan	NA	0.001	GC(Ref 6)
Fresh Milk	BHC	0.2	0.520-28.220	GC(Ref 7)
	DDT	1.2	1.140-15.420	GC(Ref 7)
Milk Powder	BHC	0.2	6.185-22.560	GC(Ref 7)
	DDT	1.25	0.940-16.780	GC(Ref 7)
Desi Ghee	BHC	0.2	0.464-48.929	GC(Ref 7)
	DDT	1.25	1.660-70.574	GC(Ref 7)

MRL = Maximum Residue Limit; GC= Gas Chromatography; UV= Ultra Violent Spectrophotometry; C= calorimetric; AAS = Atomic Absorption Spectrometry; NA = Not applicable

Waiting period in days after last pesticide application before harvesting is given in Table 70.

**Table 79: Waiting Period in Days after Last Pesticide Application before Harvesting**

Pesticide	Cauliflower	Cabbage	Okra	Brinjal	Tomato	Pea	Apple	Pomegranate	Mushroom
Endosulfan	4	6	3	3	-	-	-	1	3
Monocrotophos	16	-	12	15	15	-	-	1	-
Fenvalerate	3	3	2	3	3	-	-	1	-
Dichlorovos	1	1	1	1	1	-	-	1	1
Carbary 1	10	5	-	-	-	-	-	-	-
Cypermethrin	-	-	-	-	-	-	-	1	-
Phosphamidon	-	-	-	-	-	-	-	1	-
Quinalphos	20	15	-	-	-	-	-	1	-
Chlorpyrifos	-	-	-	-	-	19	-	-	-
Methyl 1 Parathion	-	-	-	-	-	16	-	-	-
Fungicides									
Mancozeb	-	27	3	4	-	-	25	-	3
Bitertanol	-	-	-	-	-	4	30	-	-
Carbendazim	-	-	-	-	-	-	8	-	3
Myclobutanil	-	-	-	-	-	-	30	-	-
Dodine	-	-	-	-	-	-	14	-	-

Surface Water Quality: The month wise variation in surface water quality of rivers in Himachal Pradesh is given in Table 80, Table 81, Table 82, Table 83 and Table 84 respectively.

**Table 80: River Quality Data (Annual Avg.)Year 2003**

Location	Temp (0C)	pH	DO (mg/l)	BOD (mg/l)	FC (MPN/100 ml)
Beas at u/s Manali, HP	6	8.1	10.0	0.3	135
Beas at d/s Kulu	10	8.0	9.1	0.7	283
Beas at d/s Aut,	7	8.0	10.1	0.9	82
Beas at u/s Pandoh dam,	8	8.2	9.8	0.6	20
Beas at exit of Tunnel Dehal Power House	8	8.0	10.8	1.3	29
U/s Mandi	9	8.1	9.3	1.1	25
Beas at d/s Mandi	10	8.0	8.2	1.2	421
Beas at d/s Alampur	17	8.1	8.1	0.8	10
Beas at d/s Dehragopipur	19	8.1	7.7	1.0	26
Beas at d/s Pong dam	24	8.1	8.3	0.7	6
Sutlej at Neptha Zakhai	14	8.3	9.5	0.3	7
Sutlej at u/s Rampur	13	8.1	9.4	0.1	152
Sutlej at d/s Rampur	14	8.2	9.4	0.2	226
Sutlej at u/s Tatapani	15	8.2	9.2	0.2	104
Sutlej at u/s Slapper	10	8.4	9.5	0.8	38

Location	Temp (0C)	pH	DO (mg/l)	BOD (mg/l)	FC (MPN/100 ml)
Sutlej at d/s Slapper	9	8.3	10.2	0.9	41
Sutlej at d/s Bhakhra	16	8.3	9.2	0.4	2
Ravi at u/s Chamba	12	8.2	9.2	0.7	8
Ravi at u/s Madhopur	18	7.8	8.2	0.8	7
Parvati before conf. To river Beas	9	7.8	9.8	0.7	152
Largi at d/s, HP	6	7.8	10.4	0.6	80
River Sirsa , u/s Sitoma-jri Nallahgarh	23	8.3	8.0	0.2	77
River Sirsa , d/s Nalagarh , bridge	26	8.3	7.6	0.4	318
Yamuna at d/s, at Paonta Shahib	20	8.9	8.0	2.0	46
Yamuna at u/s, at Paonta Shahib	22	8.9	7.7	4.8	76

Source: Central Pollution Control Board

**Table 81: River Quality Data (Annual Avg.) Year 2004**

Location	Temp (0C)	pH	DO (mg/l)	BOD (mg/l)	FC (MPN/100 ml)
Beas at u/s Manali	5	8.4	11.0	0.5	8
Beas at d/s Kullu	7	7.9	10.5	0.6	12
Beas at d/s Aut	8	8.1	10.2	0.5	7
Beas at u/s Pandon Dam	10	7.8	9.8	0.5	6
Beas at exit of tunnel Dehal Power House.	13	7.8	8.3	0.3	4
U/s Mandi	16	8.2	7.7	0.4	10
Beas at d/s Mandi	17	7.7	7.5	0.6	13
Beas at d/s Alampur	20	7.5	9.6	0.8	4
Beas at d/s Dehragopipur	21	7.7	9.3	1.3	5
Beas at d/s Pong Dam	25	8.1	7.5	0.8	4
Sutlej at Nethpa Zakhai	13	8.2	9.3	0.1	3
Sutlej at u/s Rampur	15	8.1	9.3	0.1	115
Sutlej at d/s Rampur	15	8.2	9.3	0.1	142
Sutlej at u/s Tatapani	17	8.1	9.4	0.1	107
Sutlej at u/s Slapper	15	7.6	7.7	0.7	7
Sutlej at d/s Slapper	15	7.8	7.9	0.3	7
Sutlej at d/s Bhakhra	21	8.0	8.8	0.1	8
Ravi at u/s Chamba	12	7.8	10.0	0.7	2
Ravi at u/s Madhopur	20	7.3	8.8	1.4	7
Parvati before conf. To river Beas	7	7.8	11.1	0.3	7
Largi at d/s, H.P.	6	7.8	10.7	0.7	4
River sirsa , u/s Sitomajri Nallahgarh,	25	8.2	8.2	0.3	30
River sirsa , d/s Nalagarh Bridge	30	8.1	7.2	2.3	460
Yamuna at d/s, at Paonta Shahib	20	7.5	7.3	5.4	31
Yamuna at u/s, at Paonta Shahib	20	7.9	7.5	5.8	56

Source: Central Pollution Control Board

**Table 82: River Quality Data (Annual Avg.)Year 2005**

Location	Temp (0C)	pH	DO (mg/l)	BOD (mg/l)	FC (MPN/100 ml)
U/s Manali	4	7.78	11.1	0.9	5
D/s Kulu	7	7.64	10.1	0.7	8
D/s Aut, H.P.	6	7.85	9.8	0.4	6
U/s Pandon Dam	7	7.77	9.2	0.7	6
Exit of tunnel Dehal Power House	11	8	10.1	0.7	7
U/s Mandi	16	8.01	9.2	0.6	8
D/s Mandi	18	7.98	9	0.7	17
D/s Alampur	26	7.8	8.7	1	4
D/s Dehragopipur	27	7.99	8.3	1.3	6
D/s Pong Dam	26	8.23	7.9	0.9	8
B/c with river Spiti at Khab, distt. Kinnaur	10	7.9	8.5	0.2	-
Neptha Zakhai	10	8.09	9.7	0.1	2

Location	Temp (0C)	pH	DO (mg/l)	BOD (mg/l)	FC (MPN/100 ml)
U/s Rampur	13	8.05	9.2	0.2	58
D/s Rampur	13	8.19	9.1	0.3	73
U/s Tatapani	13	8	9.3	0.2	77
U/s Slapper	14	8.05	9.1	0.5	10
D/s Slapper	16	8.09	9.6	0.6	8
D/s Bhakhra	12	8.13	9	0.1	20
Ravi at u/s Chamba	10	7.74	10.5	0.6	2
Ravi at u/s Madhopur	28	7.88	7.9	1.2	5
Parvati b/c to river Beas	6	7.74	10.4	0.7	8
Largi at d/s HP	5	7.88	10.2	0.7	5
River Sirsa , u/s Sitomajri Nalagarh	25	7.99	8.3	0.9	29
River Sirsa , d/s Nalagarh Bridge	25	8.26	8.9	3.9	393
River Sirsa at d/s Nalagarh distt. Solan	30	8.12	8.9	2.1	270
Yamuna at d/s, at Paonta Shahib	21	8.3	7.6	2.5	18
Yamuna at u/s, at Paonta Shahib	21	8.3	7	4.3	29

Source: Central Pollution Control Board

**Table 83: River Quality Data (Annual Avg.)Year 2006**

Location	Temp (°C)	pH	DO (mg/l)	BOD (mg/l)	FC (MPN/100 ml)
Beas at u/s Manali	4	7.49	11	1	2
Beas at d/s Kullu	7	7.66	9.8	0.8	3
Beas at d/s Aut	7	7.88	10.6	0.7	2
Beas at u/s Pandon Dam	8	7.86	9.9	0.6	5
Beas at exit of tunnel Dehal Power House	9	7.85	9.5	0.7	4
U/s Mandi	15	7.97	8.8	0.7	2
Beas at d/s Mandi	16	7.85	8.5	0.9	7
Beas at d/s Alampur	19	7.72	7.6	0.7	5
Beas at d/s Dehragopipur	21	7.84	7.4	0.8	11
Beas at d/s Pong Dam	19	7.83	6.7	0.7	10
River Sutlej b/c with river Spiti at Khab, distt.Kinnaur	14	8.07	8.5	0.5	
Sutlej at Nethpa Zakhai	10	8.18	9.8	0.2	
Sutlej at u/s Rampur	11	8.03	10.3	0.1	28
Sutlej at d/s Rampur	12	8.18	10.3	0.4	38
Sutlej at u/s Tatapani	12	8.03	10.1	0.3	37
Sutlej at u/s Slapper	11	7.96	9	0.7	6
Sutlej at d/s Slapper	11	8.03	9.1	0.8	7
Sutlej at d/s Bhakhra	16	8.13	8.7	0.2	4
Ravi at u/s Chamba	10	7.85	10.1	0.8	5
Ravi at u/s Madhopur	21	7.7	7.6	0.6	5
Parvati before conf. To river Beas	7	7.61	10.1	0.4	3
Largi at d/s, H.P.	6	7.78	11	0.7	2
River Sirsa , u/s Sitomajri Nalagarh	17	8.11	10.3	1.1	35
River Sirsa , d/s Nalagarh bridge	25	8.37	12.4	1.6	395
River Sirsa at d/s Nalagarh distt. Solan	25	7.85	9.2	23	950
River Yamuna at u/s at Paonta Shahib	20	9.12	8	4.6	11
River Yamuna at d/s at Paonta Shahib	20	9.22	8.1	4.3	15

Source: Central Pollution Control Board

**Table 84: River Quality Data (Annual Avg.)Year 2010**

Location	Temp (°C)	pH	DO (mg/l)	BOD (mg/l)	FC (MPN/100 ml)
Beas at u/s Manali	9	7.5	9.1	0.2	56
Beas at d/s Kullu	13	7.4	9.1	0.5	399
Beas at d/s Aut	12	7.6	9.5	0.3	127
Beas at u/s Pandon Dam	14	7.6	9.1	0.3	26



Location	Temp (°C)	pH	DO (mg/l)	BOD (mg/l)	FC (MPN/100 ml)
Beas at exit of tunnel Dehal Power House	18	7.5	9.6	0.2	39
U/s Mandi	18	8.0	8.8	0.5	1389
Beas at d/s Mandi	17	7.6	8.8	0.7	849
Beas at d/s Alampur	17	7.6	8.3	0.5	11
Beas at d/s Dehragopipur	16	7.4	8.2	0.5	12
Beas at d/s Pong Dam	19	7.4	7.2	0.8	12
River Sutlej b/c with river Spiti at Khab, distt.Kinnaur	8	8.1	8.8	0.2	3
Sutlej at Nethpa Zakhai	19	7.9	8	0.3	9
Sutlej at u/s Rampur	10	8.2	9.5	0.5	9
Sutlej at d/s Rampur	11	8.2	9.3	0.6	7
Sutlej at u/s Tatapani	11	8.1	9.5	0.6	12
Sutlej at u/s Slapper	17	7.6	9.6	0.4	86
Sutlej at d/s Slapper	16	7.8	9.7	0.4	124
Sutlej at d/s Bhakhra	20	7.9	8.8	0.3	6

Source: Central Pollution Control Board

Lakes/ Reservoir Water Quality: Lakes and reservoir water quality for the year 2003 to 2006 are given in Table 85, Table 86, Table 87 and Table 88 respectively. Ground water quality for the year 2003 to 2006 is given in Table 89, Table 90, Table 91 & Table 92 respectively.

**Table 85: Lakes Water Quality Data 2003**

Location	Temp (°C)	pH	Conductivity (Micromaho/ cm)	DO (mg/l)	BOD (mg/l)	COD (mg/l)	FC (MPN/100 ml)	TC (MPN/100 ml)
Gobindsagar lake at Bilaspur	10	8.4	308	9.3	0.6	53	58	159
Pong dam lake at Pong village	24	8.4	236	8.1	0.9	3	5	27
Renuka lake , 35 km from Paonta Sahib	20	8.6	1207	8.1	6	42	33	85

**Table 86: Lakes and Reservoir Water Quality Data 2004**

Location	Temp (°C)	pH	Conductivity (Micromaho/ cm)	DO (mg/l)	BOD (mg/l)	FC (MPN/100 ml)	TC (MPN/100 ml)
Gobindsagar lake at Bilaspur	17	8	205	7.5	0.3	9	22
Pong dam lake at Pong village	27	8.1	229	7.7	1.1	2	13
Renuka lake, 35 kms from Paonta Sahib	20	7.7	1077	7.3	4	24	53

**Table 87: Lakes /Dam Water Quality Data 2005**

Location	Temp (°C)	pH	Conductivity (Micromaho/ cm)	DO (mg/l)	BOD (mg/l)	COD (mg/l)	Nitrate (mg/l)	FC (MPN/100 ml)	TC (MPN/100 ml)
Gobindsagar lake at Bilaspur	14	8.15	250	9.2	0.6	-	0.26	17	48
Pong dam lake at Pong village	27	8.33	169	7.7	1	3	0.37	2	22
Renuka lake , 35 kms from Paonta Sahib	22	8.79	703	6.5	4.1	100	2.31	15	34

**Table 88: Lakes/ Reservoir Water Quality Data 2006**

Location	Temp (°C)	pH	Conductivity (Micromaho/cm)	DO (mg/l)	BOD (mg/l)	COD (Mmg/l)	Nitrate (mg/l)	FC (MPN/100 ml)	TC (MPN/100 ml)	TSS (Mg/l)
Gobindsagar lake at Bilaspur	12	8.06	221	8.8	0.5	7	0.2	9	469	1598
Pong dam lake at Pong village	24	7.95	211	8.4	0.8	4	0.2	4	31	7.2
Renuka lake, 35 kms from Paonta Sahib	21	8.17	585	6.8	2.3	19.6	1.5	10	22	30

**Table 89: Ground Water Quality Data 2003**

Location	Temp (°C)	pH	Conductivity Micromaho/cm	BOD mg/l	COD mg/l	FC MPN/100 ml	TC MPN/100 ml
At Kala Amb, HP	20	8.7	896	5.3	36	45	155
At Paonta Sahib, HP	21	8.2	666	4.3	28	37	95
At Parwanoo, HP	25	7.4	706	0.1	15	-	7
At Baddi, HP	26	7.6	526	0.1	4	-	2
At Barotiwala, HP	26	7.7	564	2.8	-	3	10
At Nalagarh, HP	25	7.6	1049	0.1	7	8	21
At Damtal, HP	27	7.5	656	0.8	4	-	2
At Una, HP	26	8.2	1124	0.1	9	16	59

**Table 90: Ground Water Quality Data 2004**

Location	Temp (0C)	pH	Conductivity Micromaho/cm	BOD mg/l	FC MPN/100 ml	TC MPN/100 ml
At Kala Amb, HP	18	7.8	530	1.5	63	130
At Paonta Sahib, HP	18	7.7	990	3.2	26	57
At Parwanoo, HP	25	7.9	520	0.1	-	1
At Baddi, HP	26	7.8	417	0.1	2	16
At Barotiwala, HP	25	7.8	483	0.1	2	8
At Nalagarh, HP	25	7.5	1275	0.1	19	45
At Damtal, HP	21	7.9	569	0.8	2	4
At Una, HP	25	8	589	0.1	4	6

**Table 91: Ground Water Quality Data 2005**

Location	Temp (°C)	pH	Conductivity Micromaho/cm	DO mg/l	BOD mg/l	FC MPN/100 ml
At Kala Amb, HP	19	7.8	1090	-	3.6	8
At Paonta Sahib, HP	19	7.3	518	-	3.2	7
At Parwanoo, HP	21	7.93	504	3.8	0.1	-
At Baddi, HP	25	7.84	408	2	0.1	-
At Barotiwala, HP	26	7.85	461	1.8	0.1	-
At Nalagarh, HP	25	7.75	1230	2	0.2	4
At Damtal, HP	19	7.67	406	6.6	0.9	-
At Una, HP	24	7.55	886	3.1	0.1	-

**Table 92: Ground water Quality Data 2006**

Location	Temp (°C)	pH	Conductivity Micromaho /cm	COD mg/l	BOD mg/l	Nitrate mg/l	FC MPN/ 100 ml	TC MPN/ 100 ml
At Kala Amb, HP	21	9.88	780	26.4	2.1	0.12	3	14
At Paonta Sahib, HP	20	8.46	431	18.8	1.8	0.18	4	16
At Parwanoo, HP	24	8.1	548	4	0.1	0.4		
At Baddi, HP	25	7.9	401	4	0.1	0.8	20	225
At Barotiwala, HP	26	8.02	431	8	0.1	2		
At Nalagarh, HP	23	7.54	1160	12	0.2	7.5		
At Damtal, HP	19	7.14	994	4	0.2	0.3		7
At Una, HP	25	7.55	906	0.8		1		
Dharamshala Kangra d/s of msw dumping site	21	7.14	380	5	0.5	1.78		5
Mandi-d/s of MSW dumping site	20	7.37	313	7	0.6	0.03	9	34
Parwanoo Industrial Area	24	8.36	806	2		0.4		
Baddi Industrial Area	23	8.09	505	6	0.1	1		
Barotiwala Industrial Area	25	7.7	510	4	0.1	0.1		
Nalagarh Industrial Area	25	8.32	1277	12	0.2	0.64		2
Kala Amb Industrial Area	21	9.03	762	20.1	1.4	0.11	4	16
Paonta Sahib Industrial Area	20	9.08	532	21.2	1.7	0.5	4	17
Mehatpur Industrial Area	26	8.09	582	2.4	0.1	1.05		2
Una Industrial Area	24	8.12	517	1.6	0.1	0.6		2
Sector 15	27	7.1	847	9	0.1	4.12	31	158
Sector 22	27	7	1117	13		10.22		
Sector 34	27	7.1	1111	11	0.1	8.1		
Sector 47	27	7.1	660	7	0.1	0.68		
Palsora village	28	7	1552	25	0.1			
Dhanas village	27	7	921	11	0.1	4.37		
Dadu majra	27	6.8	802	27	0.1	1		

#### 4.9 Institutional mechanisms within the sector to address identified environment issues

The Department of Agriculture is the nodal department for carrying out all activities connected with Agriculture in the State of Himachal Pradesh. The department is headed by Director of Agriculture. S/he is assisted by Additional Director (H.Q), Additional Director (North Zone), Joint Director (Input) and Joint Director (Crops). The existing institutional framework of Department of Agriculture is shown in Figure 2 and responsibilities of the officers are described below:-

**Director:-** Director, Department of Agriculture being the Administrative and Professional head of the Agriculture Department in the State, exercises all the Technical, Administrative & Financial Powers as exercised by the Heads of the Department in Himachal Pradesh Government. S/he also acts as Chief Technical Advisor to the State Government on all matters relating to the Agriculture Department.

**Additional Director (H.Q.):** - S/he is responsible for coordination and monitoring of Agriculture Production Programme,

**Additional Director (North Zone):** - S/he is responsible for coordination and monitoring of Agriculture Production Programme in his/her jurisdiction, Controlling Officers of North Zone (Distt. Kangra, Mandi, Hamirpur, Chamba & Una) and exercise all the administrative and financial powers attached to his/her post in the capacity of being controlling officer of North Zone.

**Joint Director of Agriculture (I):-** The Joint Director of Agriculture (I) assist the Director of Agriculture in the performance of his/her duties and responsibilities, responsible for finalising all the establishment matters, responsible for finalizing all Court Matters, responsible for finalising all the Soil & Water Conservation, Technical, Extension & Training and Project formulation matters, to inspect the institutions under his/her Control and after inspecting the institutions will record inspection notes and any other job assigned by the Head of Department.

**Joint Director of Agriculture (II):-** The Joint Director of Agriculture (II) assists the Director of Agriculture in the performance of his/her duties and responsibilities, Officers Incharges

Planning & Monitoring, Bill & Cash, Potato & Marketing and Budget & reconciliation branches, responsible for finalising all Audit & PAC Matters, to inspect the institutions under his/her control and after inspecting the institutions will record inspections notes and any other job assigned by the Head of Department.

Deputy Directors of Agriculture (Potato & Marketing):- S/he is the all over Incharge of Branch-6 (Potato & Marketing), to assist the Director of Agriculture in respect of all scheme pertaining to Potato, procurement & distribution of certified seed potato, potato development station in the State, production of foundation seed potato and its distribution, procurement of breeder seed potato from C.P.R.I, to assist the Director of Agriculture, in respect of all schemes pertaining to marketing, Marketing of Agriculture produce, MIS & supports price etc, AG Mark, Daily weekly market rates, Import & Export returns, Grading slanders of various crops, Co-ordination and supervision of marketing activities of H.P. marketing Board.

Vegetable Specialist:- S/he is responsible for assisting the Director of Agriculture in respect of all vegetable scheme, Officer Incharge Planning & Bill & Cash Branch and any other job assigned by the Head of Department.

Deputy Controller (F&A):- In an endeavour to strengthen the mechanism of internal financial control in the department, s/he will:-

- Assist the department in the preparation of Budget Estimates.
- Examine all financial sanctions, fixation of pay, step up cases, GPF cases, store stock purchases.
- Reconciliation of accounts of department with A.G.
- Function as member of Purchase committee/ Tender committee/Works committee.

- Any other duty as may be assigned by the Head of department.

Deputy Director of Agriculture/District Agriculture Officers (Kinnaur and Lahaul & Spiti):- S/he is responsible for Preparation of Block wise Agriculture Production Programme, arranging and stocking of Agriculture inputs at all sale points in the district timely and adequately, Effective control of the extension functionaries of the block level and timely monitoring and evaluation of the different development programmes, point wise reporting of the achievements every month of the ADA/Directorate, Overall responsibility for the high yielding varieties programme and organisation & imparting training along with the Agriculture Officers, Agriculture Development Officers, Agriculture Extension Officer at District, Block Headquarters.

Subject Matter Specialist: - S/he is assisted by 2 ADO's and 8 AEO's in each block. They are responsible for Preparation of Agriculture Development officer circle wise agriculture production programme, arranging and stocking all the inputs at all the sale points in the block, timely and adequately, To report shortage of seeds, fertilizers etc. if any, immediately to the District level Officers of Deputy Commissioner, Intensive working during the campaign period. Inspection of field problems such as diseases, insect pest attacks etc., To ensure full utilization of irrigation potential, to ensure quality of inputs by the drawing samples of seeds and fertilizer under the Acts from various government undertaking/ private sale outlets, organizing field days/demonstrations under various schemes and better coordination with Panchayat Samitis at Block Level.

Divisional Engineer, Shimla, Bhangrotu & Palampur: They are assisted by Sub Divisional Soil Conservation Officers in 20 Soil Conservation subdivisions. S/he responsible for checking the schemes/ works executed by the Sub Divisions and accord the Technical/Financial approval of big/large

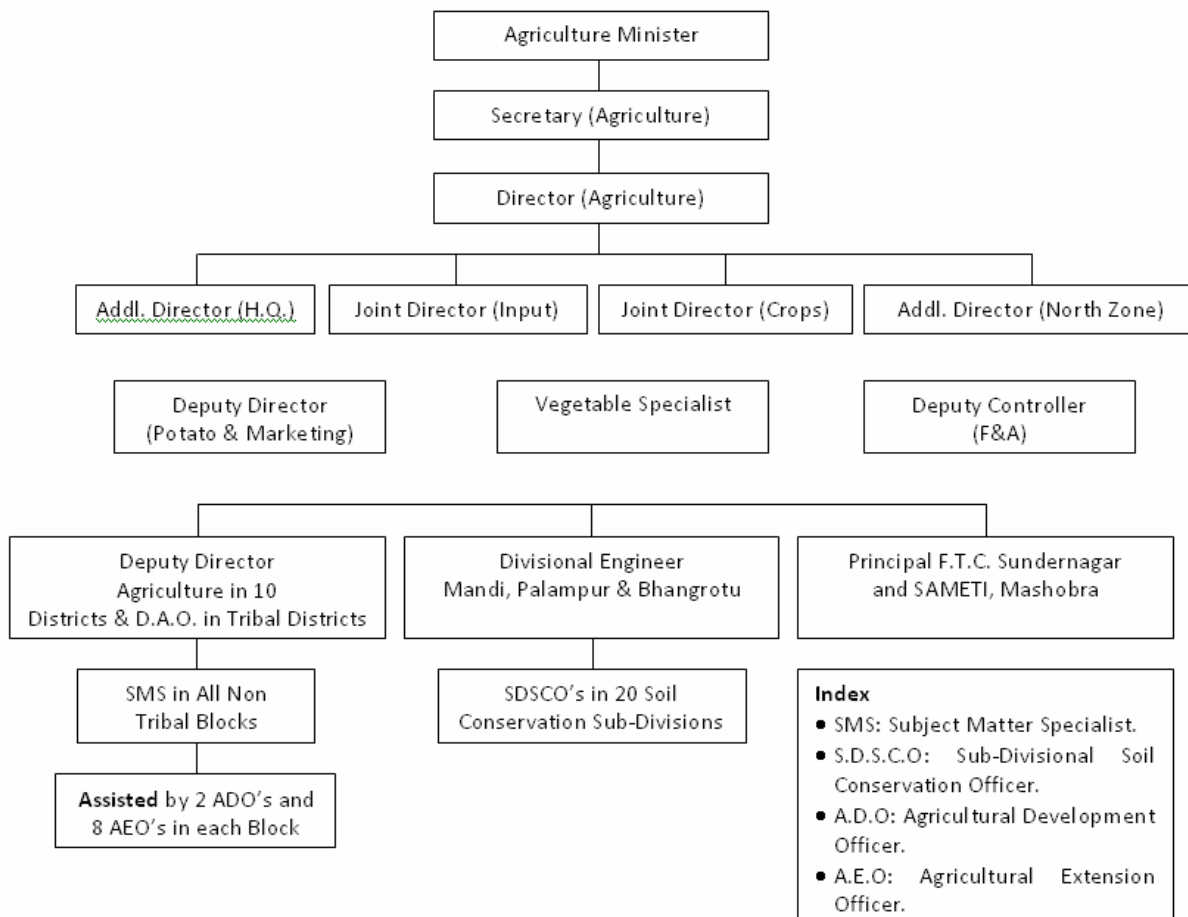
schemes and also monitor the working of Sub Divisions.

**Sub Divisional Soil Conservation Officers:-** They are responsible for the planning/execution of Soil Conservation minor irrigation works in their respective jurisdiction under the over all control of Deputy Director of Agriculture.

**Principal Farmer Training Centre Sundernagar:** S/he is responsible to formulate training and schedule programme relating to Agriculture activities in consultation with ADA/DDA's & implement them, impart training courses etc to the farmer and to organize training camps at

field level in consultation with DDA's of adjoining Distt.

Therefore, based on the above institutional structure, gaps have been identified within the existing institutional framework which is described in Institutional Mechanism report. Furthermore, institutional responsibilities to implement actions identified and approved by the nodal department and line departments have also been described in Institutional Mechanism Report. In order to address environmental issues identified in concerned sectoral guidelines, a number of interventions are required from the nodal department with identified line departments.

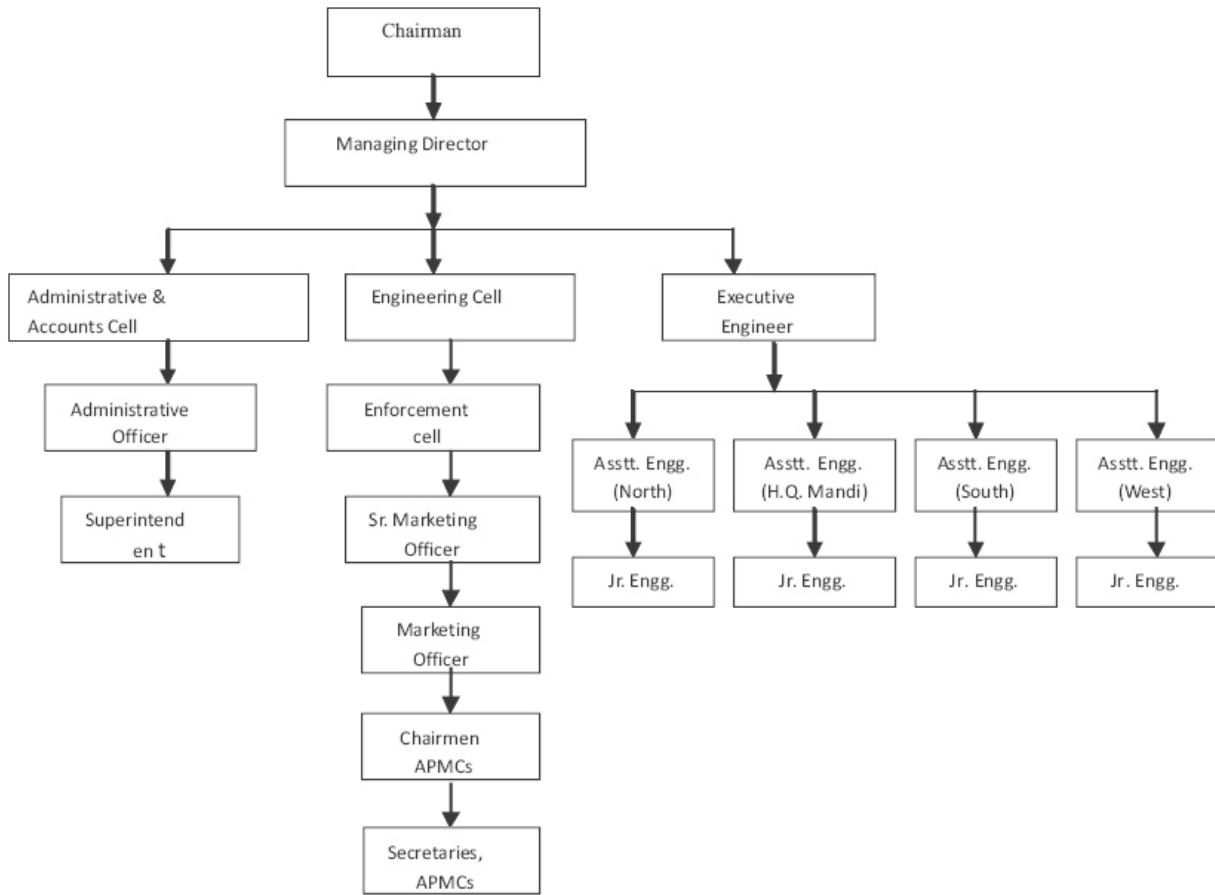


**Figure 2: Organization Structure**

Himachal Pradesh State Agriculture Marketing Board: Enforcing the improved regulation of sale and purchase of Agricultural Produce brought for sale or purchase in the notified market area/yards. Implementation and arrangement of better marketing system to provide competitive prices, correct weighment, payment and creating exploitation free atmosphere by stopping illegal activities in the

marketing of Agricultural Produce through its Agricultural Produce Market

Committees: The Board acts as a liaison agency between the Agricultural Produce Market Committees and the State Government of Himachal Pradesh for all round development of agricultural marketing system in the State. The organization structure is given in Figure 3.



**Figure 3: Organisational Chart of HP Agriculture Marketing Board**

#### 4.10 Data / documentation pertaining to addressing demographic issues in the context of the sectors, such as population changes; requirements of population and changing lifestyles; migratory population including tourists; transhumant; transit labour population; pressures felt by communities due to degraded environment conditions

Himachal Pradesh has 16,997 inhabited villages and over 90% of State population lives in rural areas. According to 2001 Census, there were 29.92 lakhs of total workers in a population of 60.78 lakhs in the State (Table 93). Thus, the Work Participation Rate (WPR) which is defined as the proportion of total workers (including main and marginal workers) expressed as percentage of total population, worked out to be 49.24%. Across districts, it varied from 43.99% in Kangra to 63.47% in Lahaul & Spiti. The classification of workers into main and marginal workers shows the duration for which a person has been employed

in a year. If one is employed for more than 183 days (six months) he/she is regarded as main worker. And if he/she is employed for less than 183 days in a year, he/she is categorised as marginal worker. Of the total population, 32.31% were main workers while 16.92% were categorized as marginal workers. There were wide variations across different districts. For instance, while the proportion of main workers was lower in Kangra (25.14%), Una (26.56%) and Chamba (27.87%), it was higher in Lahaul & Spiti (57.82%), Kinnaur (51.46%) and Shimla (42.31%). The broad industrial classification of main workers further revealed that 65.33% of the total workers were cultivators in the State (Table 94). The proportion of agricultural labourers was 3.15 percent. Taken together, 68.48% of the total workers were directly dependent upon agriculture. Across districts, the dependence on agriculture was quite high for Kullu (78.63%), Sirmaur (74.09%), Mandi (73.95%) and Chamba (73.44%). In comparison, Lahaul & Spiti (54.53%) and Solan (56.91%) had lower dependence on agriculture. While household industry workers were only 1.75%, remaining 29.77% were categorized as 'other workers'.

**Table 93: Distribution of Population by Workers in Himachal Pradesh (number)**

Districts	Population	Main workers	% Main workers	Marginal workers	% Marginal workers	Total workers	% Total workers	Non-workers	% Non-workers
Bilaspur	340885	110652	32.46	56056	16.44	166708	48.90	174177	51.10
Chamba	460887	128452	27.87	102000	22.13	230452	50.00	230435	50.00
Hamirpur	412700	119870	29.05	85535	20.73	205405	49.77	207295	50.23
Kangra	1339030	336649	25.14	252345	18.85	588994	43.99	750036	56.01
Kinnaur	78334	40313	51.46	7498	9.57	47811	61.03	30523	38.97
Kullu	381571	166715	43.69	49798	13.05	216513	56.74	165058	43.26
Lahaul & Spiti	33224	19209	57.82	1879	5.66	21088	63.47	12136	36.53
Mandi	901344	269076	29.85	185216	20.55	454292	50.40	447052	49.60
Shimla	722502	305709	42.31	64514	8.93	370223	51.24	352279	48.76
Sirmaur	458593	175913	38.36	49959	10.89	225872	49.25	232721	50.75
Solan	500557	172274	34.42	91171	18.21	263445	52.63	237112	47.37
Una	448273	119050	26.56	82608	18.43	201658	44.99	246615	55.01
HP	6077900	1963882	32.31	1028579	16.92	2992461	49.24	3085439	50.76

Note: Percentages are with respect to total State population. Source: Census, 2001, HP./ State Agriculture Plan H.P.

**Table 94: Composition of Total Workers in Himachal Pradesh (number)**

Districts	Total workers	Cultivators		Agricultural labourers		Household industry		Other workers	
		Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Bilaspur	166708	114244	68.53	2923	1.75	2727	1.64	46814	28.08
Chamba	230452	167590	72.72	1655	0.72	2780	1.21	58427	25.35
Hamirpur	205405	143535	69.88	3291	1.60	2916	1.42	55663	27.10
Kangra	588994	335357	56.94	39534	6.71	19345	3.28	194758	33.07
Kinnaur	47811	30977	64.79	1101	2.30	871	1.82	14862	31.09
Kullu	216513	164646	76.04	5590	2.59	2733	1.26	43544	20.11
Lahaul & Spiti	21088	11160	52.92	339	1.61	136	0.64	9453	44.83
Mandi	454292	329472	72.52	6518	1.43	6747	1.49	111555	24.56
Shimla	370223	237490	64.15	9814	2.65	4392	1.18	118527	32.02
Sirmaur	225872	161598	71.54	5767	2.55	2595	1.16	55912	24.75
Solan	263445	143630	54.52	6309	2.39	3291	1.25	110215	41.84
Una	201658	115171	57.11	11330	5.62	3986	1.98	71171	35.29
HP	2992461	1954870	65.33	94171	3.15	52519	1.75	890901	29.77

Source: State Agriculture Plan H.P.

Land holding size: Agriculture happens to be the premier source of State income (GSDP). About 18% of the total GSDP comes from agriculture and its allied sectors. Out of the total geographical area of 55.67 lakh ha the area of operational holdings is about 9.79 lakh ha and is operated by 9.14 lakh farmers. The average holding size comes to 1.1 ha. Distribution of land holdings according to

Agriculture Census 2000-2001 shows that 86.4% of the total holdings are of small and marginal farmers. 13.2% of holdings are owned by semi medium/ medium farmers and only 0.4% by large farmers (Table 95). As per Agriculture Census 2001, the highest average land holding size (0.0214 km<sup>2</sup>) was found in district Sirmaur and the lowest (0.0068 km<sup>2</sup>) in district Kullu (Table 96).

**Table 95: Year wise No. of Operational Holdings and Area Operated by Size Class in H.P.**

Census Year	Marginal (<1 Ha)		Small (1-2 Ha)		Semi Medium (2-4 Ha)		Medium (4-10 Ha)		Large (10 Ha & above)		Total all sizes	
	No. of holding	Area (Km <sup>2</sup> )	No. of holding	Area (Km <sup>2</sup> )	No. of holding	Area (Km <sup>2</sup> )	No. of holding	Area (Km <sup>2</sup> )	No. of holding	Area (Km <sup>2</sup> )	No. of holding	Area (Km <sup>2</sup> )
1990-91	532134	2147.19	166410	2351.44	93916	2576.16	35811	2051.99	5522	970.83	833793	10097.66
1995-96	555632	2301.98	173455	2407.37	95057	2563.02	34019	1941.28	4734	783.11	862897	9996.76
2000-01	614942	2517.72	174230	2446.29	89873	2433.16	30899	1758.79	3970	631.60	913914	9787.56

Source: Directorate of Land Record, H.P.

**Table 96: District wise No. of Operational Holdings and Area Operated by Size Class in H.P.**

District	Marginal(<1 Ha)		Small(1-2 Ha)		Semi-Medium(2-4 Ha)		Medium(4-10Ha)		Large(10 Ha& above)		Total all sizes	
	No. of holding	Area (Ha)	No. of holding	Area (Ha)	No. of holding	Area (Ha)	No. of holding	Area (Ha)	No. of holding	Area (Ha)	No. of holding	Area (Ha)
Bilaspur	35947	15347	12315	16085	5277	13552	1027	5337	43	633	54609	50954
Chamba	49345	21815	13604	18897	4622	12101	543	2778	11	637	68125	56228
Hamirpur	48976	20759	14362	20292	7267	19347	2096	11689	177	2362	72878	74449
Kangra	172602	60569	32846	46126	16725	45818	6649	38393	868	15675	229690	206581
Kinnaur	5663	2398	2316	3310	1536	4194	478	2626	44	1302	10037	13830
Kullu	50331	19169	8731	12203	3047	8130	502	2715	14	182	62625	42399
Lahaul & Spiti	1848	989	1142	1674	893	2511	203	1056	11	160	4097	6390
Mandi	101546	43568	30773	42785	11984	31557	1903	9922	41	640	146247	128472
Shimla	61578	27869	27753	32435	12772	31772	4150	23189	284	3745	101537	122010
Sirmaur	22412	10387	10203	14532	8547	24055	5595	33504	1309	20205	48066	102683
Solan	22123	11329	13412	19364	10169	27828	4428	25030	444	6596	50576	90147
Una	42571	17573	11773	16926	7034	19451	3325	19640	724	11023	62427	84613

Land use pattern



Total geographical area of the State is 55,673 km<sup>2</sup> according to the Surveyor General of India. According to 'Village Papers' i.e. the reporting area for which revenue papers exist, total geographical area was 2930.9 thousand ha in 1972-73 which increased to 4544.7 thousand ha in 2005-06. Thus, the unreported area from the view point of land has come down from 47% of the total geographical area in 1972-73 to only 18.37% in 2005-06. The process of bringing more and more area under village papers has been hastened during the nineties even in the tribal districts. The broad land use pattern at the State level (Table 97) reveals that the area under forests was 1101.1 thousand ha in 2005-06. As regards the land not available for cultivation, the area under barren and unculturable lands stood at 671.9 thousand ha in 2005-06. The area under non-agricultural uses increased from 317.5 thousand ha in 2001-02 to 458.1 thousand ha in 2005-06. While the net sown area in the State was 542.7 thousand ha, Total Cropped Area (TCA) amounted to 953.6 thousand ha in 2005-06, exhibiting a cropping intensity of 176%.

In terms of per cent of the reported area, the forests accounted for almost one-fourth of the total area. The area under barren lands category stood at 14.78%. Area put to non - agricultural uses increased from 6.67% in 2001-02 to 10.08% in 2005-06. Under different categories of land use that is amenable to cultivation, it was 2.80%. Almost one-third of the total area was under pastures and grazing lands. Area under miscellaneous tree crops was 1.51%. About 1.33 and 0.31% of the total area was under current fallows and other fallows, respectively. While net sown area in the State was 11.94% of the total reporting area, total cropped area remained at 20.98%. When these changes are viewed overtime, one finds that most of the decline in net sown area has occurred during the nineties. Likewise, land put to non-agricultural uses also increased after mid 80s and the increase was quite pronounced after mid 90s. Another disturbing feature is that the land under fallows has increased

considerably and it was more so for the category 'other fallows'. On the other hand, land under current fallows increased appreciably during 90s.

**Table 97: Changes in Land Utilization Pattern in Himachal Pradesh, 2001-02 to 2005-06 ('000 ha)**

Sr. No.	Particulars	Himachal Pradesh	
		2001-02	2005-06
1.	Total geographical area		
	By professional survey	5567.3	5567.3
	By village papers	4542.8	4544.7
2.	Forests	1098.7 (24.19)	1101.1 (24.23)
3.	Area not available for cultivation of which	1124.1 (24.74)	1130.0 (24.86)
4.	i. Barren and unculturable land	806.6 (17.76)	671.9 (14.78)
5.	ii. Land put to non-agricultural uses	317.5 (6.98)	458.1 (10.08)
6.	Other uncultivated land excluding current fallows	1701.0 (37.44)	1696.3 (37.32)
7.	i. Culturable waste	122.1 (2.69)	127.2 (2.80)
8.	ii. Permanent pastures and other grazing lands	1518.7 (33.43)	1500.5 (33.02)
9.	iii. Land under miscellaneous tree crops	60.2 (13.25)	68.6 (1.51)
10.	Fallow lands of which	69.4 (1.53)	74.5 (1.64)
11.	i. Current fallows	56.3 (1.24)	60.4 (1.33)
12.	ii. Other fallows	13.1(0.29)	14.1(0.31)
13.	Net sown area	549.6 (12.10)	542.7 (11.94)
14.	Total cropped area	955.6 (21.04)	953.6 (20.98)
15.	Cropping intensity (%)	174	176

*Note: Figures in parentheses are percentages.*

*Source: Annual Season and Crop Report, 2002-03, Directorate of Land Records, Himachal Pradesh and Directorate of Economics and Statistics, Government of Himachal Pradesh, Shimla.*

Food grains production and yields: According to the Economic Survey Report, 2009-10, the food grain production targets for 2010-11 are to be around 16.70 lakh MT (Table 98). The Kharif production mainly depends upon the behaviour of South West monsoon, as about 81.5% of the total cultivated area is rainfed. During 2000-01, food grains production was 8.27 lakh MT in Kharif season while 3.75 lakh MT in Rabi season (Table 99).

**Table 98: Food grains Area and Production**

Year	Area ('000 ha)	Production ('000 MT)	Production per ha (MT)
2004-05	811.04	1487.65	1.83
2005-06	792.69	1068.68	1.35
2006-07	806.10	1476.47	1.83
2007-08	811.98	1440.66	1.77
2008-09	789.01	1399.56	1.77
2009-10 (Anti.Ach.)	750.24	956.38	1.27
2010-11 (Target)	795.00	1670.60	2.10

Source: Economic Survey Report, H.P., 2009-10

**Table 99: Year wise Area, Production and Productivity of Rabi and Kharif Crops**

Crop	1997-98			1998-99			1999-2000			2000-01		
	Area (sq. km)	Production (000 MT)	Productivity (Kg. Ha)	Area (sq. km)	Production (000 MT)	Productivity (Kg. Ha)	Area (sq. km)	Production (000 MT)	Productivity (Kg. Ha)	Area (sq. km)	Production (000 MT)	Productivity (Kg. Ha)
<b>Kharif</b>												
Corn	3118.6	620.68	1990	3009.8	662.82	2202	2999.1	681.42	2272	2980.5	683.64	2222
Paddy	861.8	120.44	1398	821.3	117	1425	802.2	120.37	1500	815.2	124.9	1532
Millets	116.7	7.38	632	105.3	7.23	686	111.1	7.41	667	107.8	7.07	656
Ragi	40.6	4.29	1056	36.7	4.16	1134	39.6	4.44	1121	41.3	4.16	1007
Pulses & Oilseeds	278.5	8.67	315	266.5	10.02	376	242.1	9.67	399	232.2	7.97	343
Total	4116.3	761.42	1724	4239.5	800.68	1889	4194	823.32	1963	4177	827.73	1982
<b>Rabi</b>												
Wheat	3773.4	641.31	1700	3797.2	481.27	1267	3705.9	583.3	1574	3626.8	251.32	693
Barley	276.9	41.34	1493	267.5	27.76	1038	259	32.5	1255	256.4	21.41	835
Chickpea	23.4	2.5	1068	19.1	1.29	675	17	1.53	900	13.5	1.49	1104
Pulses & Oilseeds	45.9	1.55	338	46.4	2.02	435	48.4	5.5	1136	48.7	1.62	333
Total	4119.6	686.69	1667	4130.2	512.33	1240	1030.2	622.82	1545	3945.4	375.54	699
G. Total	8535.8	1448.11	1696	8369.7	1313.02	1569	8274.2	1416.14	1722	8122.3	1103.58	1359

The consumption of fertilizers (N+P+K) in 2006-07 was 48981 tonnes. The district wise use of fertilizers is depicted in the Table 100.

**Table 100: District wise Fertilizer Consumption in MT (2006-07)**

District	Nitrogenous(N)	Phosphatic (P)	Potassic (K)	Total(N+P+K)
Bilaspur	1494	274	140	1908
Chamba	1085	161	92	1338
Hamirpur	2133	307	157	2597
Kangra	6351	1881	973	9205
Kinnaur	87	66	45	198
Kullu	1757	928	964	3649
Lahaul & Spiti	133	138	83	354
Mandi	4495	1296	812	6603
Shimla	3382	2478	3312	9172
Sirmaur	2267	590	302	3159
Solan	2893	748	396	4037
Una	4717	1358	686	6761

Source: Directorate of Land Record H.P.

Daily wages: Trend of wages during 1992-2006 for skilled and unskilled labourers (including Field Labour and Other Agricultural Labour is given in Table 101.

**Table 101: Agricultural Wages per Days (₹) in the Month of July-June**

Year	Skilled Labour			Unskilled Labour		
	Carpenter	Blacksmith	Cobbler	Field Labour	Other agricultural labour	Herdsmen
1992-93	57.00	47.00	45.00	36.00	31.00	31.00
1993-94	59.36	50.06	48.81	34.78	31.30	30.49
1994-95	65.03	54.80	55.55	39.97	34.79	35.76
1995-96	69.64	62.43	62.19	49.32	43.44	45.48
1996-97	79.00	72.00	70.00	55.00	49.00	49.00
1997-98	94.00	88.00	81.00	64.00	57.00	54.00
1998-99	102.00	96.00	93.00	61.00	60.00	57.00
1999-00	110.00	101.00	65.00	66.00	62.00	55.00
2000-01	120.66	112.91	105.75	80.91	67.75	65.58
2001-02	130.00	122.00	114.00	84.00	84.00	67.00
2002-03	132.00	125.00	115.00	88.00	70.00	68.00
2003-04	137.00	129.00	118.00	90.00	74.00	73.00
2004-05	141.73	130.82	117.75	93.36	75.36	75.72
2005-06	143.83	132.42	119	111.42	76.92	77.27

Source: Directorate of Land Records, Himachal Pradesh.

It has been found that the growth and transformation of agriculture has been disproportionate across different districts. The most agriculturally predominant districts namely, Kangra and Mandi that constitute

maximum proportion of cultivators and cultivated area of the State showed dismal and sluggish growth affecting the overall development of the agricultural sector (Table 102 & Table 103).

**Table 102: District wise area under high yielding variety crops**

District	Wheat (Km2)		Paddy (Km2)		Maize (Km2)	
	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08
Bilaspur	265	244.5	12.5	13	256	255.1
Chamba	172	152.2	15	16	262	263.2
Hamirpur	336.5	317	18	19	305	304.9
Kangra	887.5	867.5	364	364.5	506	506.3
Kinnaur	4	4	0.3	30	4.5	4.8
Kullu	205	186.1	100	10	150	150.2
Lahaul & Spiti	2.5	2.5	-	-	0.5	0.5
Mandi	640	641	191.2	191.8	466.1	466.5
Shimla	174.5	155.5	14.5	14.7	131	129
Sirmaur	274	254.5	52	53.5	215.5	213.6
Solan	227.5	208	29	31	237.5	237.1
Una	307.5	288.1	20	21.3	272	271.9

Source: Directorate of Agriculture, Himachal Pradesh

**Table 103: District wise crop intensity**

Sr. No.	District	1981-82	1991-92	1996-97	1997-98
1	Bilaspur	189.9	190.5	191.3	192.9
2	Chamba	150.7	153.5	140.8	156.5
3	Hamirpur	194.8	195.1	190.7	196.7
4	Kangra	157.9	181.2	182.8	186.9

Sr. No.	District	1981-82	1991-92	1996-97	1997-98
5	Kinnaur	134.7	120.2	125.8	131.3
6	Kullu	160.4	175.2	177.6	172.4
7	Lahaul & Spiti	100	106.3	104.4	102.5
8	Mandi	174.6	171.8	172.6	179.6
9	Shimla	152.5	142.6	144.6	150.7
10	Sirmaur	180.2	186.3	183.1	185.9
11	Solan	154.8	166.6	158.8	166.5
12	Una	171.3	168.6	179.3	186.8

Source: Department of Economics & Statistics, Himachal Pradesh, Shimla

#### 4.11 Information on human resource management issues (which may have relevance to environment management) in the sectors such as: manpower, vocational training, awareness levels, etc.

The Department of Agriculture is headed by the Director of Agriculture with headquarter at Shimla.

The Director of Agriculture is assisted by one Additional Director and two Joint Directors. One Additional Director of Agriculture has been posted for North Zone at Dharamsala, district Kangra, who is monitoring all the activities in Kangra, Chamba, Una, Hamirpur and Mandi districts. In each district (except Lahaul & Spiti and Kinnaur) the Deputy Director of Agriculture is responsible for implementation of all agricultural development programmes in the districts. In Lahaul, District Agricultural Officer at Keylong and in Spiti Division, Assistant Project Officer (Agr.) at Kaza and in Kinnaur district, District Agricultural Officer (ADO) at Reckong Peo is responsible for implementation of Agriculture Development Programmes (ADP). The Deputy Director of Agriculture in the district is assisted by the District Agricultural Officer, Regional Potato Development Officer and Subject Matter Specialists. With a view to strengthen the extension network at grassroots level, one SMS, two ADOs and 5 to 8 Agriculture Executive Officer (AEOs) have been provided in each block. For soil and water conservation activities, 20 sub-divisions are in existence and

each sub-division is headed by a Sub-Divisional Soil Conservation Officer. These sub-divisions are under the control of three divisions with divisional headquarter at Shimla, Bhangrotu and Palampur.

One Agriculture Extension Training Centre upgraded as State Agriculture Management Extension and Training Institute (SAMETI) at Mashobra and one Farmer's Training Centre at Sundernagar headed by the Principal are in operation in the State and a number of training courses for the grassroots level functionaries viz. Agriculture Development Officers, Agriculture Extension Officers and farmers are being organized at these centres. Soil Testing Laboratories headed by Soil Testing Officers in each district (except Lahaul & Spiti) are also functioning.

Department of Agriculture runs 2 Training Centres one at Mashobra (Shimla) and other at Sundernagar (Mandi). The Department of Agriculture, State of Himachal Pradesh has following officers/ employees cutting across various levels namely Director Of Agriculture, Additional Director Of Agriculture, Dharamsala, Joint Director Of Agriculture (I), Joint Director Of Agriculture (II), Deputy Director of Agriculture/District Agriculture Officers (Kinnaur, Lahaul & Spiti), Deputy Directors of Agriculture (P&M), Agriculture Statistical Officer, Vegetable Specialist, District Agriculture Officers, Agriculture Development Officer (Vegetable), Plant Protection Officer, Assistant Agriculture Marketing Officer, Agriculture Information Officer, Soil Testing Officers, Senior Analytical Chemist, Principal Farmer Training Centre Sundernagar, Assistant

Soil Survey Officer, Analytical Chemist, Deputy Controller (F&A), Section Officer (F&A), Law Officer, Subject Matter Specialist, Training Officer, Regional Potato Development Officer, Agriculture Development Officers, Assistant Agriculture Statistical Officer, Assistant Agriculture Development Officer, Agriculture Extension Officers, Divisional Engineer, Shimla, Mandi at Bhangrotu, Kangra at Palampur, Sub Divisional Soil Conservation Officers, Map Officer, Circle Head Draughtsman, Junior Engineers, Surveyors, Head Draughtsman, Draughtsman, Junior Draughtsman, Technical Assistant (Statistics) & Statistical Assistant, Superintendent Grade-I, Superintendent Grade-II, Senior Assistant, Clerks/ Junior Assistants.

Training and capacity building has been identified as one of the major area of intervention. The area and scope of training programme for nodal department and other collaborating agencies have been described in report on Training and Capacity Enhancement.

#### **4.12 Regulatory analysis to identify any regulations that have environment implications (negative or positive), and compliance with the same.**

Agriculture sector and cross sector policy and regulatory framework at State level shows the intent of the State government to address inadequate service delivery in order to reduce burden in the State. A list of policy and programme is given below.

- National Agriculture Policy, 2000
- National Policy for Farmers, 2007
- National Seed Policy, 2002
- The Seeds Act, 1966
- The Seeds Rules, 1968
- The Seeds (Control) Order, 1983
- National Oilseeds and Vegetable Oils Development Board Act, 1983 (29 of 1983)
- The National Oilseeds and Vegetable Oils Development Board Rules, 1984
- Pandit Deen Dayal Kisan Bagwan Samridhi Yojna
- Diversification of Crops Programme (Government of India and JICA)
- Quality Seed Multiplication and Distribution (Cereals, Pulses, and Vegetables)
- National Environment Policy, 2006
- Agriculture Produce Marketing Committee (APMC) Act
- The Agricultural and Processed Food Products Export Development Authority Act, 1985
- Agricultural Produce (Grading and Marking) Act 937 (Act No. 1 of 1937) as amended up to 1986.
- The Himachal Pradesh Agricultural & Horticultural Produce Marketing (Development & Regulation Act) 2005
- Agriculture marketing through APMC
- Fertiliser Control Order, 1985
- Insecticide Act, 1968
- National Water Policy, 2002
- State Water Policy (undated)
- Rural Infrastructure Development Fund (Minor Irrigation and Water Harvesting Schemes)
- Destructive Insects and Pests Act, 1914
- The Himachal Pradesh Agricultural Pests, Diseases & Noxious Weeds Act, 1969
- Plant quarantine (Regulation of Import into India) Order 2003
- The Himachal Pradesh Holdings

(Consolidation & Prevention of Fragmentation) Act, 1971

### References

- National Agriculture Resource Project Report-ICAR
- Department of Agriculture
- State Environment Report
- 10th & 11th Five Year Plan of HP
- Annual Season & Crop Report, 1998-99
- Directorate of Land Record, HP
- Annual Administrative Report, 2001-02
- Statistical Outline of HP
- Districts Statistical Handbook, 2000
- Potato Statistics –India and World by N.K. Pandey
- Economic Survey Report of HP, 2009-10
- Work Plan for Accelerated Growth of Agriculture and Horticulture, 2002-2003

## CHAPTER 5 HORTICULTURE

### 5.1 Resource inventory of existing assets of the sector

Himachal Pradesh has the advantage of climate and topography in the cultivation of a variety of fruits. Temperate fruits cover about 64% of the total cultivated area of the State of which more than 40% is under apple cultivation. The area under fruits more than doubled in the last two

decades. Similarly, the productivity of apples almost doubled to 4500 kgs per ha during 2000-2001, but the productivity of nuts and dry fruits, citrus and other sub-tropical fruits decreased even though the area under these crops increased. Production of apples was the maximum during 1988-1990. Trends in fruit production 1980 to 2001 are given in Table 1.

**Table 1: Fruit Production**

Fruit	Area	Production	Productivity	Area	1	1	1	1	1	1
Apple	43.3	118.1	2727	62.8	342.1	5447	83.7	367.7	4500	
Other Temperate Fruits	633	17.5	9.3	531	28.5	14.9	523	32.4	20.5	
Nuts and Dry Fruits	6.9	1.8	261	13.2	3.1	235	16.4	2.7	165	
Citrus	14.5	4.4	303	36.0	12.6	350	39.1	11.1	284	
Other Sub-Tropical Fruits	468	10.3	6.4	621	22.9	13.6	594	36.3	17.0	
Total	92.5	140	1574	163.4	386.3	2364	207.9	428.0	2059	

Source: *Work Plan for Accelerated Growth of Agriculture and Horticulture in H.P., 2002-03.*

Note: (Area: 00 ha; Production MT Productivity: kgs/ha)

The production of fruits for the last three years

and current year up to December, 2009 is given in Table-2.

**Table 2: Fruit Production ('000 tonnes)**

Item	2006-07	2007-08	2008-09	2009-10 up to 31-12-09
Apple	268.4	592.58	510.16	280.11
Other temperate fruits	35.65	53.91	39.93	18.39
Nuts & dry fruits	2.91	2.92	3.55	1.44
Citrus fruits	12.67	24.67	26.01	6.52
Other sub tropical fruits	49.47	38.76	48.43	24.7
Total	369.1	712.84	628.08	331.16

Source: *Economic Survey Report, 2009-2010*

The districts of Shimla and Kullu are the dominant areas of apple production while in Sirmour, peach is the main fruit crop. Kullu district grows plums and pears. Citrus fruits, mango and lichi are main fruits grown in the the State as compared to 19% under citrus fruits.

About one-seventh of the fresh fruit trees are non-bearing while in case of dry fruits the proportion of non-bearing trees is about one-eighth of the total plantation covering about 16% of the area under fruits. The districts of

district of Kangra (Table 3). The area under mango is about 39% of the total area under sub-tropical fruits in the lower hill region and about 6 % of the total area under all fruits in Shimla and Kinnaur have the largest number of non-bearing trees of fresh as well as dry fruits (Table 4). Fruit production, which was 1200 metric tonnes in 1950-51, increased to 4.3 lakh metric tonnes in 2000-2001 (about 360-fold increase), but the yields are about 10-12 times below what is produced in the European countries (H.P. State Plan, 2001-02).

**Table 3: District Wise Area (ha) under different fruit crops bearing trees (1998-99)**

District	Apple	Peaches	Plum	Pears	Kinnow & Orange	Litchi	Mango
Bilaspur	-	-	2	7	28	80	178
Chamba	-	-	-	-	-	-	-
Hamirpur	-	-	-	-	-	-	79
Kangra	-	-	8	-	2139	107	2141
Kinnaur	1591	-	-	-	-	-	-
Kullu	7958	-	740	44	-	2	-
Lahaul & Spiti	19	-	-	-	-	-	-
Mandi	916	-	190	-	-	-	-
Shimla	20028	10	226	-	24	45	4
Sirmaur	649	323	59	24	33	41	286
Solan	80	5	63	30	30	55	49
Una	-	-	-	-	-	-	-

Source: Annual Season and Crop Report (1998-99), Commissioner Revenue, H.P.

**Table 4: District-wise bearing and non-bearing area (ha) under fresh fruits, dry fruits**

District	Fresh Fruits		Dry Fruits		Vegetables	Others	
	Bearing	Non-Bearing	Bearing	Non-Bearing		Kharif	Rabi
Bilaspur	338	75	2	-	-	13	498
Chamba	2147	-	-	-	533	26	698
Hamirpur	84	-	-	-	-	13	199
Kangra	6092	-	9	-	122	1246	2229
Kinnaur	1597	318	552	57	244	-	921
Kullu	8744	272	58	3	850	139	2308
Lahaul & Spiti	19	40	-	-	874	-	900
Mandi	5757	-	-	-	1635	195	4904
Shimla	20337	6815	308	93	5130	817	13062
Sirmaur	1489	100	33	5	1082	384	3395
Solan	745	137	4	-	18	125	3197
Una	538	-	-	-	89	293	927
HP	47887	7757	966	158	10577	3251	33238

Source: Annual Season Crop Report 1998-99. Commissioner (Revenue) Himachal Pradesh

In recent years mango has emerged as an important fruit crop. Litchi is also gaining importance in certain regions. Mango and litchi are fetching better market prices. In the mid-hill zone, the agro-climatic conditions are highly suitable for the successful cultivation of new

fruits like kiwi, olive, pecan nut and strawberry.

### 5.1.1 Horticulture Resource

The zone wise list of suitable crops is given in Table 5 and shown in Figure 1.

**Table 5: Horticultural resources (crops) and Zones in Himachal Pradesh**

Sr. No.	Zone Description	Elevation Range (meters amsl)	Rainfall (cms)	Suitable Fruit Crops
1	Low Hill and Valley areas near the plains	365-914	60-100	Mango, Litchi, Guava, Loquat, Citrus Fig, Ber, Papaya, Early varieties of Grapes, Jack Fruit, Banana, Low chilling varieties of Peach, Plum and Pear, Strawberry
2	Mid Hills (Sub Temperate)	915-1523	90-100	Stone Fruits (Peach, Plum, Apricot, Almond), Persimmon, Pear, Pomegranate, Pecan nut, Walnut, Kiwi Fruit, Strawberry
3	High Hills and Valleys in the interiors (Temperate)	1524-2742	90-100	Apple, Pear (Soft), Cherry, Almond, Walnut, Chestnut, Hazel -nut, Strawberry.
4	Cold and Dry Zone (Dry Temperate)	1524-2656	24-40	Apples, Prunes, Drying type of Apricot, Almond, Chilgoza, Pistachio nut, Walnut, Hazel -nut, Grapes and Hops

Source: Department of Horticulture



In addition to fruits, vegetable and flower cultivation is undertaken for off season supplies to the plains, while the mushroom cultivation is being taken up even by the landless for the augmentation of their income. Fruits: More than thirty types of fruit species are being

grown in the State either on a large or small scale. Most important are – apple, apricot, peach, pear, plum, almond, walnut, pecan nut, mandarin, sweet orange, kagzi lime, hill lemon, mango, guava, papaya, litchi, kiwi fruit, olive and strawberry.

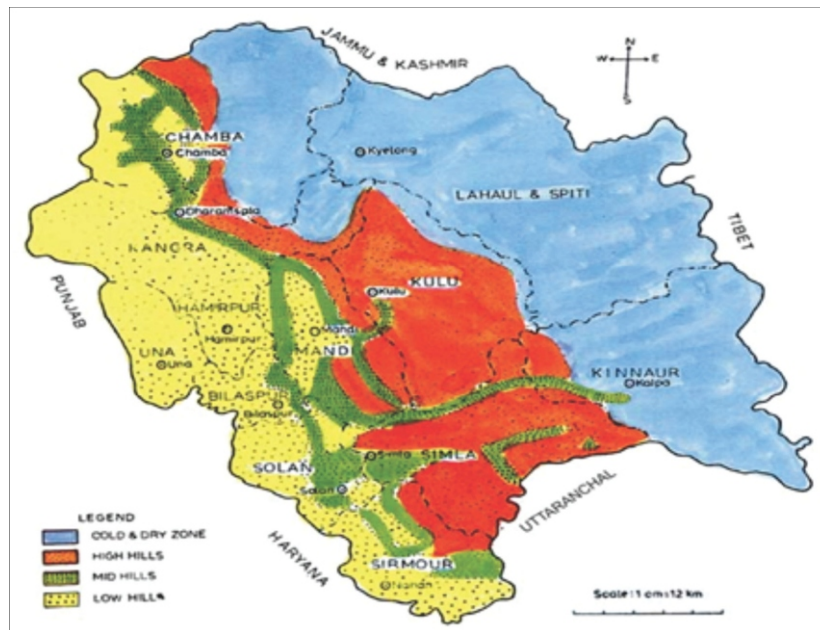


Figure 1: Zones in Himachal Pradesh

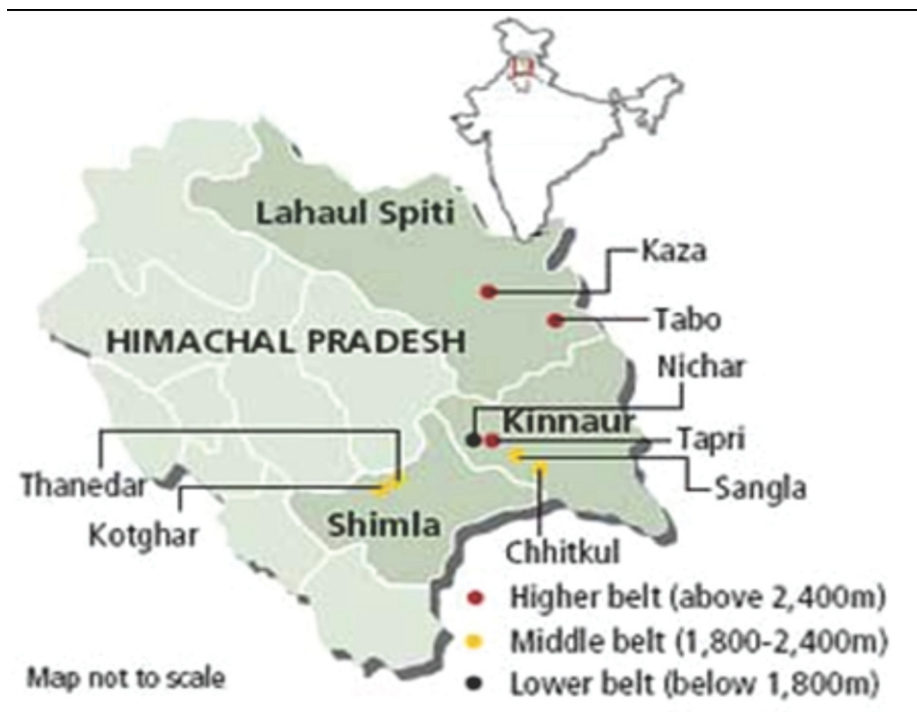


Figure 2: Apple growing belt

Source: Department of Horticulture

## District wise horticulture status

Based on Census 2001 data, the district wise horticulture status of Himachal Pradesh such as area, production, fertilizer consumption,

pesticide consumption, etc. for different fruits are given in this section. The district wise production (MT) per ha is given below in Table 6.

**Table 6: Fruits Production (MT) /ha**

District	Year	Apple	Other temperate fruits	Sub-tropical fruits	Nuts & Dry fruits	Citrus fruits	Total	
Kullu	1998-1999	5.16	3.55	0.23	0.26	0.06	4.60	
Mandi	1998-1999	0.85	0.14	0.12	0.13	0.04	0.43	
Shimla	1998-1999	7.67	0.55	0.10	0.25	0.11	6.55	
Una	1998-1999	NA	0.16	1.81	0.09	0.35	0.92	
Kinnaur	1999-2000	3.49	1.39	NA	0.25	NA	2.85	
Sirmaur	1999-2000	0.26	0.17	2.77	1.08	2.25	1.13	
Solan	1999-2000	0.76	0.60	0.48	0.76	2.52	0.74	
Bilaspur	1999-2000	NA	0.27	0.82	0.01	1.08	0.82	
Chamba	1999-2000	0.46	0.21	0.04	0.05	0.16	0.31	
Kangra	2000-2001	1.11	0.98	0.40	0.13	0.39	0.42	
		<b>Apple</b>	<b>Apricot</b>	<b>Almond</b>	<b>Plum</b>	<b>Cherry</b>	<b>Walnut</b>	<b>Total</b>
Lahaul & Spiti	31 DEC, 001	0.37	6.15	4.00	9.00	3.33	0.50	0.49

Source: District Statistical Abstract and District Horticulture officer

To bring diversification in horticulture industry, a total area of 413 ha has been brought under flower cultivation till 31-12-2009 and 48 flower grower cooperative societies are functioning in the State. Ancillary horticultural activities like mushroom and bee keeping are also being promoted. During 2009-10 up to December 2009 335.00 MT of pasteurized compost for mushroom was prepared in two developmental projects located at Chambaghat/Palampur and distributed to mushroom growers and 239.00 MT of mushroom was produced during the year. Under the bee keeping programme, 296.77 MT of honey has been produced up to 31st December, 2009 against the target of 1,600 MT for the year 2009-10.

### 5.1.2 District level information of horticulture sector resources are described below.

1 Bilaspur: Bilaspur falls in the sub tropical zone and fruits like Mango, Citrus, Grapes, Litchi, Pear, Peach and Plum can be grown successfully. Horticulture Department is making vigorous efforts to bring more and

more mango orchards because mango is drought resistant, needs less water and is a profitable crop. In addition, efforts are being made to develop subtropical fruits like Citrus, Galgal, Lemon, Litchi and Guava etc. The popularisation of horticulture in this district is due to 6 Progeny-Cum-Demonstration farms, 2 Fruit Plant Nurseries and four horticulture extension centres. These farms provide better plants to the farmer and also provide with regards to the latest horticulture techniques.

Area under different fruit plants was 7628.4 ha. during 1990-91 which declined to 6263.36 ha. during 1999-2000. The area under fruit crops continued to rise from 1990-96 to 1996-97 when it was 9,610.3 ha. thereafter it declined all of a sudden to 5,862.6 ha. in 1997-98. The production of fruits which was 4,820 metric tonnes in 1990-91 declined to 3,105 metric tonnes during 1998-99. However, during the subsequent year it rose to 5160 metric tonnes.

Fertilizers are supplied to the growers through cooperative societies. Pesticides are procured

by the Horticulture department. These are sold/ distributed through extension centres to the growers. Nurseries located at Lalda and Manjhari provide plants to the growers at subsidised rates through extension centre. Departmental Progeny –cum-demonstration orchards are situated at Nihari, Nihal, Baroha, Kot Kahloor, Guru ka Lahore and Salva. Department of Horticulture provides free technical knowledge to the fruit growers through the staff posted at block headquarters and in the extension centres.

2 Chamba: The variations in the climatic and soil conditions in the district present immense possibilities for the development of horticulture. Thus, horticulture plays an important role in the socio-economic upliftment and prosperity of the inhabitants of this district. The district has suitable pockets for the production of hazelnut, chilgoza, apricot, walnut, peach, apple, pear, plum, quince and mango. The apple orchards are located predominantly in Chaurah, Bharmaur, Chamba and Pangi Tehsils and Saluni sub-Tehsil, where delicious varieties of red, royal and golden etc are mostly found. Plum is grown in Chamba and Bharmaur Tehsil and Holi sub-Tehsil. Besides the local varieties Sentoroza and Maricoza are also grown in the district. Walnuts are grown all over the district. Chilgoza is mostly found in Pangi and certain pockets of Bharmaur Tehsil and Holi sub-Tehsil. Mango is generally found in the lower portion of Bhattiyat Tehsil and Sihunta sub-Tehsil. The area under fruit plantation during 1998- 99 was 14,431 ha. During the same period, the fruit production was 6,484 MT.

The lower areas of development block of Chamba, Tissa and Saluni are most suitable for propagating the plantation of olive. In order to meet the plant requirements of the cultivators, the department is maintaining progeny orchards and nurseries in the district. The plant protection centre is located at Chamba with a sub centre Mani, Chatrari, Gharola, Madubar and at block headquarters which provides

technical guidance to the orchardists and supplies pesticides. Under the component plan, loans and subsidies are provided for procuring the plants, fertilizers and pesticides to the various segments of the population. In order to provide a market for the horticultural produce, the Horticulture Department has started fruit canning unit in the district.

3 Kangra: Climatic conditions prevailing in the district offer a great scope for growing of fruit plants, which improve the economy of the district. Kangra district has immense potential for growing citrus fruits, mangoes, loquat, and pomegranate, papaya etc. During the last 30 years, steps have been taken to bring more area under fruits. During the year 2000-2001, the area was 32,455 ha. and in the same period, production was 13,537 MT.

A fruit farm was established at Palampur in the year 1936 with a view to find out types and varieties of fruit plants, which can be grown. The results favoured the growing of fruits like peaches, plums, apricots, and almonds under the existing conditions. In order to meet out the fruit plants requirement and to provide technical guidance to the orchardists, 10 departmental progeny-cum-demonstration orchards are functioning at Bhtaoon, Palampur, Baba Baroh, Shahpur (N), Gummer, Jachh, Indpur, Multhan, Khuted and Dharamsala. In these progeny-cum demonstration orchards and nurseries, plants of improved varieties are raised and distributed through the extension agencies. Besides Govt. nurseries, about 100 registered private nurseries are also functioning in the district which meets the increasing demands of orchardists

4 Kinnaur: The climatic conditions prevailing in the district are very useful for the development of horticulture and apples in particular. With the introduction and availability of improved techniques, expertise in the field of horticulture and transportation facilities, the production of

fruits is also increasing year by year. Kinnaur district is popular for its quality of apples and temperate fruits like walnuts, almonds, chilgoza, raisin, apricot etc. The main commercial varieties of apple grown are Royal Delicious, Rich Red, Red Delicious and Golden Delicious which are directly marketed to Chandigarh, Delhi, Madras, Kolkata and Mumbai markets.

Since the creation of district, constant emphasis has always been given on the horticulture to improve the traditional economy and considerable progress has been achieved in this regard. The area under apple was 3,124 ha in 1990-91 which has increased to 6,256 ha in 1999-2000. The production of apple in the district has increased from 13,812 tonnes to 21,818 tonnes during this period. Total production of fruits in the district, which includes apple, nuts and dry fruits, other temperate fruits etc., was 14,482 tonnes in 1990-91 which has increased to 22,303 tonnes during 1999-2000.

19,939 tonnes of apples was exported to other parts of the country during the year 1999-2000 which has greatly improved the economic conditions of people of the area.

5 Kullu: Agro-climatic conditions prevailing in the district offer a great scope for the production of temperate and sub-tropical fruits especially apple, peach, apricot, chestnut, almonds, jani phal, cherries, gooseberries and olive. With a view to augment income of farming community, special efforts are being made to bring more area under orchards in the valley and higher ranges also.

In order to meet the increasing demand for improved fruit plants, a number of progeny-cum-demonstration orchards besides some private nurseries have been set up at various places. Regional Horticulture Research Station of Dr. Y.S.Parmar University of Horticulture and Forestry at Bajaura has been set up to achieve the target in the horticulture sector. All

these efforts have been successful to improve the economic conditions of the people. During the year 1998-99 the area was 24,229 ha while fruits production was 111,544 MT in the same period.

6 Lahaul & Spiti: The people of the district have also adopted apple cultivation particularly in the Pattan valley. There are five horticultural extension centres working in the district, which provide technical know how of various horticulture operations to be carried out and to distribute various horticultural inputs on 50% subsidy to them. The fruit crops introduced in the district are apple, pear, plum, almond, apricot, cherry, walnuts and hops. The area fruit production as on 31 December, 2001, was 143.8 ha. 70.7 MT respectively.

Except apple and hops, all the fruit crops are not marketed due to limited cultivation and inadequate transportation facility. Unmarketable and surplus fruits are marketed to HPMC by packing in gunny bags under market intervention scheme. The horticulture department provides 50% subsidy on fertilizers, pesticides, and other horticulture inputs involved in the cultivation and package & practices of horticulture crops. There is one Govt. Fruit nursery farm established at Thiroth in which apple, apricot and plum plants are prepared for sale every year.

7 Mandi: The agro-climatic conditions of Mandi district are quite suitable for tropical and sub-tropical fruits. Apple orchards are located predominantly in Karsog, Chachyot and Thunag. The geographical conditions are favourable for the development of horticulture. The places at higher altitudes produce apple, cherry, plum, apricot and lower areas produce mangoes, litchis, guava and citrus fruits. An area of 30,653 ha during 1998-99 is reported to

have been brought under horticulture as against the area of 24,271 ha during 1989-90. The area under apple cultivation has increased from 9,628 ha to 13,232 ha during the same period. The area under cultivation increased from 4,744 ha to 5,147 ha in the case of citrus fruits, from 2,516 ha to 2,972 ha in nuts and dry fruits, from 5,092 ha to 5,693 ha in other temperate fruits and from 2,291 ha to 3,609 ha in sub-tropical fruits during the decade. However, the production of fruits has decreased from 27,282 tonnes in 1989-90 to 13,103 tonnes in 1998-99 due to vagaries of weather and less production of fruits. This decrease in fruit production is noticed in the district from the year 1996-97 onwards. The most common delicious varieties of apple grown in the district are royal Rich-A-Red and golden. The plum varieties found in the district are sentarozza and merycoza. The local varieties of apricot are being replaced by more delicious varieties like shakarpara, etc. Walnuts are grown all over the district and off late commercial varieties of walnuts have found great favour. Citrus fruits like kagzi lemons, kinnow, and orange are being propagated in the lower areas of Sundarnagar, Mandi, Sarkaghat and Jogindarnagar Tehsils. Unmarketable surplus fruits of the district and adjoining areas are utilized in two canning cum fruit preservation plants at Panarsa and Jarol. Apple juice processing plant at Jarol is proving to be a boon to the horticulturists in providing ready markets for their surplus apples.

The plant protection centres are located at Mandi with sub-centres at each block headquarters, which render technical guidance to the orchardists and supply pesticides through the Agriculture Department. The progeny-cum-demonstration centres for the development of horticulture have been established at Jawar, Madhan, Bhangrotu, Harabag, Adakahar, Jarol, Nals, Pangana, Jhanjeli, Serahan, Narla, Keeas, Pingla and Nagwain. All types of insecticides, fungicides, etc. are made available at plant protection centres. The Horticulture Department is responsible for supplying nursery plants to the orchardists on reasonable

rates from the Government and private registered nurseries. An olive station is functioning at Karsog and bee-keeping centres are an added importance in the apple cultivation which is most essential for the cross-pollination.

8 Shimla: Shimla is the biggest apple growing district in Himachal Pradesh and it has earned a name in propagating a rich collection of many delicious varieties of apples. The main commercial varieties now grown are Royal Delicious, Rich-a-Red, Red Delicious and Golden Delicious. Apart from these delicious varieties, other varieties like Red Gold, Pearman, Tideman, Worsester, Ambri, Granny Smith are also being grown by the people besides pears, peaches, apricots, plums, walnuts, almonds, citrus, mangoes and cherry. The district has exported 18,432 MT of apples in 1,016,510 boxes during the year 1999. The cropping pattern has altogether changed with the enormous efforts put in by the Horticulture Department and horticulture as a vocation has come to play a vital role in the economy of the district. It has established a place for itself in respect of the scientific orchard management and quality fruit production.

During the year 1989-90, the total area under fruit in the district was 29,141 ha and the total annual production was 248,109 MT whereas in the year 1998-99 this area was increased to 39,844 ha and the production has gone up to 260,996 MT. There are 15 progeny orchards one each in Mashobra, Theog, Rohru, Chirgaon and Basantpur, two each in Narkanda, Jubbal and Chaupal and four in Rampur blocks functioning in the district. One nursery farm was also functioning in Chaupal block during the year 1998-99. There are two research stations at Mashobra and Kotkhai, 31 plant protection centres, 2 garden colonies, one community colony and 6 grading and packing houses are functioning in the district. The district produces one third of the total production of the fruits in the State. For safeguarding the interest of the growers, the

State government has set up four cold storage centres in the district at Oddi, Jarol Tikar, Rohru and Gumma each having capacity of one thousand tonnes. Apart from these, there is one canning unit in the district and unmarketable surplus fruits are used to prepare Cider wine in apple wine factory at Gumma.

9 Sirmaur: The topography and agro-climatic condition of the district are quite suitable for raising of various fruits. The topography of the district can be grouped into three categories namely high hill areas located at higher elevation, mid hill areas and low lying valley areas. Fruits of different varieties depending upon the terrain, climatic conditions and soil, ranging from apples in the higher slope areas to mango, lichi, mandarins, sweets oranges, lime, lemon and guava in the lower hill and valley areas are grown in the district. Some fruits like almond and walnut are grown in the mid hill areas. Apple cultivation has made tremendous progress during the last four decades. The Rajgarh Tehsil is renowned for growing different varieties of apples like royal, golden and delicious royal. Plum is being grown in Rajgarh as well as in Pachhad Tehsil, popular variety being cantra-roza and marri-roza. Walnuts are grown all over the district and off late commercial varieties of walnuts have found great favour. Paonta Sahib area grows Kagzi lemon which has been further propagated in lower areas of Nahan and Pachhad Tehsils, particularly Dun valley which has taken up the cultivation of Kagzi lemon. Orange cultivation has also not lagged behind and the popular variety being Kinnow. The Dushehri and Langra varieties of mango are also grown. With a view to provide assured remuneration to the orchardists, three fruit canning units at Dhaula Kuan, Bagthan and Rajgarh have been set up. In addition, three privately run fruit processing units at Rajgarh, Sarahan and Paonta Sahib are also functioning.

The area brought under fruit cultivation has increased to 16,249 ha during the year 1999-2000 as compared to 12,732 ha in 1991-92. An

area of 3,839 ha has been covered under apple cultivation, 5,161 ha under other temperate fruits, 1,628 ha under nuts and dry fruits, 1,651 ha under sub-tropical fruits and 3,970 ha under other fruits at the end of year 1999-2000 in the district. The production of 1,010 MT of apple, 901 MT of other temperate fruits, 1,760 MT of nuts and dry fruits, 3,714 MT of sub-tropical fruits and 11,013 MT of other fruits has been recorded in district during 1999-2000. The total production of fruits in the year 1999-2000 was 18398. About 1,549 tonnes of apples packed in 83,730 crates have been exported from the district during the year 1999-2000. The Horticulture Department has initiated various measures like providing technical knowhow, subsidies, loans, horticultural inputs etc. to the farmers. Bee keeping and mushroom cultivation are also being encouraged.

10 Solan: The varied agro-climatic conditions in the State are suitable for growing a wide range of fruit crops. Solan district holds excellent promise for raising of horticultural crops like stone fruits, citrus fruits, mushroom, kiwi, bee keeping, floriculture in poly green houses, etc. The stone fruits orchards in the district are located mainly in Solan, Kandaghat and some parts of Kasauli Tehsils. In the lower parts of Nalagarh and Arki Tehsils, the citrus plantation is quite popular. Apart from stone and citrus fruits, apples are also being grown in higher reaches of the district and its cultivation is mainly in Chail area of Kandaghat block. Dr. Y.S.Parmar University of Horticulture and Forestry is also playing an important role in evolving new strains/varieties of various horticulture crops.

The area under different fruit plants during the year 1999-2000 was 6973 ha. Out of this total area, 3741 ha were covered under other temperate fruits, 2125 ha under sub-tropical fruits, 615 ha under citrus fruits, 332 ha under nuts and dry fruits and 160 ha under apple cultivation. Similarly, 5185 MT fruit production was recorded in the district during the same year. The district has produced and marketed

2235 MT of other temperate fruits, 1552 MT of citrus fruits, 1,024 MT of sub-tropical fruits, 253 MT of nuts and dry fruits and 121 MT of apple during the year 1999-2000. The Horticulture Department has introduced some improved varieties of pears, pecan nuts, almonds etc. from abroad and these varieties are being grown in different progeny orchards of the district. These varieties are now being distributed among growers to popularise their cultivation. Since the district is endowed with varied type of climate, there is a vast potential to introduce different fruits crops of temperate and sub-tropical nature. Apple is being grown successfully in a few pockets of the district as some low chilling cultivator of apples viz. Mollies Delicious, Tyman Darly, Vorcestor are available

for cultivation in low hills. Two new varieties of Pear viz. Nyissit Ki and Chajure have been introduced on trial basis at Progeny Cum Demonstration Orchard (PCDO) Darlaghat and will be made available for distribution among growers. Sub-tropical fruits like mango, litchi, citrus guava and grapes are successfully grown in the district. The fertilizer is obtained by the growers from different private sale centres and Cooperative Societies. Pesticides are used for control of different insect, pest and disease. Department of Horticulture makes arrangements for availability and distribution of these pesticides to the growers at the block level and different sale centres under the block.

The district has seven Progeny and Demonstration centres. In addition to this, two fruit nurseries are located at Bagga and Khatmali. Standard stock of fruit plants of commercial varieties are produced in these fruits nurseries and progeny orchards, which are subsequently distributed among growers. Private fruit plant nurseries are also registered with the Horticulture Department distribution disease-free and quality fruit plants. Regular inspection of these nurseries is also carried out by the Horticulture Departmental officials. Apart from giving technical know how to the farmers, the Horticulture Department provides

subsidy for purchase of horticultural material for the establishment of orchards. Horticultural loans for new plantations are sponsored by the commercial banks for obtaining financial assistance. Bee keeping scheme is being offered by the Horticulture Department since its inception. Bee keeping training camps are organised to impart training in bee keeping to the orchardists. Duration of these camps vary from a week to one month. Farmers trained in bee keeping are given bee hives and bee colonies. Farmers belonging to Scheduled Castes and Scheduled Tribes category are given 50% subsidy on bee hives, bee colonies and other related equipments. Bank loans to growers are sponsored by the Horticulture Department for establishment of apiary. Surplus honey is purchased by the Horticulture Department from private growers and consequently numbers of enterprising farmers are coming forward every year to adopt bee keeping on commercial scale. In addition to this, department has three bee keeping stations in the district at Subathu, Kuthar and Kunihar where farmers are trained in bee keeping management.

11 Una: Main fruit crops which are grown in the district are citrus, mango, guava and pear. During the year 1998-99, the total area under fruit in the district was 5,228 ha and the total annual production was 4,787 MT.

The district has one Progeny-cum-Demonstration Orchard at Saloh where nursery of pear, mango, guava and citrus are grown for the benefit of the farmers.

Fertilizers for the fruits growers are being supplied by HIMFED organization through the agriculture services societies. All pesticides are supplied to the growers through the A.D.O. (Horticulture) posted in the block. Besides, horticulture inputs are provided on subsidized rates to the farmers for the development of horticulture. In the recent years mango has emerged as an important fruit crop.

### 5.1.3 Horticultural Production Infrastructure

#### a. Progeny-cum Demonstration Orchards (PCDOs)/Nurseries:

These have been developed for different fruits in 98 locations in the State to serve as growth centres for

Horticulture development in their impact zone of normally 10 km radius. The district wise positions of these PCDO's are given in Table 7.

**Table 7: District wise Progeny-cum Demonstration Orchards (PCDOs)/Nurseries**

Sr. No.	District	No. of Units	Total Area (Km <sup>2</sup> )	Kinds of plants propagated
1	Bilaspur	6	0.17	Mango, litchi, citrus, guava, peach, pear, etc.
2	Chamba	14	0.55	Apple, stone fruits, mango, citrus, walnut, pear, guava etc.
3	Hamirpur	5	0.11	Mango, citrus, pear
4	Kangra	8	0.36	Mango, litchi, citrus fruits, low chilling varieties of stone fruits, guava, pecan nut, aonla, grapes, etc.
5	Kinnaur	8	0.40	Apple, stone fruits, almond, apricot & grapes
6	Kullu	5	0.37	Apple, stone fruits, cherry, pomegranate, persimmon, kiwi fruit, strawberry, clonal rootstocks of apple, cherry, pear, stone fruits, etc,
7	Lahaul & Spiti	3	0.07	Apple, apricot, almond & hops
8	Mandi	11	0.49	Apple, stone fruits, mango, citrus fruits, kiwi fruit, walnut, strawberry, etc
9	Shimla	14	0.88	Apple, stone fruits, pear, cherry & pomegranate
10	Sirmaur	14	1.16	Apple, stone fruits, Kiwi fruit, mango, citrus fruits, etc.
11	Solan	9	0.42	Stone fruits, kiwi fruit, hazelnut, persimmon, pear, mango & citrus
12	Una	1	0.34	Mango, pear, citrus, papaya, pomegranate, etc.
	Total	98	5.32	

**b. Private Registered Nurseries:** 732 nurseries have been registered under this act of which 662 are in private & 70 in public sector. About 2 million fruit plants are propagated in

these nurseries per annum. The district wise status of these private registered nurseries is given in Table 8.

**Table 8: District wise private registered nurseries**

Sr. No.	District	No. of Units	Total Area (Km <sup>2</sup> )	Kinds of plants propagated
1	Bilaspur	23	0.10	Mango, litchi, guava, aonla, pear, papaya & grapes
2	Chamba	67	0.22	Apple, stone fruits, mango, walnut, pear, guava & kiwi fruit
3	Hamirpur	21	0.07	Mango, citrus & pear
4	Kangra	68	0.31	Mango, citrus, litchi, pecan nut, grapes stone fruits, aonla, guava & loquat
5	Kinnaur	34	0.10	Apple, pear, apricot, almond, grapes & kiwi fruit
6	Kullu	130	0.32	Apple, pear, stone fruits, pomegranate, persimmon, olive, cherry & kiwi fruits
7	Lahaul & Spiti	1	0.003	Apple, apricot, almond & hops
8	Mandi	110	0.28	Apple, stone fruits, mango, guava, litchi, walnut, pomegranate, strawberry, olive & pecanut
9	Shimla	117	0.33	Apple, pear, cherry, apricot, peach, almond, kiwi fruit, strawberry, walnut & pomegranate
10	Sirmaur	64	0.20	Stone fruits, apple, mango, citrus & kiwi fruit
11	Solan	12	0.04	Stone fruits, apple, kiwi fruits, mango, citrus, guava & pear
12	Una	15	0.06	Mango, pear, papaya, pomegranate, banana, peach & strawberry.
	Total	662	2.033	



**c. Olive Stations:** To promote development of olives, 3 olive stations have been established to collect varieties & develop suitable package of practice for its cultivation. The description of these stations is given in Table 9.

**Table 9: Status of Olive Stations**

Sr. No.	Name of Station	Area (Km <sup>2</sup> )	No. of Olive Plants
1	Olive Station, Panarsa, District Mandi, Himachal Pradesh	0.05	1000
2	Olive Station, Lanji, District Chamba, Himachal Pradesh	0.09	1900
3	Olive Station, Jerva, District Sirmaur, Himachal Pradesh.	0.06	399

**e. Plant Protection Centers:** 337 plant protection centres have been established in different fruit growing regions of the State. The status of these centres is given in Table 11.

**Table 11: Status of plant protection centre**

Sr. No.	Name of district	No. of units
1	Shimla	78
2	Kinnaur	20
3	Solan	23
4	Bilaspur	16
5	Mandi	47
6	Sirmaur	13
7	Kangra	16
8	Una	13
9	Hamirpur	16
10	Chamba	47
11	Kullu	42
12	Lahaul & Spiti	6
Total		337

**g. Introduction of improved plant materials:** The Department of Horticulture, Himachal Pradesh has been making efforts from the seventh Five-year Plan for the introduction of

**Table 13: Improved plant materials**

Sr. No.	Name of the Fruit	Cultivars/Rootstocks Introduced
1	Apple	Oregon Spur, Silver Spur, Well Spur, Stark Rimson, Red Chief, Royal Gala, Summer Red, Bright-n-Early, Criterion, Mutsu, Real McCoy Delicious, Park Dale Beauty, Scarlet Spur, Braebum, Gold Spur, Compact Winter Banana, Red Gravenstein, Early Red One, Sparton, Elstar Elshof, Gala Mitschla (Mondial), Fuji Kiku 8, Golden Delicious Kloon B, Camspur (Red Del.), Gloster, Topred Crab Apples - Golden Hornet, Manchurian, Snow Drift, Red Flesh Rootstocks - M 4, M 7, M9, M 26, MM 106, MM111, M 793, ANLARP-A2, Bud 9

**d. Walnut Development Stations:** These have been established at Nohra in Sirmaur District to collect walnut varieties & to develop & adopt technology for cultivation of walnut. The description of this station is given in Table 10.

**Table 10: Status of Walnut Station**

Sr. No.	Name of Station	Area (Km <sup>2</sup> )	No. of Olive Plants
1	Walnut Development Station, Nohra, District Sirmaur, Himachal Pradesh	0.04	351

**f. Present capacity of fruit and vegetable processing units:** At present the fruit and vegetable processing units in Himachal Pradesh have a capacity of about 75000 MT. The breakup of this capacity is given in Table 12.

**Table 12: Present capacity of fruit and vegetable processing units**

Sr. No.	Particulars	No. of Units	Capacity (MT)
1	HPMC	3	28,200
2	Cooperative Units		400
3	Private/Joint Sector Units		46,000
4	Departmental Units (small scale)	9	400
		Total	75000
5	Honey Processing Units	1	120
6	Hop processing Units	5	24MT/day

the improved varieties of fruits from the advanced countries as well as the other States of India. The following cultivars of different fruits apple, pear, cherry, almond and apricot have been enlisted in Table 13.

Sr. No.	Name of the Fruit	Cultivars/Rootstocks Introduced
2	Pear	Max Red Bartlette, Conference, Red Sensation, Red D' Anjou, Anjou, Shinseiki, Nijisseiki, Chojuro, Hosui, Kosui, Beurre Hardy Rootstocks - Quince C, BAC 29
3	Cherry	Van, Sam, Stella, Sun Burst, Lambert, Durone Nero I, II & III, Durone di Vignola, Durone di Cesena, Bigarreau Van, Bigarreau Napoleon, Ranier, Compact Stella, Summit, Sylvia, Schneiders. Rootstocks - Muzzard F12/1, Colt, Colt Emla, Gisela
4	Almond	Texas, Christomorto, Tuono, Phillipococe, Frageulio, Genco, Ferregues, Ferraduel, Robijn
5	Apricot	Harcot, Canino, Taradivo, Angelio Errani, Winatchee Moorpark, Red Gold.
6	Peach	Andros, Baby Gold-7, Early Elberta, Sun Crest Rootstocks - Brompton, St. Julien A, P.myrobalana
7	Plum	Early Prolific Rootstocks - Brompton, St. Julien A, P.myrobalana
8	Walnut	Sorrento, Grenoble, Franquette, Hartley, Eureka, Carpathion
9	Hazelnut	Tonda Griffoni, Tonda Romana, Gentile Della, Langhe, Barcellona, White Heart, Melville de ville, Auckland
10	Pistachionut	Napoletana
11	Fig	White and Black varieties
12	Carob	SEL-608
13	Olive	Oil Type - Carolea, Bianciollila, Zaituna, Leccino, Moraiolo, Coratina, Pendolino, Cipressino, Frantoio Pickle Type - Nocellara del Belice, Nocellara etnea, Nocellara Messinese, Tonda Iblea, Picholine, Dolce di cerignola, Itrana
14	Strawberry	Fern, Silva, Brighten, Douglas, Chandler, Pajaro, Gorella, Addie, Confutura
15	Kiwi Fruit	Allison, Abbot, Monty, Bruno, Hayward, Tamori
16	Grapes	Perla-di-Osaba, Flame Seedless, King Ruby, Italia, Chardonnay, Pinot Noir, Cabernet, Ugni Blanc, Tash-e-Ganesh, B1 Portugieser (125 AA Red), Chardonnay (Borner White), Muller (Thurgau), Auxerois (Borner), Bacchus (5BB), Fruhburgunder 5C, Dunkelfelder 5 BB, Gewrztraminor 125 AA White, Chenin Blanc B220, Marsanne (B574), Roussanne (B468), Reisling (B49), Semillon (B173), Cinsaut (N 6), Chardonnay (B 96), Sauvignam (B 241), Gammay (N 509), Merlot (N 18l) Rootstocks - 5 BB, RU140, 41 B, R 99, 1103
17	Citrus	Valencia Campbel, Campbel Washington, Sanguinello, Moscato Tarucco, Valencia Oilndo, Clementine Matrod, Clementine Nutes, Moro
18	Nectarine	Red Gold, Early Blaze, Mayfair, Snow Queen
19	Aonla	Narinder 6, Narinder 7, Narinder 10, Chakaya
20	Mango	Sindhu, Amarpali, Malika, D 51, Ramkela
21	Pomegr-anate	Ganesh, Kandhari, Jodhpur Red, Mridula, Musket

The year wise gross value added by horticulture from 1999 to 2007 in summarised in Table 14.

**Table 14: Gross Value Added of Horticulture, 1999-2000 to 2006-07 in Himachal Pradesh (at 1999-2000 prices)**

Sr. No.	Years	Gross Value Added of Horticulture	Growth Rates in Gross Value Added (% per annum)
1	1999-2000	84376 (25.21)	
2	2000-01	154839 (40.44)	
3	2001-02	134683 (32.46)	
4	2002-03	174007 (41.60)	
5	2003-04	205258 (43.31)	
6	2004-05	226275 (43.54)	
7	2005-06	241292 (46.50)	
8	2006-07	224497 (40.67)	13.7*

Note: Figures in parentheses are percentages of tot al value in agriculture. '\*' denotes significance at 5 per cent level probability level.

Source: 'Gross Domestic Product of Himachal Pradesh (1999-2000 to 2006-07)', Directorate of Economics and Statistics, Government of Himachal Pradesh.

Fruit Production and Yields: Himachal Pradesh has long been regarded as a horticultural State due to its magnificent achievements in the production of fruits, mainly apple. The other fruit crops grown in the State include temperate fruits such as peach, pear, plum, apricot and the subtropical fruit crops such as mango, citrus, litchi, etc. Area under all fruits in the State has more than doubled from 86.23 thousand ha in 1980-81 to 186.90 thousand metric tonnes by 2005-06. The corresponding production has gone up 2.5 times from 1.46 lakh metric tonnes to 3.68 lakh metric tonnes during the same period. However, the large gains in this production have come from this area as the productivity increased marginally from 1.69 metric tonnes per ha in 1980-81 to 1.97 metric tonnes in 2005-06. The share of apple in the total area under fruits and consequent production was 48.66% and 85.62%,

respectively in 1980-81. By 2005-06, its share fell marginally to 46.12%. Consequently, the area share of other fruits has gone up to 53.88% during the same period. Contrarily, while the share of apple production came down to 72.83%, the same for other fruits increased to 27.17% by 2005-06.

The compound growth rates in area, production and yields of these crops were computed for the period 1980-81 to 2005-06. The area under all fruit crops registered negative growth rate of 2.88% between 2000-01 and 2005-06. The negative growth rate was more pronounced for other fruit crops at 4.65% per annum as compared to apple (-0.57 per cent). As regards the production, these growth trends were mostly positive except for other crops during the period 1990-91 to 1994-95. These other fruit crops exhibited negative growth rates during the decades of 1980s and 90s.

**Vegetable Production and Yields:** Earlier, the production of vegetables in the State was dominated by potato that was confined to selected high hill pockets. However, since early 80s the focus shifted to vegetable crops other than potato. These included crops such as green peas, tomato, cabbage, cauliflower and capsicum and their cultivation was mainly restricted to mid to high hill pockets. However, realizing the importance of off-season vegetable growing, even the farmers in low-mid hill locations started growing vegetables during the 90s. Furthermore, new crops (e.g. garlic) are being grown in quite a few of the districts. These changes have been aptly captured by the following figures. The area under all vegetables increased from 2.10% to 3.60% of the total cropped area during 1972-2004 while that under potato remained around 1.5%. In other words, all the increase in area under vegetables went to vegetables other than potato. At present, the State is producing 9.91 lakh metric tonnes of vegetables from an area of 52,000 ha with an average productivity of 19.05 metric tonnes per ha (2006-07). This yield level is

higher than the national yield of 17.0 metric tonnes per ha. The CGR of area under vegetables during the past one and a half decade has been 5.90% per annum. The production of vegetables registered an annual growth rate of 6.95% during the same period. The growth rate of vegetable yields, however, was 1.0% per annum.

Thus, there is a strong need to increase the productivity of vegetables in the State as the shifting of area from main food grain crops will have its own ramifications. However, identification of suitable pockets with congenial climate for vegetable growing can go a long way in increasing the vegetable production in the State provided appropriate back up support is given along with suitable marketing environment.

**Yield Gap Analysis of Fruit Crops:** The yield gap analysis for various fruit crops grown in the State was carried out to find out the scope of increasing yield levels of these fruits. As may be seen in this Table, mango is the main fruit crop of the low hill districts of Kangra, Hamirpur, Bilaspur, parts of Mandi, Solan and Sirmour. The farmers in Kullu and Shimla have also started growing mango wherever agroclimatic conditions permit. The yield gap of mango varied from 3.75 q/ha in Bilaspur to 11.30 q/ha in Kangra. However, the progressive farmers' yield in Kangra was 2.0-4.0 times higher as compared to the yields of the progressive farmers in Mandi, Bilaspur and Hamirpur districts. Similarly, the citrus fruits constitute the second most important subtropical fruit crop of the State. The yield gap between the average and the progressive farmers' ranged from 0.4 q/ha in Shimla to 24.58 q/ha in Mandi district. In Kangra district which is known for citrus cultivation, the yield gap was moderate at 7.40 q/ha. For another important subtropical fruit of litchi whose cultivation is confined to Kangra, Mandi, Hamirpur and Bilaspur districts the observed yield gap stood at 6.90, 9.55, 2.96 and 3.32 q/ha, respectively.

Among the temperate fruits, apple occupies the most important place. It is grown in eight out of the twelve districts of the State. The gap in productivity of the average farmer and the progressive farmer varied from 10.0 q/ha in Solan to 118.0 q/ha in Kullu district. The inter-district variations in the yield levels of even progressive farmers were quite wide. For example, against the yield of 13.0 q/ha in Solan or 30.0 q/ha in Sirmaur, the same was 250.0 q/ha in Kullu and 150.0 q/ha in Lahaul & Spiti. Such variations present immense scope to increase the productivity of the apple crop in the State by adopting appropriate location

specific technologies. The yield gaps for other temperate fruits such as apricot, peach, plum, nuts, etc. were also quite high in these districts. Source: State Agriculture Plan, Himachal Pradesh, 2009

5.10.1 Decadal Trend of Production and Area of fruits: Fruits area in Himachal Pradesh has significantly increased during the last four decades. The area under fruits was 4432 ha in the year, 1970-1971, which has increased to 223035 ha in the year 2001-02, thereafter it declined all of a sudden to 18244 ha in the year 2003- 04. The data in Table 15 show the patterns of area of different fruits in the State.

**Table 15: Decadal Variation of Areas under different fruits**

Name of Fruit	1970-71	1980-81	1990-91	1998-99	1999-2000	2000-01	2001-02	2003-04
<b>A. Temperate Fruits</b>								
(a) Apples	26735	43331	62828	85631	88673	90347	92820	84112
(b) Other temperate fruits	7563	17464	28483	31925	32400	32801	33161	24378
(c) Nuts and dry fruits	1745	6892	13154	16061	16396	16619	16956	10939
Sub Total (A)	36043	67687	104465	133617	137469	139767	142937	119429
<b>B. Sub-Tropical Fruits</b>								
(a) fruits Citrus	5495	14471	36005	38711	39138	39627	40174	20261
(b) Other sub tropical fruits	2791	10267	22880	34912	36344	37832	39924	42751
Sub Total (B)	8286	24738	58885	73623	75482	77459	80098	63012
GRAND TOTAL	44329	92425	163330	207240	212951	217226	223035	182441

The production of fruits was 13982 MT in 1980-81 which increased to 446684 MT in 1998-99 but in the year 1999-2000 declined to

89415 MT. In the year 2004-05 the production increased to 559977 MT. The Table 16 gives year wise production of fruits crops in MT.

**Table 16: Decadal variation in production of different fruits**

Name of Fruits	1980-81	1990-91	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04
<b>A. Temperate Fruits</b>								
(a) Apples	118013	342071	393653	49129	376736	180528	348263	459492
(b) Other temperate fruits	9264	14934	17974	17901	20450	29236	63026	40652
(c) Nuts and dry fruits	1782	3105	3025	1895	2755	2911	3256	3570
Sub Total (A)	129059	360110	414702	68925	399941	212675	414545	503714
<b>B. Sub-Tropical Fruits</b>								
(a) Citrus fruits	4400	12100	13111	9257	11068	20465	16027	28121
(b) Other sub tropical fruits	6369	13604	19871	11233	17040	30306	29051	28142
Sub Total (B)	10769	26204	31982	20490	28108	50771	45078	56263
GRAND TOTAL	139828	386314	446684	89415	428049	263446	459623	559977

As per estimates of Department of Horticulture, Himachal Pradesh, the total area tonnes. Table 17 shows year wise area & production of different fruits in Himachal Pradesh.

under fruit plantation in 1995-96 stood at 1.96 lakh ha & production in 1996 was 3.12 lakh

**Table 17: Year wise Area & Production of different fruits in Himachal Pradesh**

Year	Total Area(Km <sup>2</sup> )	Total production (Tonnes)
1980-81	924.25	139828
1981-82	1000.42	341943
1982-83	1086.76	177854
1983-84	1140.51	304275
1984-85	1205.80	215920
1985-86	1287.70	207742
1986-87	1349.85	400508
1987-88	1420.51	308693
1988-89	1492.84	197355
1989-90	1564.69	459990
1990-91	1633.30	386314
1991-92	1707.68	342303
1992-93	1768.91	324855
1993-94	1828.66	325477
1994-95	1896.89	170541
1995-96	1956.84	311889

Source: Horticulture Development in Himachal Pradesh, A.K. Dwivedi & others, May, 1997 Department of Horticulture, H.P.

Among the various fruits, area used for the cultivation of apples is largest with a maximum area during the year 2001-02. The incremental increase in the apple cultivation is 26.7% from

the year 1993 to 2007. The area under Citrus fruit and Nuts and Dry fruits has declined from the year 1993 to 2007 (Table 18). The fruits and crops production is summarized in Table 19 to 24.

**Table 18: Area under Fruits 1994-2007 (Km<sup>2</sup>)**

Year	Apple	Citrus	Nuts & dry fruits	Other fruits	Total
1993-94	724.06	379.61	145.53	579.46	1828.66
1994-95	754.69	383.23	149.35	609.62	1896.89
1995-96	782.92	385.95	152.37	635.60	1956.84
1996-97	803.38	383.69	154.78	620.27	1962.12
1997-98	830.56	386.35	158.32	648.39	2023.62
1998-99	856.31	387.11	160.61	668.37	2072.40
1999-00	886.73	391.38	163.96	687.44	2129.51
2000-01	903.47	396.27	166.19	706.33	2172.26
2001-02	928.20	401.74	169.56	730.85	2230.35
2002-03	816.30	197.84	107.00	640.92	1762.06
2003-04	841.12	202.61	109.39	671.29	1824.41
2004-05	862.02	204.02	111.00	691.99	1869.03
2005-06	885.60	207.29	112.10	711.69	1916.68
2006-07	918.04	211.18	113.28	731.95	1974.45

Source: Horticulture Department, Himachal Pradesh

**Table 19: Production of Fruits ('000 tonnes)**

Year	Apple	Citrus	Nuts & Dry fruits	Other fruits	Total
1993-94	294.73	4.41	2.21	24.12	325.47
1993-95	122.78	6.67	2.37	38.72	170.54
1995-96	276.68	5.84	2.47	26.90	311.89
1996-97	288.54	13.83	3.35	45.91	351.63
1997-98	234.25	11.76	2.45	31.23	279.69
1998-99	393.65	13.11	3.07	37.85	447.68
1999-00	49.13	9.26	1.89	29.13	89.41
2000-01	376.73	11.06	2.75	37.49	428.03
2001-02	180.53	20.46	2.91	59.55	263.45
2002-03	348.26	16.03	3.25	92.08	459.62

Year	Apple	Citrus	Nuts & Dry fruits	Other fruits	Total
2003-04	459.49	28.12	3.57	68.79	559.97
2004-05	527.60	28.55	3.73	132.13	692.01
2005-06	540.36	29.16	3.92	122.08	695.52
2006-07	268.40	12.67	2.91	85.12	369.10
2007-08	592.57	24.67	2.90	92.70	712.84

Source: Horticulture Department, Himachal Pradesh

**Table 20: District wise fruit production in 2005-06 (in tonnes)**

District	Apple	Plum	Peach	Pear	Almond	Mango	Lime	Orange	Total Fruit
Bilaspur	0	37	72	209	1	3173	88	16	4297
Chamba	10367	356	140	345	35	361	272	15	3953
Hamirpur	0	67	104	248	12	2196	151	110	5143
Kangra	650	1232	648	2045	314	49885	4367	16789	86308
Kinnaur	41101	3	2	24	225	0	0	0	41632
Kullu	140633	6452	18	14988	12	4	10	0	162328
Lahaul & Spiti	193	9	0	2	4	0	0	0	227
Mandi	36421	1232	175	908	350	870	400	198	43084
Shimla	310252	557	147	2632	273	51	63	1	315200
Sirmaur	680	761	6367	437	74	2799	289	154	13996
Solan	59	991	133	1251	3	1027	245	36	6006
Una	0	16	17	903	0	2725	37	1078	5406
State	540356	11713	7823	23992	1303	63091	5922	18397	695517

Source: Department of Horticulture, Himachal

**Table 21: Production of fruits (2006-07) (in tonnes)**

Name of fruit	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul&Spiti	Mandi	Shimla	Sirmaur	Solan	Una	Total
Apple	4	3533	0	443	40277	43730	191	16625	163301	245	53	0	268402
Plum	13	150	99	1106	2	6770	3	612	557	315	898	21	10546
Peach	13	70	119	578	2	6	0	240	147	6855	126	17	8173
Apricot	0	132	0	43	166	21	13	353	269	325	1446	0	2768
Pear	306	152	320	1843	42	3961	2	967	2632	350	732	932	12239
Cherry	0	3	0	0	1	12	1	0	421	0	0	0	438
Green Almond	0	20	0	0	0	17	0	235	289	0	0	4	665
Persimmon	0	5	1	1	0	11	0	72	58	25	1	0	174
Olive	0	1	0	0	0	2	0	4	1	0	0	0	8
Kiwi	1	14	0	5	0	1	0	7	33	4	12	0	77
Strawberry	0	0	0	5	0	4	0	0	0	515	0	0	-
O.T.F.	333	547	539	3581	213	10805	19	2490	4507	8389	3215	974	35612
Almond	1	28	15	160	191	8	1	112	641	47	7	0	1211
Walnut	6	245	10	60	53	37	1	94	37	905	107	0	1555
Pica nut	1	11	1	122	2	2	0	5	0	0	2	0	144
Nuts & Dry fruits	8	284	26	342	246	47	2	211	678	952	116	0	2912
Orange	55	9	144	3258	0	0	0	172	1	153	30	828	4650
Malta	28	1	61	715	0	0	0	0	0	4	9	115	933
K.lime	81	10	198	1698	0	6	0	244	62	220	333	125	2977
Galgal	274	10	583	1129	0	1	0	463	28	20	234	120	2862
Other	3	0	38	1201	0	0	0	0	4	0	2	0	1248
Citrus	441	30	1024	8001	0	7	0	879	95	397	608	1188	12670
Mango	2924	140	3954	22640	0	2	0	881	52	2520	1166	5680	40159
Litchi	84	41	131	2013	0	0	0	234	3	310	31	4	2851
Guava	110	38	182	852	0	0	0	271	3	240	291	220	2207
Papaya	183	1	150	642	0	0	0	14	1	90	67	103	1251
Loquat	13	1	6	22	0	0	0	0	0	0	2	5	49
Aonala	309	3	164	751	0	1	0	50	4	18	43	22	1365
Grapes	4	1	17	26	55	1	0	8	0	0	4	12	128
Pomegranate	4	1	12	36	0	14	0	26	38	0	28	24	183
Jack fruit	12	0	32	239	0	0	0	0	0	90	1	4	378
Other	49	1	96	920	0	0	0	15	0	0	34	21	1136
O.S.T.F.	3692	227	4744	28141	55	18	0	1499	101	3268	1667	6095	49507
Total	4478	4621	6333	40508	40791	54607	212	21704	168682	13251	5659	8257	369103

O.T.F. – Other temperate fruits , O.S.T.F. – OtherSub Tropical fruits

Source: Directorate of Horticulture

**Table 22: Crop wise production in tonnes (2008-09)**

Name offruit	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmaur	Solan	Una	Total
Apple	1	8640	0	502	55169	77409	577	30300	336753	776	34	0	51061
Plum	8	133	46	1113	2	5154	3	430	551	795	1317	39	9591
Peach	18	97	62	553	2	4	0	304	178	8578	99	40	9935
Apricot	0	185	0	40	156	24	4	380	295	478	1662	0	3224
Pear	335	176	217	1637	38	6863	3	885	2710	553	803	1230	15450
Cherry	0	1	0	0	1	11	0	0	440	0	0	0	453
Kiwi	0	2	0	6	0	4	0	10	35	29	32	0	118
Pomegrate	19	6	26	37	0	31	0	82	42	1	35	32	311
Olive	0	0	0	0	0	1	0	5	1	2	0	0	9
Perssimon	0	1	1	5	0	10	0	105	60	42	0	0	224
Strawberry	0	0	0	6	0	4	0	0	0	425	0	0	435
Green almond	0	0	0	0	0	6	0	0	116	0	0	2	124
Almond	4	19	10	145	188	3	2	255	901	90	6	0	1623
Walnut	3	341	2	113	49	46		132	46	927	116	0	1776
Picanut	0	4	2	126	0	3		9	0	0	2	0	146
Hazelnut	0	0	0	0	3	0		0	0	0	0	0	3
Chestnut	0	0	0	0	0	0	1	0	0	0	0	0	1
Orange	26	3	84	12935	0	3	0	291	2	171	64	1718	15360
Malta	6	4	39	1346	0	0	0	25	0	7	10	465	1902
K.Lime	55	355	179	2749	0	3		312	75	522	297	292	4839
Galgal	77	590	373	1437	0	3	0	385	29	184	220	315	3613
Other	2	0	16	268	0	0	0	0	4	0	0	3	293
Mango	3040	392	2742	21028	0	7	0	3003	44	2323	422	5750	38751
Litchi	49	70	121	2044	0	1	0	830	3	203	38	4	3363
Guava	129	48	142	745	0	1	0	422	4	215	282	438	2426
Aonala	439	8	298	1026	0	1	0	82	4	26	81	52	2017
Jack Fruit	8	0	18	149	0	0	0	9	0	28	2	8	222
Papaya	90	3	85	223	0	0	33	1	46	45	160	686	
Grapes	0	2	8	35	59	1	0	0	0	0	6	8	119
Loquat	9	1	7	35	0	0	0	0	0	0	2	6	60
Karonda	0	0	0	3	0	0	0	0	0	0	0	0	3
Ber	0	0	5	6	0	0	0	0	0	0	3	1	15
Sapota	0	0	2	3	0	0	0	0	0	0	2	1	8
Fig	4	0	0	0	0	0	0	0	0	0	0	0	4
Banana	10	0	46	205	0	0	0	37	0	0	0	10	308
Jamun	16	0	12	289	0	0	0	0	0	0	15	50	382
Bael	0	0	0	16	0	0	0	0	0	0	0	0	16
Deun	0	0	5	97	0	0	0	0	0	0	2	2	106
Total	4348	11081	4548	48922	55667	89593	590	38326	342294	16421	5597	10689	628076

**Table 23: District wise area under different fruits (2005-06) (Km<sup>2</sup>)**

Name of fruit	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmaur	Solan	Una	Total
Apple	0.04	104.41	0	4.30	81.51	208.21	6.21	148.32	296.71	34.77	1.12	0	885.60
Plum	0.89	3.79	1.46	4.10	0.08	20.04	0.07	26.73	5.91	13.48	6.25	0.80	83.60
Peach	1.24	2.14	1.07	2.12	0.67	0.34	0	7.34	2.98	28.49	2.70	0.91	50.00
Apricot	0	3.78	0.01	0.34	2.45	2.22	0.15	2.13	6.38	4.21	8.67	0	30.34
Pear	4.96	3.56	1.12	4.21	0.42	4.71	0.06	17.96	14.54	5.75	11.19	7.48	75.96
Cherry	0	0.05	0	0	0.04	0.58	0.05	0.25	2.16	0	0	0	3.13
Kiwi	0.01	0.03	0	0.11	0	0.26	0	0.30	0.14	0.11	0.17	0	1.13
Pomegrate	0.38	0.18	0.49	0.62	0	0.94	0	1.30	0.82	0.25	0.76	0.62	6.36
Olive	0	0.03	0	0	0	0.10	0	0.10	0.30	0.01	0	0	0.54
Perssimon	0.03	0.05	0.01	0.04	0	1.53	0	1.52	0.26	0.08	0.05	0.01	3.58
Strawberry	0	0	0	0.02	0	0.05	-	0.02	0	0.44	0.04	0	0.57
O.T.F.	8.51	13.61	4.16	11.56	3.66	30.77	0.33	57.65	33.49	52.82	29.83	9.82	255.21
Almond	0.31	2.90	1.94	4.16	9.87	3.83	0.06	14.86	15.23	2.06	1.35	1.09	57.66
Walnut	0.34	13.23	0.74	1.99	2.34	0.78	0.01	9.87	3.08	13.68	1.69	0.10	47.85
Picanut	0.19	0.22	0.12	1.82	0	0.33	0	3.45	0.04	0.08	0.12	0.09	6.46
Hazelnut	0	0.03	0	0	0.05	0	0	0	0.05	0	0	0	0.13
Nuts & Dry fruits	0.84	16.38	2.80	7.97	12.26	4.94	0.07	28.18	18.40	15.82	3.16	1.28	112.10
Orange	2.42	0.21	1.94	53.26	0	0.23	0	7.14	0.33	4.75	2.70	7.35	80.33
Malta	0.56	0.01	0.54	6.25	0	0.04	0	1.50	0	0.17	0.07	0.54	9.68
K.lime	3.67	3.29	8.36	26.40	0	0.50	0	28.46	4.26	9.01	3.85	5.56	93.36
Galgal	2.19	2.80	1.54	4.84	0	0.08	0	5.34	0.73	2.25	1.75	1.86	23.38
Other	0.12	0	0.17	0.14	0	0	0	0.03	0	0.06	0.01	0.02	0.55

Name of fruit	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmaur	Solan	Una	Total
Citrus	8.96	6.31	12.55	90.89	0	0.85	0	42.47	5.32	16.24	8.38	15.33	207.30
Mango	38.21	4.37	26.05	204.00	0	1.24	0	32.31	2.25	28.39	18.38	18.88	374.08
Litchi	2.59	0.65	2.08	25.07	0	0.02	0	1.98	0.24	1.25	0.43	1.08	35.42
Guava	0.70	0.38	1.51	6.59	0	0.14	0	6.55	0.14	1.20	3.32	1.62	22.15
Aonala	1.31	0.18	1.50	5.37	0	0.04	0	0.60	0.22	0.51	0.63	0.84	11.20
Jack fruit	0.83	0	0.34	0.84	0	0.01	0	0.60	0.01	0.36	0.26	0.51	3.76
Papaya	0.30	0.01	0.08	0.95	0	0	0	0.22	0.01	0.17	0.18	0.36	2.28
Grapes	0.27	0.02	0.14	0.16	0.12	0.03	0	0.04	0.07	0	0.05	0.43	1.33
Loquat	0.09	0.01	0.02	0.48	0	0	0	0.04	0.03	0.01	0.01	0.01	0.70
Others	0.67	0.01	0.20	4.05	0	0	0	0.09	0.03	0.07	0.27	0.19	5.58
O.S.T.F.	44.97	5.63	31.92	247.51	0.12	1.48	0	42.43	3.00	31.96	23.53	23.92	456.47
Total	62.32	146.34	51.43	362.23	97.55	246.25	6.61	319.05	356.92	151.61	66.02	50.35	1916.68

O.T.F. – Other temperate fruits, O.S.T.F. – Other Sub Tropical fruits;

Source: Directorate of Horticulture

**Table 24: Crop wise Area (ha)- (2007-08)**

Name of fruit	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmaur	Solan	Una	Total
Apple	4	11473	0	453	8874	23179	734	15135	31323	3443	108	0	94726
Plum	89	385	154	416	9	2051	9	2689	598	1312	632	84	8428
Peach	125	217	109	217	68	41	0	754	302	2965	279	98	5175
Apricot	0	389	1	37	248	236	18	229	679	467	926	0	3230
Pear	496	358	115	421	61	483	7	1807	1505	471	1081	756	7561
Cherry	0	5	0	0	11	62	5	25	266	0	0	0	374
Kiwi	1	4	0	11	0	30	0	33	16	8	17	0	120
Pomegranate	51	17	94	69	1	215	0	198	91	49	82	69	936
Olive	0	3	0	0	0	10	0	10	29	1	0	0	53
Perssimon	3	5	2	4	1	167	0	176	28	6	4	1	397
Strawberry	0	0	0	2	0	5	0	2	0	44	2	0	55
Almond	32	290	194	417	990	390	6	1503	1500	134	135	110	5701
Walnut	34	1343	74	201	237	88	2	1016	303	1240	170	10	4718
Hazelnut	20	31	29	196	0	39	0	387	6	6	14	19	747
Mango	0	3	0	1	7	0	0	0	5	0	0	0	15
Litchi	3088	469	2730	21245	0	133	0	3807	300	2381	1873	1814	37840
Guava	74	41	149	663	0	15	0	656	20	88	340	172	2218
Aonala	135	23	216	668	0	4	0	89	30	66	70	174	1475
Jack Fruit	83	0	53	109	0	2	0	84	3	36	27	60	457
Papaya	23	1	8	101	0	0	0	27	1	14	19	36	230
Grapes	27	2	14	16	12	3	0	4	7	0	5	43	133
Loquat	9	1	2	48	0	0	0	4	3	0	1	1	69
Karonda	3	0	1	5	0	0	0	1	0	0	1	3	14
Ber	18	0	1	5	0	0	0	3	1	0	3	1	32
Sapota	9	0	14	10	0	0	0	0	0	1	6	14	54
Fig	13	0	0	2	0	0	0	0	0	0	0	0	15
Banana	18	0	6	86	0	0	0	3	0	0	2	4	119
Jamun	3	1	1	254	0	0	0	2	0	1	8	8	278
Bael	2	0	0	12	0	0	0	0	0	0	0	0	14
Deon	3	0	2	33	0	0	0	0	0	0	1	4	43
Orange/ Kinnu	242	21	214	5544	0	23	0	731	37	441	273	853	8359
Malta/ Musambi	56	1	112	667	0	4	0	169	2	11	8	83	1113
K.Lime	386	343	940	2749	0	51	0	2821	461	783	430	567	9531
Galgal	219	289	140	491	0	8	0	533	74	195	175	192	2316
Grape fruit	12	0	16	14	0	0	0	3	0	6	1	2	54
Harar	0	0	1	0	0	0	0	0	0	0	0	1	2
Total	5537	15796	5653	37878	10519	27241	781	33158	37623	14271	6740	5305	200502

**Table 25: Comparison of Area Production and Productivity of fruits in the Himachal Pradesh**

Fruit	1980-81			1990-91			2000-01		
	Area (km <sup>2</sup> )	Production (MT)	Productivity (Kg/ha)	Area (km <sup>2</sup> )	Production (MT)	Productivity (Kg/ha)	Area (km <sup>2</sup> )	Production (MT)	Productivity (Kg/ha)
Apple	43.3	118.1	2727	62.8	342.1	5447	83.7	376.7	4500
Other temperate Fruits	17.5	9.3	531	28.5	14.9	523	32.4	20.5	633



Fruit	1980-81			1990-91			2000-01		
	Area (km <sup>2</sup> )	Production (MT)	Productivity (Kg/ha)	Area (km <sup>2</sup> )	Production (MT)	Productivity (Kg/ha)	Area (km <sup>2</sup> )	Production (MT)	Productivity (Kg/ha)
Nuts & Dry fruits	6.9	1.8	261	13.2	3.1	235	16.4	2.7	165
Citrus	14.5	4.4	303	36	12.6	350	39.1	11.1	284
Other Sub tropical fruits	10.3	6.4	621	22.9	13.6	594	36.3	17	468
Total	92.5	140	1574	163.4	386.3	2364	207.9	428	2059

Source: Work Plan for Accelerated Growth of Agriculture & Horticulture in H.P. (2002-2003)

Temperate fruit covers about 64% of total cultivated area of the State out of which more than 40% is under Apple cultivation. Shimla & Kullu are dominant areas of apple production while in Sirmaur peach is the main fruit crop. Kullu district grows Plum & Pear. Citrus, mango & litchi are main fruits of Kangra. Area under, mango is about 39% of total area under sub-tropical fruits in lower hill region & 6% of total area under all fruits in the State as compared to 19% under citrus fruits.

About one-seventh of fresh fruit trees are nonbearing while in case of dry fruits, it is one-eighth covering about 16% of area under fruits.

Shimla & Kinnaur have the largest number of non-bearing trees of fresh as well as dry fruits. Fruit production which was 1200 metric tonnes in 1950-51 increased to 4.3 lakh metric tonnes in 2000-01. According to time series data, average productivity of Apple is 5830 kgs/ha, other temperate fruits are 990 Kg/ha, nuts & dry fruits are 450 kgs/ha, Citrus 510 Kg/ha & Other sub Tropical fruits is 1370 kgs/ha.

(Source: Work Plan for Accelerated Growth of Agriculture & Horticulture in H.P. 2002-2003)

District wise Bearing & Non bearing Area under Fresh fruits, Dry fruits & Vegetables (1988-99) is given in Table 26.

**Table 26: District wise Bearing & Non bearing Area(Km<sup>2</sup>) under Fresh fruits, Dry fruits & Vegetables (1988-99)**

District	Fresh Fruits		Dry Fruits		Vegetables		
	Bearing	Non-Bearing	Bearing	Non Bearing	Potato Kharif	Rabi	Others
Bilaspur	3.38	0.75	0.02	-	-	0.13	4.98
Chamba	21.47	-	-	-	5.33	0.26	6.98
Hamirpur	0.84	-	-	-	-	0.13	1.99
Kangra	60.92	-	0.09	-	1.22	12.46	22.29
Kinnaur	15.97	3.18	5.52	0.57	2.44	-	9.21
Kullu	87.44	2.72	0.58	0.03	8.50	1.39	23.08
Lahaul & Spiti	0.19	0.40	-	-	8.74	-	9.00
Mandi	57.57	-	-	-	16.35	1.95	49.04
Shimla	203.37	68.15	3.08	0.93	51.30	8.17	130.62
Sirmaur	14.89	1.00	0.33	0.05	10.82	3.84	33.95
Solan	7.45	1.37	0.04	-	0.18	1.25	31.97
Una	5.38	-	-	-	0.89	2.93	9.27
Himachal Pradesh	478.87	77.57	9.66	1.58	105.77	32.51	332.38

Source: Annual Season & Crop Report 1988-99, Commissioner (Revenue) Himachal Pradesh

Himachal Pradesh is a rich repository of Medicinal & Aromatic plants because of its situational advantage. About 500 medicinal, 150 aromatic and a large number of potent alternative and drug plant species are available in this area.

There are 70 units in State which manufacture Ayurvedic medicines. 2 bigger units are set up at Joginder Nagar & Majra to procure raw material from the market. Department of Ayurveda, Government of Himachal Pradesh has set up

one herbal garden in each of the 4 agro-climatic zones of the State to raise germplasm nurseries. An Ayurvedic Herbarium has been set up at Joginder Nagar to keep specimens of medicinal plants in a systematic manner. Among the

cultivated medicinal plants *Saussurea lappa* (Kuth), *Bunium persicum* (Kala Zira), *Crocus sativus* (Kesar) & *Humulus lupulus* (Hops) are important. Following species exported from Himachal Pradesh are given in Table 27.

**Table 27 Major Medicinal Herbs Exported From Himachal Pradesh (Quintal)**

Name	1988-89	1989-90	1991-92	1994-95
Jurinea sp.	5884	4064	4939	3260
Dioscorea sp.	1672	180	380	4
Gentiana kurroo	1468	199	2899	343
Valeriana sp.	1954	1247	2014	1642
Cinnamomum camphora	1430	849	-	675
Centella asiatica	417	166	335	921
Saussurea lappa	3	648	667	321
Morchella sp.	402	137	2800	490
Viola sp.	26	195	-	71
Pistachia integerima	129	437	278	17
Aconitum violaceum	60	12	48	-
Aconitum heterophyllum	189	1	2	25
Bunium persicum	70	5	5	-
Berberis sp.	2981	11195	12824	-
Pinus gerardiana	656	568	600	403
Agaricus bisporus	37	15	-	-
Other sp.	4239	4913	10328	684

*Source: Biotechnology Policy of Himachal Pradesh, Department of Biotechnology & Govt. of H.P. Brochure s. 2001*

## 5.2 Patterns of planning and development in the sector

Himachal Pradesh is regarded as a horticultural State due to its magnificent achievements in the production of fruits, mainly apple and the cultivation of off-season vegetables. The other fruit crops grown in the State include temperate fruits such as peach, pear, plum, apricot and the subtropical fruits such as mango, citrus, litchi, etc. Area under all fruits in the State has more than doubled from 86.23 thousand ha in 1980-81 to 186.90 thousand ha by 2005-06. The corresponding production has gone up 2.5 times from 1.46 lakh tonnes to 3.68 lakh tonnes during the same period. However, the large gains in this production have come from area as the productivity increased marginally from 1.69 tonnes per ha in 1980-81 to 1.97 tonnes in 2005-06. With this background, an attempt was made during plan preparation to know as to what is the scope of bringing additional area under various fruit crops. Secondly, the level of gap in

productivity of various crops on an average farm and the corresponding progressive farm was also computed so that the relevant interventions could be suggested for various districts based on the field survey observations. The existing status of horticulture along with the potential for further development in the State is potential of bringing in around forty thousand ha under apple, the main fruit crop in the State. Besides, the State can also increase area under other temperate fruits, nuts, stone fruits and pear, etc. by about twenty thousand ha. In the low altitude districts, the area under mango and citrus fruit can be increased by about twenty thousand ha each. In addition, another ten thousand ha can be brought under other subtropical fruits such as litchi, guava, aonla, pomegranate, papaya, etc. in these low and mid hill districts of the State. This would help strengthen the horticultural base of the State by making it more broad-based both spatially as well as crop wise.

*(Source: State Agriculture Plan, Himachal Pradesh, 2009).*

Himachal Pradesh has made significant progress in the development of Horticulture. The rich diversity of agro-climatic conditions, topographical variations and altitudinal differences coupled with fertile, deep and well drained soils favour the cultivation of temperate to sub-tropical fruits. The region is also suitable for cultivation of ancillary horticultural produce like flowers, mushroom, honey and hops.

*(Source: - Economic Survey Report -2009-10).*

Experiments are under way in the State to grow fruits like strawberry, pomegranate, olive, kiwi, hazelnut, etc., which have been identified as the potential crops of the future. Some highbearing clones of these fruits have been imported and are being tested for commercial cultivation. Planting material imported during 2001-02 includes apples (six cultivars) 5000, cherry (two cultivars) 3500 and plum (three cultivars) 1500. Work plan for the development of horticulture aims at complementing and supplementing the efforts of the State Government to bridge the gap between the low level of productivity and the quality of fruit crops resulting from:

- Lack of availability of elite planting material
- Lack of modern production and protection technologies and facilities
- Lack of rapid and efficient transfer of technology
- Poor communication due to hilly terrain
- Inadequate irrigation
- Lack of post-harvest management
- Losses due to the vagaries of nature, etc.
- Inadequate marketing infrastructure and intelligence

Horticulture industry at present contributes about 584 Crores per annum to the GDP. Gross income from fruits has increased from 45.74 Crores in 1990-91 to about 584.35 Crores in 1998-99. Government of Himachal Pradesh is aware of the potential for developing of horticulture in the State and treats horticulture as a priority area in the development plans. It is a matter of great satisfaction that as a result of the

pragmatic policies adopted by the State Government and the unequivocal adoption of development programmes by the farmers, the State has achieved a transformation in the horticulture sector over the last fifty years. The total area under fruits, which was only 792 ha in 1950, has increased to 2.23 lakh ha during 2001-02. Similarly, the fruit production has also increased from 1200 MT in 1950 to 5.6 lakh tonnes during 2003-04. The horticulture industry of the State is now contributing about ` 777 Crores per annum to the Gross Domestic Product of the State. The development of horticulture in the State has generated many employment opportunities not only at the farm level but also in other related activities, such as post-harvest management operations of packing, grading, transportation, processing, marketing, etc. It has been estimated that about 900 lakhs man-days of employment are generated in the fruit production activities alone. Every year about 35000 trucks are required for the transportation of fruits from the State to various fruit markets in the country.

The State is producing only 1% of the total fruit production of 415.07 lakh tonnes (1995-1996) in India. The temperate fruit industry is older than the sub-tropical fruit industry in Himachal Pradesh and contributes about 90 % of the total output of the fruit industry in the State, against the share of 10% for the sub tropical fruits. The reason for the low level of production in sub-tropical fruits is that the plantations of these fruit trees are still young and most plantations have not reached the bearing stage.

Apple dominates the fruit production in the State and contributes about 82 % of the total. The time series data exhibit erratic patterns of annual fruit production in the State. The main reason for this is that fruit cultivation in Himachal Pradesh is done mainly under rainfed conditions. Moreover, the weather vagaries like hailstorms, frost, drought and heavy rains, etc., act as limiting factors in fruit production. (Source: State of the Environment Report on Himachal Pradesh (undated), released in October 09)

The Department of Horticulture came into existence in September 1970. The policies for the development of horticulture of the State Government combined with their adoption of the farmers have resulted in transformation of the horticulture industry of Himachal Pradesh. The State has earned the distinction of being the "Apple State of India". The sector plays an important role in providing employment opportunities both "on farm" and "off farm" and sustaining the livelihoods of people directly and indirectly. The development of infrastructure and peripheral services related to horticulture provide further livelihood opportunities.

The planned development of Horticulture in Himachal Pradesh is of a recent origin and more so a post independence phenomenon. During the preindependence period, there had been practically no or very little development of Horticulture. Pioneering efforts were, however, made by a few European and American Missionaries by way of introduction of the different varieties of temperate fruits, particularly apples.

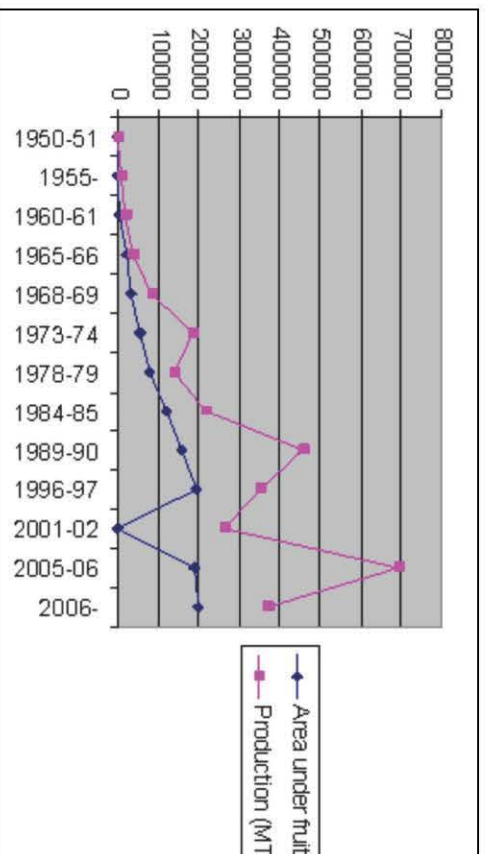
It was only after the launching of Five-Year Plans in 1951-52 that the development of horticulture started receiving any attention. This is particularly so in the hilly areas of Himachal Pradesh where the horticultural development gained momentum with the establishment of the Regional Fruit Research Station at Mashobra in the year 1953. During the year 1950-51, the total area under all kinds of fruits was 792 ha, with an annual production of 1200 tonnes. In the initial years of development, stress was laid on the variable trials, development of technologies and plant propagation with the main aim of initiating fruit plantation activities. The programme launched integrated development of all sectors of Horticulture. However, the programme was quite successful so far as the plantation activity is concerned and the area under fruit increased to 1.92 lakh ha in the year 2005-2006, end of 4th year of 10th five year plan. The fruit production

reached the figure of 6.96 lakh MT during the year, 2005-06, end of 4th year of 10th five-year plan. The figures given in Table 28 provides plan-wise comparative position on area and production of fruits during previous plans. Figure 3 shows the trend in fruit production (MT) in relation to area since 1950-51 to 2006-2007.

**Table 28: Area under fruits and production**

S. No.	Year/Plan	Area under fruit (ha)	Production (MT)
1	1950-51 (before the advent of plans)	792	1200
2	1955-56 (End of 1 <sup>st</sup> plan)	2030	7000
3	1960-61 (End of 2 <sup>nd</sup> plan)	6004	18710
4	1965-66 (End of 3 <sup>rd</sup> Plan)	22358	36910
5	1968-69 (End of 3 cons. Annual Plans.)	34572	81081
6	1973-74 (End of 4 <sup>th</sup> Plan)	55539	186186
7	1978-79 (End of 5 <sup>th</sup> Plan)	80301	137227
8	1984-85 (End of 6 <sup>th</sup> plan)	120580	215920
9	1989-90 (End of 7 <sup>th</sup> plan)	156469	459990
10	1996-97 (End of 8 <sup>th</sup> Plan)	196212	351625
11	2001-02 (End of 9 <sup>th</sup> Plan)	170457*	263446
12	2005-06 (End of 4 <sup>th</sup> year of 10 <sup>th</sup> Plan)	191668	695517
13	2006-07 (End of 10 <sup>th</sup> Five year Plan)	197445	369103

*\*The area has reduced on the basis of a survey conducted during 2001-02 by the Departmental Committee, because the plants, which had completed their economic life, were uprooted.*



**Figure 3: Trends in fruit production in relation to area**

Area under Fruits: Most of the orchards in the State, which were planted during 1950s and 1960s have outlived their economic life. Therefore, a survey was conducted by the Departmental Committee and on the basis of the survey report, the area of 50000 ha, which was under the old plantations was taken out of the total area under fruit plantations during the year 2001-02, (end of the 9<sup>th</sup> Five Year Plan). Consequently, total area under fruit crops was reduced and 170457 ha was taken as the base figure of total area under fruit plantation in the beginning of the 10<sup>th</sup> Five Year Plan. As such, against a targeted area of 200,000 ha, the total area under fruit crops in the State is likely to increase to 197,668 ha by the end of the 10<sup>th</sup> Five Year Plan. However, against a targeted additional area of 30,000 ha, 27,211 ha additional area has been brought under new plantation and 9,607 ha of area has been covered under re-plantation.

The hops industry in the State has received a great setback due to liberal trade policy of the Government of India under which import duty on hops products has been reduced from 120% to 30% as a result of which, the prices of domestic hops crashed down considerably. Moreover, the brewing industries in the country are using hops pellets and hops extracts instead of dried hops. As a result, hops growers in the State are facing difficulties in marketing of hops product and area under cultivation of hops has

gone down considerably. Targets under the production area of olive could not be achieved due to the reason that considerable reduction in olive production has been noticed in the recent years. The growers have cultivated olive on the marginal lands and they could not fetch satisfactory yield/income, with the result, the other farmers could not come forward for adopting the cultivation of olive crop.

The Horticulture sector in the State has a highly comparative advantage & plays an important role in providing nutritional food to the people in the country under the mountainous environment, although it is marked by ecological fragility and inaccessibility. Farm sector features as a core sector as far development strategies are outlined in the 11<sup>th</sup> Five Year Plan. In order to increase the incomes from farming and allied activities as well as the employment opportunities within this sector, the focus is to be on improvement of irrigation facilities, supply of high quality seeds, fertilizers and other inputs, facilitation of adequate credit and effective market linkage, and research and extension works, all of which are expected to lead to sustainable value addition. Among others, the priority is put over speedy completion of ongoing irrigation project, bringing of additional 98000 ha under irrigation and bridging of the existing gap between irrigation potential already created and its actual utilization.

Fruit Processing and Utilization: Department of Horticulture is implementing a scheme for the utilization of unmarketable surplus of fruits and vegetables since the year 1959. Two types of approaches are being adopted in this regard.

1. Setting up of fruit processing units in the fruit growing areas.
2. Organizing community canning service and training in home scale preservation of fruits and vegetables in rural areas.

Department of Horticulture is running 8 small fruit processing units in different districts with total installed capacity of processing of 500 MT fruit products. Besides these, one microbiological laboratory for product development and standardization of recipe of different fruit products and other laboratory for testing the quality of fruit product being manufactured in departmental units, have also been set up. The objectives of the scheme are given below.

1. Utilization of unmarketable surplus of fruits and vegetable in the State.
2. Creation of infrastructural facilities for providing community canning services to the local population in each district.
3. Organizing training in home scale preservation of fruits and vegetables in rural areas especially for women.
4. Standardization of recipe of the fruit products based upon the raw material available in the State.
5. Ensuring quality control over the production of fruit products for making the same available to the consumer at reasonable rates through departmental units.
6. Providing consultancy and technical advisory services to the entrepreneurs for setting up of their own processing units.

A target of manufacturing 1000 MT fruit product in the departmental units and 250 MT

fruit products to be processed under community canning services is proposed for 11th Five Year Plan 2007-12. A target of manufacturing 200 MT of fruit products at departmental units and 50 MT through community service is proposed for the year 2007-08.

Horticulture Development Activities: Horticulture Development scheme is the major programme aiming at creation and maintenance of infrastructural facilities in the rural areas for ensuring equitable access to the resources and inputs required for the promotion of all fruit crops. Under this scheme, the programmes like development of fruit production, area expansion programme, demonstration of new technologies and improved package of practices on the orchards of fruit growers, development of Walnut / Hazelnut / Pistachio nut, development of olive, development of mango / litchi in lower hill areas, development of strawberry and other small fruits, development of medicinal and aromatic plants, Horticulture Information Services, development of hops schemes, short term research projects for solving the field problems of emergent nature, other schemes and externally added projects will be carried out.

*(Source: Economic Survey, 2009-10).*

Currently Department of Horticulture has mandate for carrying out the activities relating to the production and post harvest management of fruit crops, commercial floriculture, apiculture, mushrooms, hops, herbs, medicinal and aromatic plants. The vegetable cultivation, though an integral part of horticulture, is however, presently being managed and under control of the Agriculture Department.

The objective of the future strategy is to develop horticulture as an enterprise with three dimensional

features namely: Economic development, Nutritional Security and Environment conservation.

The State has adopted following strategies for the development of horticulture in the State.

1. Improvement of productivity of existing horticulture plantations.
2. Quality improvement of horticulture produces.
3. Diversification of the horticulture industry.
4. Modernization of the nursery production programme for the production of virus free certified planting material on suitable rootstocks.
5. Introduction of improved fruit varieties and rootstocks from advanced countries and their multiplication for supply to the farmers.
6. New orientation to the planting density in the fruit orchards from the present low-density plantation to medium and high-density plantation, with the objective of obtaining higher productivity of quality fruits per unit area.
7. Minimum use of pesticides with emphasis on Integrated Pest Management (IPM) and biological control of pests and diseases.
8. Utilization of the information technology for the dissemination of technical know how and marketing information to the fruit growers.
9. Improvement of water management practices in the orchards through adoption of scientific water harvesting, storage and application practices.
10. Utilization of high-tech horticulture technologies like protected cultivation of horticulture produce, use of biotechnology, micro irrigation technologies, use of plastics etc. for the improvement of horticulture productivity.
11. Creation of scientific post harvest management infrastructure.
12. Value addition and diversification in processing industry.

13. Market promotion through branding, advertisement and exports.

Further, in the context of 11th FYP (2007-12) following strategy is outlined:

- Development of modern facilities for the propagation of plant materials to the farmers through introduction of improved genome and plasma technology from abroad and identification of plant materials of outstanding merits from within and outside of the State.
- Improvement of water management through the scientific method of on-farm water harvesting, conservation and application for making best use of scarce water resources by means of micro irrigation techniques for the improvement of horticulture productivity.
- Integrated nutrition management with emphasis on need based application of fertilizer for maintenance of soil productivity.
- Implementation of programme for pest and weather forecasting.
- Diversification of horticulture with greater emphasis on planting of nut crops, olive, cherry, pear, small fruits and others as well as cultivation of medicinal and aromatic plants in farmer's fields.
- Utilization of IT as an important tool for horticulture extension, dissemination of technical know how and market information.
- Utilization of protected cultivation of flower and high value horticulture crops like strawberries.
- Development of horticulture crops especially for fruit processing like wine varieties of grapes, cider varieties of apple, apple varieties of juice making and so on.

- To establish demonstration farms for the collection and multiplication of medicinal and aromatic plants for supply to the farmers,
- To demonstrate the technology in the cultivation of medicinal and aromatic plants on farmer's fields,
- To provide incentives to the farmers for increasing the production of medicinal and aromatic plants in the State for providing raw materials to the pharmaceutical and cosmetic industries and,
- To supplement the farm income of the farmers for their upliftment.

Priority Areas as per the Eleventh Five Year Plan (2007-2012)

1. Implementation of the programmes for the improvement of productivity and quality of fruits and the production of fruits by the end of the plan period.
2. Intensification of horticulture development in the less developed areas and diversification of horticulture in the already developed areas with emphasis on nut fruits and other new fruits.
3. Utilization of the environmental friendly practices for horticulture production and marketing.
4. Development of modern post harvest management facilities for reducing post harvest losses, increasing shelf life, standardization of grading and packing and regulation of the flow of fruits to the market.
5. Development of fruits exclusively for processing industry.
6. Increase in use of the frontier technologies like Remote Sensing and
7. Information Technology and Bio-Technology in the field of horticulture.

#### **a. Production Related**

1. Development of modern facilities for the propagation of the plant material to the farmers through (i) introduction of the improved germplasm from abroad and identification of the plant material of outstanding merit from within and outside the State and its multiplication (ii) creation of facilities for the commercial production of the virus free plant material (iii) Utilization of the micro- propagation of the plant material for increasing the supply of the improved plant material to the growers (iv) shift towards the use of clonal rootstocks in place of existing practice of seedling rootstocks (v) creation of the bud-wood banks of elite fruit varieties and rootstocks in the public sector for further supply to the private nurserymen for multiplication and (vi) development of a scientific system for the supply of certified plant material of fruits to the farmers.
2. Increased use of bio- technology for the fast multiplication of the plant material as and where the cost effective protocols are available.
3. Utilization of the Integrated Pest Management Technologies for decreasing the use of chemicals for pest control both for reducing the plant protection costs and also for checking environment pollution. Emphasis shall be given on biological control of the pests and diseases.
4. Implementation of the programmes for the pest forecasting and weather forecasting.
5. Integrated Nutrient Management with emphasis on need based application of the chemical fertilizers and increased use of the biological fertilizers for the maintenance of soil productivity.



6. Improved water management through scientific methods for farm water harvesting, conservation and application for making best use of the scarce water resources for the improvement of the horticulture productivity.
7. Diversification of horticulture with emphasis on nut crops, olive, cherry, pear, small fruits etc. and cultivation of Medicinal and Aromatic Plants in the farmer's fields.
8. Utilization of protected cultivation of flowers and other high value horticulture crops like strawberries for which project area approach shall be adopted and region specific schemes will be prepared.
9. Utilization of information technology as an important tool for horticulture extension, dissemination of the technical know how and market information and e-Governance.
10. Development of horticulture crops specially for fruit processing like the wine varieties of grapes, cider varieties of apples, apple varieties for juice making, etc.

#### **b. Post Harvest Management**

1. Development of infrastructure for the scientific post harvest management and marketing of extremely perishable horticulture commodities like flower crops and mushroom in the private, cooperative and public sector. Demonstration units will be established in the public sector.
2. Development of farmer's organization for the implementation of the programmes of the post harvest management of the horticulture produces.

#### **c. Research and Development**

1. Project approach shall be utilized for the solution of the various problems of horticulture industry through the research institutions.

#### **d. Post Harvest Processing**

1. Emphasis on on-farm conservation/preservation of the unmarketable fruits.
2. Establishment of fruit preservation training and community fruit processing centre at the block level and in areas of concentrated fruit production.

#### **Area expansion and re-plantation programme**

Replantation of fruit plantations which are very old and have become uneconomical.

Bring 20,000 ha of area under new fruit plantation and to replant about 10000 ha orchard area with new improved varieties during 11th Five Year Plan.

Activities related to the development of horticulture being taken care of by the State Department of Horticulture, with a view to improve socio-economic status of the farming community, are given below:

1. Area Expansion: Every year around 6000-7000 ha of area is being brought under fruit plantation all over the State for which 15 to 20 lakhs fruit plants of different species are distributed amongst the farmers. This also includes replantation of old orchards.

- a. Production and supply of elite planting material: The production and supply of the planting material of different fruits is arranged through 98 Progeny - cum - Demonstration Orchards (PCDOs) and Nurseries and about 662 private Nurseries. The State is self sufficient in the production and supply of the most of the temperate fruit plants but is

deficient in planting material of mango, citrus and other sub - tropical fruits. Various programmes have been initiated for increasing the production of planting material of these fruits. Two plant tissue culture laboratories, one each in the public and private sector, have been established for the rapid propagation of planting material. Clonal rootstocks of temperate fruits like apple, pear, cherry etc, are also being multiplied and made available to the growers from the PCDOs.

## 2. Ancillary Horticulture activity

i. Bee Keeping - British introduced bee-keeping in Kullu Valley in 1934 and in Kangra valley in 1936. Migratory system of bee keeping was introduced in 1952 when bee flora from high hills was brought down to lower altitudes during winter months. State took a lead in introduction of Exotic honey bee *Apis mellifera* for the first time in 1962-63. Before this, honey was produced from *A.acerana* and production was 10 MT /annum from 2500 bee colonies maintained by 500 beekeepers. There are about 26000 bee colonies with more than 939 beekeepers producing over 650 MT of honey of diverse flora every year. Over 1000 bee colonies were distributed by Government agencies in 2001-02. One honey processing unit with capacity to process 120 MT of honey is working at Kandrori in Kangra District and is managed by Agro Industry Corporation Ltd.

For the development of beekeeping, 32 beekeeping stations have been established all over the State for providing technical know how to the farmers in commercial beekeeping. About 1256 bee colonies are maintained in these stations for multiplication and supply to the farmers. Two bee breeding multiplication centres have also been promoted in the private sector. Two Ag-marking laboratories for honey have been established, one at Hatkoti (Shimla District) and other at Chaitru (Kangra District).

**Kangra District:** Four Bee Keeping Centres in the district are providing technical knowledge

to private Bee Keepers and other interested farmers. These centres are located at Jachh, Bhadwar, Shahpur and Ghurkhari. Bee keeper is provided in each centre who provides necessary training in raising of bee keeping farms.

**Lahaul & Spiti District:** Some farmers produce honey for their domestic use. The Horticulture Department has made tremendous achievement in development of hops production by establishing five hops processing centres (three at Kangra and one each in Shansha and Baring). During the year 1994-95, a record of 130.6 MT of dry hops was produced and marketed @ 16/50 paise per Kg. of green hops.

**Shimla District:** Sufficient bee flora is available in the district for the bees for extraction of honey. There are, at present 60 commercial private units and 500 small private bee keeping units who are running their own bee keeping units in the district. An Ag-mark laboratory where honey is processed, packed under Ag-mark label, is working at Kotkhai. In addition to Ag-mark laboratory, seven bee keeping stations at Hat Koti, Sawra, Annu, Nerua, Dodra-Kwar, Gauna and Shimla are functioning in the district.

ii. Floriculture - Commercial cultivation of flowers in H.P. started in 1980 under the guidance of Department of Horticulture and was declared a thrust area for economic development. The District Rural Development Agencies in Kangra, Mandi, Shimla and Solan are engaged in this activity. Several small nurseries have been established for propagation of floriculture planting material. The main crops are Gladiolus, Chrysanthemum, Daffodils, etc. Cultivation of traditional flowers like Marigold has been taken up in areas like Rajgarh. Area under floriculture in State has increased from 5 ha in 1991 to more than 188 ha in 2002 and flowers worth `6 Crores are produced every year. They are being exported

to Chandigarh, Amritsar, Delhi, Haridwar, Hrishikesh and other places.

Seven floriculture nurseries have been established at various places for multiplication and supply of floriculture planting material. One Model Floriculture Center has been established at Mahog Bag, Chail (Solan) to serve as a training center in commercial floriculture. In Kangra district, the Horticulture Department is providing a subsidy at 50% on the cost of planting material and other inputs subject to the maximum of 20,000 for bulbs crops, 50,000 for grafted/cutting crops, 4,000 for seeds crops respectively. Two flower nurseries are located at Bhatoon and Dharamsala which provide input to the growers.

iii. Mushroom Cultivation - For the development of mushroom cultivation, the Horticulture Department has established four Mushroom Compost Manufacturing Units at Chambaghat (Solan), Palampur Baijnath (Kangra district) and Bajwara (Kullu district). In addition, about thirty Mushroom Compost Manufacturing Units are in operation in the private sector. Project Co-ordinator Mushroom and two Horticulture Development Officers along with technical staff are posted to popularise the cultivation of mushroom in the Kangra district.

iv. Plant Protection - The main function of this activity is the surveillance of pests and diseases in the fruit growing areas and distribution of pesticides. Varieties of apples and other temperate fruits are prone to diseases caused by the vagaries of the weather and by the pests. Some diseases which assume an epidemic form are fought every year with fortitude and determination by organising special campaigns in addition to regular plant protection programmes in the orchards. One such disease has been identified as "apple scab". Sometimes this disease can destroy the fruit of whole orchards. The situation is however, being brought under control by unified repeated

fungicidal sprays. Special measurements under special schemes are being adopted by the Department of Horticulture with co-operation of the people in controlling the disease.

**Kangra District:** About fourteen blocks have been covered in the district under plant protection activity. The recommended insecticide/fungicides are distributed at 50% subsidy to Small/ Marginal/ Scheduled Caste and Scheduled Tribe/backward orchardists and 30% subsidy to the big farmers for control of pests and diseases of important fruit crops.

**Shimla District:** Apple farmers are adopting new techniques for their plant protection from various diseases. Maximum production of apples are exported to others States of India and to the foreign countries. Small size apples of this district are also purchased by HPMC for preparing Juice, Jam, etc. The biggest processing unit of the HPMC is located at Parwanoo in Himachal Pradesh.

v. Horticulture training institutions - 14 Horticulture training institutions are functioning in the district to provide various types of training on Plant Protection, Bee Keeping, Mushroom Cultivation, Floriculture Development, Fruit Preservation etc. One such institution/station is located at the headquarters of C.D. block and each station is provided with one Horticulture Development Officer, two Horticulture Extension Officers who provide the training to the farmers in raising of orchards. For this purpose, training camps of short and long duration are held regularly. Besides this, study tour of the orchardists within State and outside the State are also conducted in addition to providing training in pruning, plant protection and fruit preservation, etc.

One fruit processing unit in the Kangra district has been established at Nagrota Bagwan for the manufacture of fruit products and providing training facilities in fruit preservation to the local orchardists.

vi. Demonstration of New Technologies & Improved Package of Practices: Demonstrations are the most effective tools for convincing the fruit growers of the effectiveness of modern technologies in improving the productivity of fruit crops. This programme is of great importance in the transfer of technology to the fruit growers for increasing the productivity and quality of fruit crops. The programme of work includes demonstration of the new technology or improved package of practices developed by the State Horticulture University or any other research institutions and industries on the farmland. The incentives to the fruit growers for implementing this scheme shall be given as per the approved procedure of the State Government. The objectives of the programme are given below:-

1. To effect improvement in the level of management in the existing plantations through the demonstration of new technologies, primarily with a view to maximize production per unit area.
2. To provide opportunities to the fruit growers specially small and marginal farmers and other weaker sections of farming community to acquire skills to augment their knowledge and understanding by learning through doing.
3. To provide forum for the farmers to exchange ideas and experience operating under various agro-climatic conditions.
4. To collect data on the impact of the package of practices and the new technologies demonstrated on the yield and quality of fruit crops.

As per Economic survey 2009-10, arrangements were made for making available the packing material to the fruit growers for packing their fruit produce. The State Government has leased out the carton manufacturing factory situated at Pragatinagar, District Shimla. It was decided that HPMC, AIC, HIMFED and KINFED (for Kinnaur

District only) will supply cartons to the growers on consignment basis without any subsidy. The survey also indicated that about 4.00 lakh eucalyptus/ popular wooden boxes were also bought by the growers from outside the State.

vii. Market Intervention Scheme: During the heavy crop year, the fruit growers receive very low price from the market due to over supply in the market. They also receive less price when the crop is damaged by weather vagaries like hail storms. Therefore, to stabilize the market prices for fruits and to save the fruit growers from economic losses, the State Government has formed a policy to provide market support to the growers for their fruit produce under Market Intervention Scheme. The procurement of fruits under this scheme is done through HPMC and HIMFED for utilization in fruit processing industries, with the extension support of Department of Horticulture. It was also proposed to introduce the policy of Apple Crop Insurance during the 11<sup>th</sup> Five Year Plan. Efforts are being made at the Government level to include apple fruit under Crop Insurance Scheme.

### State Sector Schemes

Under the State sector Schemes, the following assistance is available to farmers:

- Subsidy on horticulture production inputs @25% to small farmers, 33.3% to the marginal farmers and 50% to the scheduled caste/tribe and backward area farmers.
- Subsidy on pesticides @ 50% to the small farmers and 30% to the big farmers.
- Subsidy (on mushroom trays, mushroom compost, pesticides and plant protection equipments for mushroom cultivation) @ 25% to the small farmers, 33.3% to the marginal farmers and 50% to the Schedule caste, Schedule tribe, backward area farmers. In addition, 10% subsidy on the cost of

capital investment subject to a maximum of ` 2,500 per individual, 3% subsidy on the rate of interest and 100% subsidy on the transportation cost of compost is also available to the above categories of the farms.

- Subsidy on corrugated fibre board cartons for the packing of the fruits @ 8 20 kgs capacity telescopic carton manufactured by AIPIL subject to a ceiling of 9,600/-.
- 50% subsidy is provided for the purchase of the plastic crates.
- Subsidy on the transportation of the wooden packing cases ranging between 0.50 to Re. 1.00 per box is provided for the import of such material from the adjoining States for the packing of fruits depending upon the distance. The transportation subsidy of wooden logs for packing boxes for orchardists owning land less than 10 bighas, is ` 500/- to ` 1000/- per truck, depending upon distance.

The details of assistance available under Horticulture Technology Mission Mini Mission -II, being implemented by the State Department of Horticulture is as follows:

(i) Area Expansion: Fruits like apple (spur, colour strains & processing varieties), pear (colour strains), plum, peach, nectarines, apricot, prunes, cherry, pomegranate, hazel nut, walnut, pecan nut, aonla, mango, litchi, kiwi, ber, guava, citrus (sweet orange, kinnow, k. lime), vegetables including root & tuber crops, exotic vegetables and vegetable hybrids, flowers, spices, medicinal & aromatic plants etc. are the crops being covered under this programme. Area Expansion also includes replacement of old and senile plants. Assistance @ 50% of the cost of cultivation with a maximum limit of 13,000/- per ha is available except for floriculture, medicinal and aromatic plants, where the maximum assistance available

is 13,000/- and 4,000/-, respectively for an area of 0.2 ha.

(ii) Creation of water sources: For the creation of suitable water sources for ensuring irrigation to horticultural crops, the assistance available is as under:

@ 50% of the cost subject to a ceiling of 1 lakh for the construction of community tanks providing irrigation to 1 ha of area with a maximum limit of `10 lakhs for irrigating 10 ha of area.

@ 50% of the cost subject to a ceiling of ` 12,500/- for the construction of Tube wells/ Bore wells.

(iii) On farm water management: The assistance being made available under this programme is as follows: - (i) @ 50% of the cost, with maximum limit of 28,500/- per ha area of drip irrigation system installed, depending on the crop spacing. (ii) @ 50% of cost, with maximum limit of 15,000/- per ha area of sprinkler irrigation installed. (iii) @ 50% of cost, with maximum limit of 7,000/- per ha for Plastic Mulching. (iv) @ 40% of cost of 200 / m<sup>2</sup> or 40,000/- whichever is lower for a maximum area of 500 m<sup>2</sup> of green houses. (v) @ 1.50 lakh for establishment of green houses for flower cultivation fitted with temperature, humidity, light controls, fertigation systems, etc. for maximum area of 500 m<sup>2</sup> (vi) @ 50% of the cost or 5/ m<sup>2</sup> whichever is lower, for a maximum area of one ha area under low tunnels. (vii) @ 50% of cost or 14/ m<sup>2</sup> whichever is lower for a maximum area of 500 m<sup>2</sup> for shade nets. (viii) @ 50% of cost or 500 per tree for a maximum of 50 trees per beneficiary for anti hail nets. (ix) @ 50% of cost or 2,000 per ha for a maximum area of one ha for bird protection nets.

(iv) On farm handling unit: This programme is targeted to provide grading, sorting and storage facilities of the produce at the farm level. The assistance for setting up these units is provided

@ 30% of the total cost subject to the maximum of 50,000 per beneficiary.

(v) Production of planting material: Planting material is the most important input in horticulture plantations. Production of planting material is given special attention so that genuine material is made available to the farmers. Under this programme, Integrated Multi Crop Nurseries, Progeny and Herbal gardens and Tissue Culture Units both in public and private sectors are being established. The assistance being made available under this programme is: @ 50% of the cost subject to a ceiling of 8 lakhs (private sector) and @ 100% of the cost subject to a maximum of 18 lakhs (public sector) for setting up of "Integrated Multi Crop Nursery" for minimum area of 2 ha and producing minimum 5 lakh plants per annum; @ 50% of the cost (private sector) and @ 100% of the cost (public sector) subject to a ceiling of ` 3 lakh (private/ public sectors) for establishing a "small nursery" with a minimum production capacity of 3 lakh plants per annum; @ 50% of the cost subject to a maximum of `1.50 lakh (private sector) and @ 100 % subject to a ceiling of 3 lakhs (public sector) for establishing a "Progeny and Herbal Garden"; @ 50% of the cost subject to a ceiling of 10 lakh (private sector) and @ 100 % subject to a maximum of 21 lakhs (public sector) for setting up a "Tissue Culture Unit" with a minimum production capacity of 15 lakh plants per annum; @ Rs 12.5 lakhs per "True Potato Seed Centre (public sector) and 2 lakhs per True Potato Seed Centre" (private sector).

(vi) Transfer of technology through training, front line demonstrations, publicity and training of trainers: This programme comprises the training of technical staff of the Department of Horticulture and farmers; Organization of exhibitions; fruit shows and publicity of the programmes of the Technology Mission. Exposure visits of the farmers within and outside the State are organized so that they can see the progress made by their counterparts

within and outside the State. The assistance being provided for this purpose is as follows:

- @ 1,500 per farmer for a training of 7 day duration within wthe State
- @ 2,500 per farmer for a training of 7 day duration outside the State
- @ Actual cost with a maximum limit of ` 50,000 per trainer (Training of Trainers)
- @ 20 lakhs per Supervisory Training Centre
- @ 2 lakhs per Gardeners Training Centre.

(vii) Popularization of Organic Farming and use of Bio-fertilizers: In order to reduce the use of chemical fertilizers, pesticides and insecticides, organic farming is being encouraged. Groups of farmers are provided assistance for obtaining the certification of their organic produce. The assistance available is as under:

- @ 10,000 per ha for adopting organic farming.
- @ 90% of cost limited to 5 lakhs per year for certification.
- @ 30,000 for making vermi-compost Unit.

(viii) Promotion and popularization of horticultural equipments: Keeping in view the low availability of skilled manpower for carrying out horticultural operations, this programme is targeted to make available manually operated tools, power tillers, power operated and diesel engines to the farmers in the State. The assistance being provided for this purpose is as under:

- @ 1,000 per farmer for training of farmers as the maximum limit
- @ 1,500 per farmer for purchase of manually operated equipments as the maximum limit
- @ 5,000 per farmer for purchase of power operated equipments as the maximum limit
- @ 45,000 per farmer for purchase of power tillers as the maximum limit
- @ 9,000 per farmer for purchase of diesel engines as the maximum limit

(ix) Promotion of Integrated Pest Management: For the promotion of integrated pest management, units for disease and pest forecast are being established to forewarn about the outbreak of diseases and pests. The assistance being provided under this programme is:

- @ `1,000 per ha per farmer for adoption of Biopesticides.
- @ `80 lakhs (public sector) and @ 50% of the cost with a maximum limit of `40 lakhs (private sector) for setting up of Bio Control Laboratories.
- @ `4 lakhs for establishing Disease Forecast Centre (public sector).

(x) Establishment of Plant Health Clinic (PHC): Plant health clinics are being established in private sector by encouraging Agriculture/ Horticulture Graduates to provide this service at the farmers' doorstep. Financial assistance with a maximum limit per unit @ ` 20 lakhs (public sector) and `5 lakhs (private sector) for setting up these clinics is available.

(xi) Establishment of Tissue/Leaf analysis laboratory: Setting up of Tissue Analysis Laboratories is being encouraged in the State for the determination of essential nutrients available to the plants and enabling recommendation of different fertilizers and trace elements for supplementing the deficiency of these nutrients. Assistance @ 100% with a ceiling of 20 lakhs (public sector) and @ 50% with a ceiling of ` 5 lakhs (private sector) is being made available under this programme.

(xii) Development of Beekeeping: Assistance @ 50% of the cost or 250/- per colony and @ 50% of cost of Bee hives/ equipment or `350/- per set, which ever is less is being made available under this programme.

(xiii) Entrepreneurial Development of Women farmers: Women are inextricably involved in horticulture activities in Himachal Pradesh. There is a need for these women to be

organized into selfhelp groups and provide them training in different horticulture activities. They are being empowered and involved in decision making at the household level. The assistance being provided under this programme is as follows:

- @ ` 10,000 per district for conducting baseline survey.
- @ ` 20,000 per district for the development of curriculum.
- @ ` 10,000 per district for conducting refresher training of facilitators.
- @ ` 1,000/- per woman farmer for training of 5-day duration.
- @ ` 5,000/- for the formation of self help group.

### 5.3 Technology adopted in the sector along with any changes in technology

The Department of Horticulture is taking necessary steps for the introduction of new technologies like micro irrigation, protected cover cultivation, use of bio-fertilizers in horticulture, improved horticultural tools, implements and machinery, field diagnostic facilities for the diagnosis of the pathological and nutritional disorders.

Following strategies are being proposed by the department which intends to use technologies for development and promotion of horticulture sector

1. Minimum use of pesticides with 1. emphasis on Integrated Pest Management (IPM) and biological control of pests and diseases.
2. Utilization of information technology for the dissemination of technical know how and marketing information to the fruit growers.
3. Improvement of water management practices in the orchards through

adoption of scientific water harvesting, storage and application practices.

4. Utilization of high-tech horticulture technologies like protected cultivation of horticulture produce, use of biotechnology, micro irrigation technologies, use of plastics etc. for the improvement of horticulture productivity.
5. Creation of scientific post harvest management infrastructure.
6. Value addition and diversification in processing industry.

Furthermore, increase in use of the frontier technologies like Remote Sensing, Information Technology and Bio-Technology in the field of horticulture have been proposed. The role of Biotechnology in horticultural crops is as follows:

1. Conventionally Bred Crop Types: i.e. through cross pollination.
2. Somaclonal variants: These occur when clones are not identical to parent.
3. Somatic hybrids: These are produced when protoplast of two different species are fused.
4. Genetically Engineered Species: These are produced by manipulating chromosomal DNA
5. Tissue Culture: These are produced by regeneration of plant tissues.

A. Following technologies are being used in the State

a. Drip irrigation: Water is applied at a rate of 4-10 litres/hr to wet the portion of root system. It is very useful because of minimal water requirement with soil erosion eliminated, spread of weed is controlled and fertilizers & nutrient uptake improved.

b. Organic Manure: Farm yard manure & compost sludge are being propagated.

c. Green Manure Crops: Undecomposed plant tissues are being propagated for adding to soil in order to improve its fertility.

B. Horticulture Technology Mission (HTM): HTM for the development of horticulture in the State with the financial assistance of ` 115.50 Crores was launched to establish convergence and synergy among numerous ongoing government programmes in the field of horticulture development. Further, the programme aimed to achieve horizontal and vertical integration of these programmes to ensure adequate, appropriate, timely and concurrent attention to all the links in the production, post harvest management and consumption chain, maximize economic, ecological and social benefits from the existing investments infrastructure created for horticulture development, promote ecologically sustainable intensification, economically desirable diversification and skilled employment to generate value addition, promote tree development and dissemination of eco-technologies based on the blending of the traditional wisdom and technology with frontier knowledge such as bio-technology, information technology and space technology and to provide the missing links in ongoing horticulture development projects.

During the year 2009-10, the Government of India has approved an action plan of ` 20.00 Crores under this project. During the year 2009-10 the Government of India has released ` 13.00 Crores which has been received in two installments.

C. Technology and Information Boost: The Agricultural University at Palampur and the Horticulture and Forestry University at Nauni (Solan) are the two organisations mandated to generate technologies for improving crop and horticultural production.

D. Introduction of new technologies: Department of Horticulture is taking initiatives for the introduction of new technologies like



micro irrigation, protected cover cultivation, use of bio-fertilizers in horticulture, improved horticultural tools, implements and machinery, field diagnostic facilities for the diagnosis of the pathological and nutritional disorders.

E. Horticulture Information Services: The horticultural information and publicity service is being properly strengthened, to be able to serve the ever increasing needs of the orchardists of the State through:

1. Publication of farm bulletins, pamphlets, posters, handouts, newsletters monthly magazines, farming guide and horticultural calendars.
2. Horticultural development for publication in the newspapers and periodicals.
3. Publicity through Radio and Television by supplying scripts and recorded tapes of features, talks and timely limits to the orchardists.
4. Setting up of State and Regional Horticultural Museum.
5. Organization of farmers' fairs, horticultural shows, exhibitions and horticultural production competitions.
6. Preparation of films and videotapes on horticultural subjects.
7. Publication of horticultural products of the State through advertisements, hoardings, radio, television, slides, publicity brochures etc.
8. Establishment and maintenance of Horticulture Departmental libraries at directorate and district level.
9. Provision of modern equipments required for preparing publicity materials and other teaching aids etc.

Under this scheme, it is proposed to organize fruit shows-cum-exhibitions in State/district fairs besides publications of various booklets, farmers' bulletinbooks and CDs on recommended package of practices for fruit crops, floriculture, medicinal plant cultivation etc. and organizing seminars.

F. Plant Tissue Culture Laboratories: Department of Horticulture has promoted 2 plant tissue culture labs one in each private & public sector for rapid propagation of horticulture & floriculture planting material. The location and activities of this lab is described in Table 29.

**Table 29: Location & Activities of Plant Tissue Culture Lab**

Sr. No.	Name and Address of the Laboratory	Approximate plant propagation capacity
1	Agrigene International, Highway Home, Sanjauli, Shimla 171006	2 lakh micro plants
2	Department of Biotechnology, Dr. Y S Parmar University of Horticulture and Forestry, Nauni, District Solan, HP.	50000 virus free plants every year

G. Horticultural Research and Education: The application of science and technology is the most crucial factor in the process of development of horticulture in the State. With the increase of the area under different fruit crops in the State, the problem of the horticulture industry has increased to a greater extent requiring solution to solve them so as to keep the industry in the line of business. Increasing problems of insects, pests and diseases, low productivity of fruit crops, plant nutritional problems, post harvest losses of horticultural produce etc, are the major problems which are threatening the economic viability of the State horticultural industry. This research & education is being carried out at various levels by National & State level institutions / universities located in the State.

H. Plant Protection: The pest and disease infestations in the orchards result in the loss of fruit produce, thereby causing economic losses to the fruit growers. The damage to fruit crops both in quantity and value due to pests and diseases has been estimated at 15% to 20% even in the normal years, which is gross

national wastage. Therefore, it is a matter of prime concern to adopt modern plant protection measures at all stages of development of horticultural crops so that they do not act as a limiting factor in fruit production programme. The objectives of the scheme are as under:

1. To make timely arrangement for the supply of various pesticides, insecticides and plant protection equipments to the fruit growers for the control of pests and diseases in their orchards at reasonable rates.
  2. To prepare spray schedule for the control of pests and diseases for guidance of fruit growers.
  3. To organize campaigns for conducting spray operations for the control of pests and diseases of economic importance in important fruit crops like apple, mango, citrus, peach, plum, etc. and to provide fungicides/insecticides at subsidized rates to the fruit growers.
  4. To introduce modern technology for the surveillance and development of computer based pest and disease warning system in the fruit growing areas.
  5. Enforcement of various acts relating to nursery inspection and certification plant quarantine, plant protection and control of obnoxious weeds, etc.
  6. To promote integrated pest management for fruit crop protection through use of technologies like use of bio-chemicals, biological control of insect pests and diseases etc. which may reduce the use of chemicals harmful for human health and environment.
- The following schemes are proposed to be implemented under this programme during the 11th Five Year Plan.

(a) Control of pests and disease of economic importance: In recent years, diseases like apple scab, premature leaf fall and attack of pests like woolly aphid and red spider mite in apple crop, phytoplasma and leaf curl disease in stone fruits, attack of hoppers in mango, red rust disease are serious threats to the horticulture industry of the State. For combating these pests and diseases, effective spraying operations with

insecticides and fungicides are required to be organized in the orchards. Therefore, this scheme aims at providing insecticides and fungicides to the fruit growers at subsidized cost at the rate of 50% to small and marginal farmers and 30% to the big farmers.

(b) Integrated Pest management (IPM): Biological control of the pests and diseases is the major component of integrated pest management. Biocontrol agents are environment friendly and more cost-effective as compared to chemical pesticides. One laboratory for rearing and dissemination of the useful insects in the fruit growing areas as natural enemies of harmful insect, pest and disease has been established in the State. A target of covering 2.0 lakhs ha of area annually under plant protection through IPM has been fixed for the 11th Five Year Plan.

I. Horticulture Development: This scheme is the major programme of horticultural development aiming at the creation and maintenance of infrastructural facilities in the rural areas for ensuring equitable access to the resources and inputs required for the promotion of all fruit crops, hops and medicinal and aromatic plants. Under this scheme inputs and other related materials are provided on subsidy to the fruit growers to implement all the programmes effectively. Since the financial year 2003-04, the scheme has been restructured and the subsidy component, considered as the committed liability, has been transferred to Non-Plan activities. Therefore, during the 11<sup>th</sup> Five Year Plan 2007-12 and Annual Plan 2007-08, programmes like development of fruit production, area expansion, demonstration of new technologies and improved package of practices on the orchards of fruit growers, major works for the development of infrastructure, development of Walnut/ Hazelnut / Pecan nut, development of olive, development of mango/litchi in lower hill areas, development of strawberry and other small fruits, development of medicinal and aromatic plants, horticulture information

services, development of hops scheme, micro irrigation for private orchards, short term research projects for solving the field problems of emergent nature and externally aided projects will be carried out under this scheme.

(a) Development of Fruit Production: The scheme provides infrastructural and mobility facilities at Regional/ District/Block/Field level for the distribution of inputs required for the maintenance of existing orchards and for the expansion of area under fruit crops in rural areas. The objectives of the scheme are given below.

1. Bringing more and more area under all fruit crops in the potential areas of different agroclimatic regions.
2. Introduction of new improved varieties of different fruit crops for increasing the quality production of fruits and productivity per unit area.
3. To replace the old and uneconomic fruit plant with new improved varieties.
4. To ensure the availability of certified planting material of standard quality to the fruit growers.
5. Strengthening and maintenance of input supply services in the fruit growing areas for easy and timely availability of production inputs.
6. Identification of fruit trees of outstanding merit for the selection of State mother trees for the supply of bud wood to the nursery growers.
7. Introduction of new improved varieties and rootstocks of different fruits from advanced countries.
8. Demonstration of recommended package of practices and new technologies on the farmers' field.

(i) Area Expansion Programme: Under the area expansion programme, it is proposed to bring 20,000 ha of area under fruit plantation additionally in the State during the 11th Five Year Plan by distribution of 20.00 lakh fruit plants annually. Besides this, 10000 ha of area

of old and uneconomic orchard is also proposed to be planted during the 11<sup>th</sup> Five Year Plan. An area of 2000 ha is proposed to be replanted during the year 2007-08. During the 10<sup>th</sup> Five Year Plan, an optimum production level of 696 thousand MT was recorded during the year 2005-06. A target of achieving 906 thousand MT fruit production is proposed for the 11th Five Year Plan. A target of 746 thousand MT fruit production is proposed for the Annual Plan 2007-08. An area of 198000 ha has been covered at the end of 10<sup>th</sup> Five Year Plan by adding 27211 ha of area additionally. A target of covering 202000 ha of area under fruits is proposed for the Annual Plan 2007-08. For increasing the productivity of fruit crops in the State, it is proposed to introduce new improved varieties from advanced countries for evaluation and multiplication of the departmental demonstration orchards, for supply to fruit growers.

(b) Special Subsidy Scheme: The horticulture production units require huge investment for the installation at initial stages and further maintenance. It is therefore, proposed to provide assistance in the form of subsidy to the fruit growers to encourage them to take to horticulture and its ancillary activities for their self employment and to generate income. The objectives of this scheme are given below.

- a) To provide assistance to small and marginal farmers so as to encourage

**Table 30: Available Subsidies for individual orchards**

Sr. No.	Category of farmer	Rate of subsidy
1	Small farmers	25%
2	Marginal farmers	33%
3	Scheduled Castes/Scheduled Tribe / Backward area farmers.	50%

(ii) Subsidy for the development of garden colonies: The garden colony is the concept of developing fruit plantation by more than six farmers in a compact area under common fencing and common infrastructural facilities

them to take to horticulture avocation for their economic upliftment.

- b) To incentivize the unemployed educated rural youth to set up horticultural custom hiring-cum-service centres for self-employment.
- c) To provide incentives to the fruit growers to adopt new technology like drip irrigation for increasing the productivity in their orchards.

The details of the subsidy schemes are given below.

Under this scheme, subsidy on the cost of various inputs required for the establishment for new orchards is available to the small and marginal farmers, Scheduled Castes and Scheduled Tribes farmers and families falling under IRDP. The details of the subschemes are given below:-

(i) Subsidy for the development of individual orchards: Under this scheme, subsidy on various inputs for the establishment and maintenance of orchards like fruit plants, fencing, irrigation material, horticultural tools and implements, micro-nutrients etc. are available to an individual fruit grower belonging to small and marginal and other weaker sections of farmers community at the following rates subject to the maximum of `3000 per farmer Table 30 describes rate of subsidy as per category of farmer.

Like farm machinery and irrigation facilities. Such a programme will help in the reduction of cost on the management of orchards. The total area of the garden colony should not be less than 5 acres. The maximum amount of subsidy available for a five acres garden colony is above ` 18,000. Table 31 describes incentives available to the small and marginal and weaker section of the farmers' community for the establishment of garden colony.

**Table 31: Available Subsidies for Garden Colonies**

Sr. No.	Item of Subsidy	Rate of Subsidy Admissible
1	Common facilities like fencing, irrigation and plant protection equipments.	50% to small & marginal farmers and 75% to SC/ST & IRDP farmers
2	Consumable inputs like plant material, pesticides, micro-nutrients, horticultural tools, implements etc. for the maintenance of orchards.	25% to small farmers, 33% to marginal farmers and 50% to SC/ST & IRDP farmers

(c) Development of Walnut/Hazelnut/Pecan/Pistachio Nut:

Although, agro climatic conditions in mid and higher hill regions of the State are quite suitable for the cultivation of walnut (*Juglans regia*), yet its cultivation has not been commercially exploited. According to the horticultural census conducted by the State in 1989, there were about 1, 63,750 walnut trees (about 935 ha of area) in the State. According to the latest estimates, an area of 4785 ha is existing under walnut plantations, which are generally in scattered form planted at higher lands. So far no regular walnut orchard has been planted in the State by any fruit grower. The reasons for slow expansion of walnut cultivation in the State are:

1. Non-availability of grafted plants of superior cultivars due to lack of effective propagation techniques.
2. Walnut plants raised by seed show high variability and trees assume very large size where as the farmers have very limited land holdings.

The Department of Horticulture referred the problem of grafting in walnut to APEDA in 1998 and requested the said organization to fund a project for the standardization of grafting techniques in walnut. The State Horticulture University had standardized a technique of 'Side Veneer grafting of Walnut' in

the months of July- August. Chip budding during May to first week of June has also been recommended under mid hill conditions.

Therefore, by the adoption of these technologies it will be possible to popularize the commercial cultivation of walnut in the State.

There is a great potential for the development of Pecan nut in the low and mid hills of the State. At present 646 ha of area is existing under Pecan plantations with an annual production of 173 MT. Efforts are being made to propagate improved varieties of Pecan for distribution to the growers. Every year, a demand of around 10000 Pecan plants is being received which is being met from the Government and private registered nurseries. The growers who have got pecan plantations are fetching good returns for their produce.

The objectives of the scheme are given below.

1. To survey, identify and earmark the wastelands for the development of walnut/pecan/pistachio nut plantation.
2. Training of field staff and registered nursery growers in the techniques of veneer grafting of walnut.
3. Selection of walnut trees in the State having outstanding merits for obtaining budwood for grafting of walnut seedlings
4. Propagation and multiplication of walnut grafted planting material for distribution to the farmers at reasonable rates.
5. Development of demonstration plantation of walnut on State Govt. owned or private waste lands through the technology of "In Situ" and "Hedge Row Planting".

During the 11<sup>th</sup> Five Year Plan 2007-12, efforts will be made to develop 1-2 nut crop development stations in the State for the collection of improved germplasm of walnut /hazelnut/pecan nut and propagation of

grafted plants of these nut crops for supply to the fruit growers. It is also proposed to introduce improved walnut and Pecan varieties (specially with lateral bearing habit) from advanced countries for evaluation and propagation at walnut development stations and distribute 1.0 lakh plants to the growers during the 11th Five Year Plan.

(d) Development of Olive: There are about 20 species of olive which are found in the tropical and sub-tropical region of the world but the edible fruits and oils are produced only from the cultivars of *Olea europea*. Olive is mainly used for oil extraction, which is used in cooking and the manufacture of perfumed soaps. Olive is not only nutritious and tasty but its fat contents are also free from cholesterol. Ripe olive also contains calcium, iron and Vitamin A. Besides oil extraction, olive is used for making pickle and has got medicinal importance.

In Himachal Pradesh, the practical indication of the possibility of commercial cultivation of olive is provided by the presence of wild species of olive, locally known as "Kahu" in concentrated belts between elevations ranging from 1000-1300 metres above mean sea level. These wild olive belts are found in the districts of Kullu, Mandi, Chamba, and Sirmaur, while scattered wild olive plants are also found in the Shimla and Solan districts of Himachal Pradesh.

The introduction of the cultivated olive varieties in the State of Himachal Pradesh was initially made in the year 1959 when 21 olive trees of Italian varieties were introduced at the Progeny-cum-Demonstration Orchard (PCDO) Jadhari (Tehsil Kandaghat, Solan District). Later on in 1963, 14 varieties of olive were introduced at the PCDO Nihal, Distt. Bilaspur, on experimental basis. The olive plantation made at the Progeny orchard Nihal failed due to unfavourable agro-climatic conditions but the plantation made at progeny orchard Jadhari performed well. These preliminary trials provided broad indications regarding the micro

climatic range in which the olive cultivation could be experimentally tried.

Utilization of the available wealth and wild olive species for development of olive plantation through

the technology of top working was another significant aspect taken care of during the 1970's and large scale top working programme of wild olive trees with superior varieties were carried out in the mid hill regions of Chamba and Mandi Districts. During the year 1972 and 1974, two olive development stations were established at Lanji (Chamba district) and Panarsa (Mandi district) and a large number of wild olive trees were top worked with superior varieties earlier imported at Nihal (district Bilaspur).

Indo-Italian Project for the development of olive and other fruits was implemented from the year 1986 to 1993 in two phases. Under this project, 16 olive cultivars have been introduced at Project Base Bajaura, district Kullu. Main emphasis under the Indo- Italian Olive Project was given on the evaluation of olive varieties under local agroclimatic conditions. Demonstration plantations were established in different locations in Mandi, Kullu, and Chamba districts. The olive plantation showed very encouraging results in the year 1992-93 when 7.37 MT of olive production was recorded which yielded 874 litres olive oil. The crop during the years 1993-94 to 1995-96 was very poor due to adverse weather conditions during the flowering time. However, evaluation of olive varieties has shown encouraging results, which has yielded about 23% oil of virgin quality. The infrastructure for processing of olive and extraction of olive oil has been established at fruit canning unit, Shamshi, Kullu. The Indo-Italian project was terminated on 31<sup>st</sup> December, 1993 and since then, the activities of the project are being carried out under the State plan funds. The olive development work in the State will be undertaken under this scheme during the 11<sup>th</sup> Five Year Plan with the following objectives:

1. Introduction of improved olive varieties from abroad and multiplication of planting material of outstanding olive varieties in glass houses set up at Bajaura and Chamba for supply to the fruit growers.
2. Planting of demonstration plots in the field of the farmers in various districts/locations to evaluate the performance of different olive varieties at different locations.
3. To provide extension services to olive growers so as to acquaint them with the improved techniques of olive cultivation.
4. To organize training to olive growers in various operations in olive production.
5. Training of field staff in the propagation of olive planting material.
6. To intensify the drive to popularize the olive cultivation in mid hill areas of the State.

(e) Development of Mango/Litchi in Lower Hill Areas: Mango has wide adaptability in lower hill areas up to an elevation of 1200 metres. With deep root system, it has a capacity to withstand drought conditions, hence is suitable under rain fed conditions. Therefore, mango is developing as the main fruit crop in lower hill areas in the State. Besides mango, litchi has shown good potential in lower hill areas especially in Kangra district. But its cultivation has been confined to certain pockets only because it has got very specific climatic requirements. The areas with high humidity and abundant moisture are best suited for its cultivation. The young plantation of mango and litchi are required to be protected from frost during winter months. However, preference for the development of these fruit crops will be given in frost free areas. The salient features of this scheme are given below.

1. Increase the mango and litchi production by bringing more and more area under these crops, in lower hill

areas for economic upliftment of rural population.

2. Increasing the production of planting material of mango and litchi in departmental and private orchards and fruit nurseries.
3. To demonstrate the technology in plantation and maintenance of litchi orchards.
4. To demonstrate the technology “In Situ” plantation of mango.
5. To create employment generation through largescale plantation of these fruit crops in rural areas.

Generally fruit plantations are raised by planting seedlings or grafted plants in the properly spaced pits. Under normal plantation programme, planting material is first grown in the nursery and after one or two years, these are transplanted into pre-prepared pits. But mortality in such plantation is very high under rainfed conditions. Therefore, raising of seedling by directly sowing the seeds into the well spaced pits supplemented with the moisture conservation techniques like grass or plastic mulching etc. is the most appropriate technology for establishing fruit orchards in rainfed areas. The seedlings so raised are later on grafted with the scion of improved varieties at appropriate time. This technology is known as ‘In Situ’ plantation of orchards. This technology has been successfully practiced for raising mango orchards in lower hills and valley areas of the State Since mango is one of the most potential crop in Himachal Pradesh, it is therefore, proposed to raise mango plantations through “In Situ” technique in 7000 ha of area during the 11<sup>th</sup> Five Year Plan at the rate of 1400 ha per annum.

(f) Development of strawberry and other small fruits: The small fruit has utilization in processing industries for the manufacture of high quality fruit products and has demand in fresh market as well. Since these fruits are highly perishable, the cultivation of these fruits is being encouraged in the areas surrounding

the processing industries of the State. The cultivation of these fruits is also being encouraged in the orchards as inter crops to supplement the income of fruit growers in case of failure of the main crops. The Government had proposed to establish 1-2 demonstration orchards-cum-nurseries for the collection of improved germplasm of strawberry and other small fruits and propagation of planting material of these fruit crops for supply to the fruit growers.

(g) Development of Medicinal and Aromatic Plants: The cultivation of medicinal and aromatic plants has got greater significance in saving the forest wealth of the State in order to prevent their haphazard extraction and extinction from the forests. During the seventies, initiatives were undertaken for the introduction of several medicinal and aromatic plants into regular agriculture, necessitating the development of new varieties and improved productivity of traditionally grown crops to broaden raw material base for expanding native industries. The decade of nineties has opened up farm based economy in the country leading to increased export value products in the form of intermediary phytochemicals, perfumery, food flavours, cosmetics and toiletry goods.

In this context, the State Govt. has taken a policy decision to make the development of medicinal and aromatic plants as farm based activity and hence the mandate of cultivation of these plants has been given to the Department of Horticulture which previously was with Ayurveda Department. The State Horticulture University, Nauni, has made the collection of germplasm of many medicinal and aromatic plants and standardized the package of practices for these crops. Therefore, this scheme aims at promotion of cultivation of medicinal and aromatic plants in the State. The objectives of the scheme are given below.

1. To establish demonstration farms for the collection and multiplication of

medicinal and aromatic plants for supply to the farmers.

2. To demonstrate the technology in the cultivation of medicinal and aromatic plants on the fields of the farmers.
3. To provide incentives to the farmers for increasing the production of medicinal and aromatic plants in the State for providing raw material to the pharmaceutical and cosmetic industries.
4. To supplement the farm income of the farmers for their upliftment.

(h) Development of Hops: Hops is an important horticultural crop of the tribal areas of the State which has got specific a market within the brewing, bakeries and pharmaceutical industries. The development of hops was started in Lahaul Valley in the year 1975-76 but much progress was not made up to the 8<sup>th</sup> Five Year Plan when great thrust was given on increasing hops production in the State and as a result of which the area under hops has increased from 10 ha in 1991-92 to 215 ha in the year 1995-96. Therefore, increasing the hops production of 21.5 MT in 1992-93 to 130 MT in the year 1994-95. Recently, due to liberalized import policy of Government of India, import duty on hops and its products have been reduced considerably. The hops in products like pellets etc. are freely available in the Indian market and brewing industries in the country have switched over to the use of hops pellets in place of dried hops cones. After the year 1994-95, the hops production gradually reduced to 29.6 MT in the year 1998-99. The area under hops was also reduced to 65 ha as most of the hop growers had abandoned the hops plantation.

To save the hops industry in the State from closure, the State Government has established a hops processing factory at Baddi in Solan district in 2000 under joint sector for production of value added products of hops like hops pellets, oil and extracts etc. Under this facility, hops is procured at the price fixed annually by the intervention of the State

Government so that availability of sufficient raw material (hops cones) can be ensured to cater to this industry. With the setting up of this factory, the hops cultivation in tribal areas of the State has started picking up. The objectives of this scheme are given below.

1. Intensification of drive to increase the hops production in tribal areas.
2. Introduction of improved aromatic and nonaromatic varieties of hops and multiplication of the same for supply to the hops growers.
3. To make necessary arrangements for the marketing of hops products to the brewing and pharmaceutical industries and for export.

To increase the hops production in the State, it is proposed to bring 80 ha of area under hops cultivation at the end of the 11<sup>th</sup> Five Year Plan 2007-12. A target of 45 MT hops production is proposed for the 11<sup>th</sup> Five Year Plan.

(i) Plant Nutrition: Application of nutrients to the fruit plants is one of the most important aspects in commercial fruit production. Generally, most of the horticultural crops draw large quantity of nutrients from the soil and for the replenishment of nutrient reserve, it is quite essential to add fertilizers and other micro-nutrients into the soil. It is also a well established fact that indiscriminate application of fertilizers to the fruit plants creates nutritional imbalance in the plants which may seriously reduce the crop yield and the quality of fruits even in the absence of any noticeable reduction in the tree growth and vigour.

Diagnosis of such conditions can be done with desired accuracy, rapidity and economically by chemical analysis of plant tissues. Leaf analysis has been found to be the most suitable technique in assessing the nutritional status of perennial and deep rooted crops. Therefore, three plant nutrition laboratories viz. Shimla, Bajaura (Kullu) and Dharamshala (Kangra)



have been established for providing free advisory services to the fruit growers for determination of nutritional status of their orchards. Besides these, two small laboratories for the collection and drying of plant leaf samples have also been set up in tribal areas viz. Reckong Peo (Kinnaur) and Bharmour (Chamba). The leaf samples collected and prepared by these small units are sent for analysis in the three State laboratories. The main objectives of this scheme are given below.

1. Strengthening and maintenance of existing fruit plant nutrition laboratories by providing additional staff and equipments.
2. Preparation of optimum and economic fertilizer schedule for fruit orchards based upon the plant tissue analysis and to provide free advisory services to the fruit growers in the field.
3. Survey of different fruit growing pockets in the State to assess the nutritional status of orchards and in the long run to prepare nutritional map of fruit growing areas.
4. Conducting adaptive trials regarding efficiency of various fertilizers and organic manures etc. as available in the market, in removing the nutritional deficiencies in fruit plants.

A target of 60000 leaf samples to be collected from fruit growers' orchards and analysed at the plant nutrition laboratories is proposed for the 11<sup>th</sup> Five Year Plan 2007-12. Therefore, it is proposed to provide additional technical staff in these laboratories by deployment from other schemes.

(j) Development of Apiculture: Himachal Pradesh offers very rich potential for the development of bee keeping because of larger area under horticulture, agriculture and forest. Honey produced by the honeybees, has big demand in the country as well as good export potential. As a cottage industry, it is possible to adopt bee keeping on commercial lines by the

farming community for getting additional income to improve their economic conditions. The objectives of the scheme are given below.

1. Application of modern techniques for harnessing of honeybees for pollination in the orchards and increasing the production of honey and other bee products in the State.
2. Creating opportunities of self-employment to the unemployed rural youths by setting up of beekeeping units by them.
3. Establishing big regional nucleus apiaries in the potential areas for breeding of honeybees and large-scale multiplication of honey with honey processing and grading facilities.
4. Maintenance of present small beekeeping stations in the State.
5. Arrangement of bee keeping equipments/tools/modern beehives etc. to the beekeepers.
6. Preparation of floral calendar and floral maps of different regions/ areas.
7. Supply of bee colonies on rental basis to the orchardists for pollination in their orchards during flowering season.
8. Providing mobility for the migration of bee colonies during flowering and winter season.
9. Honey processing and grading under AGMARK.
- 10 To arrange for the marketing of honey produced by private bee keepers.

(k) Development of Floriculture: Commercial floriculture was one of the main thrust of the 10<sup>th</sup> Five Year Plan in the State. The commercial cultivation of the flowers is of recent origin in the State of Himachal Pradesh. The total area under floriculture has increased from almost negligible to about 467 ha now. About 1500 growers are involved in producing flowers worth `8.30 Crores per annum. The potential existing in the form of diverse agro-climatic conditions in various regions of the State is being exploited for the cultivation of

wide range of flowers, ornamental plants and production of flower seeds/ bulbs etc. for year round supplies to the domestic as well as export market. Bilaspur, Mandi, Sirmaur, Shimla and Chamba districts have particularly made headway in floriculture especially in the production of carnation matching international standards. Department of Horticulture has established seven floriculture nurseries in various districts, viz. Navbahar and Chharabra in Shimla district, Mahog Bag and Parwanoo in Solan District, Bajaura in Kullu district and Dharamshala and Bhatoon in Kangra district. The objectives of the scheme are given below.

1. Introduction and multiplication of planting material/bulbs/seeds of improved flower varieties for supply to the flower growers at reasonable rates.
2. Identification of potential pockets for the development of commercial flower cultivation.
3. Introduction of modern technology in the flower production and post harvest management of flowers.
4. Strengthening of extension services in commercial flower cultivation in the State by updating the knowledge of existing extension staff in flower cultivation through special training to extension officers.
5. Creation of infrastructural facilities for the establishment of commercial floriculture model centre.
6. Demonstration of commercial flower production at identified Progeny cum-Demonstration Orchards of the Department of Horticulture.
7. To organize apex body of flower growers cooperative societies to facilitate marketing of flower produce in a collective way.
8. Strengthening and maintenance of existing flower bulbs and seeds in tribal areas.
9. To explore the possibility of collaboration with some advanced

countries for commercial flower production for export markets.

In order to boost commercial floriculture in the State, the Government of India has sanctioned a "Model Floriculture Centre" for Himachal Pradesh. The "Model Floriculture Centre" has been established at Mahog Bag (Chail), District Solan and a Tissue Culture Laboratory has been set up for the propagation of planting material of commercial important floriculture crops. The present infrastructure at the "Model Floriculture Centre" consists of 1706 m<sup>2</sup> of Greenhouse area, one unit for post harvest handling of flowers and three cool chambers for storage of planting material. Establishment of another Model Floriculture Centre in public sector has been approved by the Government of India for the year 2006-07 under Horticulture Technology Mission. This floriculture centre has been instrumental in proliferation of commercial floriculture in the State through collection and multiplication of improved floriculture germplasm and to create modern facilities for mass propagation of the same. The centre is providing training/demonstration to the commercial flower growers, entrepreneurs and departmental extension staff.

The scheme has proved to be quite useful in raising the socio-economic status of the farmers of the State. An area of 500 ha under floriculture is proposed to be covered during the 11th Five Year Plan 2007-12.

(l) Establishment/Maintenance of Government Orchards / Nurseries: Fruit plants as a basic input has vital importance in the development of fruit industry. Due to long gestation period of fruit crops, the fruit growers have to take utmost care while selecting the planting material for planting in their orchards. Therefore, the concept of Progeny-cum-Demonstration Orchards (PCDO) and nurseries as growth centres was developed right from the First Five Year Plan (1951-55). The Department of Horticulture is maintaining 104

PCDOs and nurseries in the State occupying about 1394 acres of land on which about 1.22 lakhs progeny trees of different species have been planted as a source of budwood for the propagation of planting material for supply to the fruit growers. These PCDOs apart from serving as models of demonstration to the orchardists are also sources of preservation, production and multiplication of quality plant material for commercial plantations in the State. The main objectives of the scheme are given below.

1. To stock progeny trees of outstanding merit for the supply of bud wood.
2. To multiply and supply pedigree and disease free plants at reasonable rates and to make supply available from the nearest possible source.
3. To conduct adaptive trials regarding the suitability of various varieties/ fruits/ new introductions and also the recommendations on various package of practices on micro area basis.
4. To serve as a model demonstration orchard and nucleus for the proliferation of the orchards in the surroundings areas.
5. To serve as an extension centre with a zone of impact in a radius of 8 kms.

A target of 40 lakh fruit plants to be produced at departmental fruit nurseries is proposed for the 11<sup>th</sup> Five Year Plan. Major thrust will be given on increasing the production of nursery plants of sub tropical fruits especially of mangoes. In temperate region, major stress will be given on the multiplication of clonal rootstocks of apple, pear, cherry and stone fruits and the production of grafted plants of improved varieties on these rootstocks for higher productivity in the orchards.

(m) Development of Mushroom: Mushroom cultivation was first introduced in the State in 1961 on trial basis under Technological Co-operation Programme of FAO. Later commercial application of technology was introduced under the FAO & UNDP assisted

project at Chamba Ghat in Solan district during 1977-82. During 1986-1992, project under Indo-Dutch programme for mushroom production was introduced at Palampur, Kangra. All these establishments helped in increasing productivity from 6 kgs per m<sup>2</sup> in 1992 to 10-15 kgs per m<sup>2</sup>. During 2001-02 over 3260 MT of mushroom were produced in State. Production of pasteurized compost for distribution to mushroom growers has been taken up by the Government at Dharbaggi (Kangra) & Bajaura (Kullu) District. These units supply pasteurized compost to about 400 new production units in Kangra, Kullu, Mandi & Bilaspur. About 20 small units are operating in private sector in Solan district which produces pasteurized compost. Present capacity to produce pasteurized compost is about 11170 MT annually. There are 9 spawn production labs in the State of which 6 are in the private Sector and 3 are with research institutions. Production of 2495 MT of mushrooms was recorded in 2000-01 in the State.

Mushrooms are popular for their delicacy, flavour as well as food value. The agro climatic conditions prevailing in many parts of the State provide ample scope for the cultivation of mushroom, both for domestic consumption as well as for export purpose. Mainly two types of mushroom viz. button mushroom (*Agaricus bisporous*) and Dhingri (*Pleurotus spp.*) are being cultivated in the State. The modern technology in commercial cultivation of mushroom was introduced under two externally aided projects implemented in the State viz. FAO/UNDP Mushroom Development Project, Chambaghat, Solan during the 8<sup>th</sup> Five Year Plan and Indo Dutch Mushroom Development project at Palampur (district Kangra) during the 9<sup>th</sup> Five Year Plan. Two bulk pasteurization units for compost have been established under these projects with total production capacity of 1350 MT of pasteurized compost (Chambaghat 350 MT and Palampur 1000 MT). The pasteurized compost from these units is being made available to the registered mushroom growers of Shimla, Solan,

Sirmaur, Kinnaur, Kangra, Chamba, Hamirpur, Una and Bilaspur districts. The small and marginal farmers and unemployed graduates are being given preference under these projects. The main objectives for the scheme are given below.

1. To provide facilities for training in mushroom cultivation to the prospective mushroom growers.
2. To provide extension services to the mushroom growers.
3. To demonstrate the techniques of mushroom cultivation in the production chamber of the projects.
4. To provide consultancy services to cooperative and private sector for setting up of mushroom production and processing units.
5. To develop suitable marketing and processing channels for this industry.

A target to achieve a production level of 6000 MT Mushroom per annum is proposed for the 11<sup>th</sup> Five Year Plan. Similarly, a target of production/supply of 3500 MT pasteurized compost through departmental units is proposed for the 11<sup>th</sup> Five Year Plan 2007-12.

#### **5.4 Stakeholder involvement in environment preservation and restoration**

Horticulture Department is the major stakeholder in the State. The horticulture extension services of this department have been strengthened up to the grass root level. In addition, the programme relating to the farmers training, demonstrations, fruit shows, exhibitions, seminars and workshops are organized for the dissemination of the technical know how to the farmers. Stakeholders (farmers) have been primarily the beneficiaries of the schemes of the Horticulture department. They

have also been part of the awareness, training and demonstration of various schemes and projects.

Himachal Pradesh Horticultural Produce Marketing and Processing Corporation Ltd. (HPMC): HPMC, a State Public Sector Undertaking, is marketing fresh fruits and vegetables, processing the un-marketable surplus and marketing the processed products. HPMC is planning to link its offices with Internet to help farmers sell their fruits directly to various markets in India.

During the year 2009-10 up to 30 November, 2009, HPMC has sold about ` 960.00 lakh processed products in the domestic market. Under Market Intervention Scheme (MIS), HPMC has procured about 875.00 MT of Apple due to less Apple production in the State and higher prices in the market, out of which about 813.00 MT of Apple was processed in the HPMC plants and about 52.70 MT of apple juice concentrate have been produced. HPMC purchased quality apple worth of `21.42 lakhs which was marketed through its network in the country. The Corporation did not receive any Mango fruit from the growers due to good return from the open Market and procured 41.00 MT of citrus fruits from the growers till date under this scheme. HPMC is supplying its products to Indian Airlines, Railways, Northern Command H.Q, Udhampur, M/s Parley. Up to 30.11.2009, HPMC has supplied products worth ` 253.00 lakhs to these institutions. HPMC also continued supplying fruits and vegetables to ITDC Hotels and institutions in Metro cities like Delhi, Mumbai, and Chandigarh. As on 30.11.2009, HPMC has supplied fruits and vegetables worth `170.00 lakh to these institutions. Similarly, as on 30.11.2009 HPMC has sold material worth `243.00 lakh to the growers in the State.

Himachal Pradesh Council of Science, Technology and Environment (HPCSTE): The primary objective of the Council is to deal with science & technology issues relevant to the

State. However, the Council is also involved in conducting activities related to environmental matters. The present environment related activities include Development of State of Environment Report, providing environmental data/information through the ENVIS centre, supporting National Green Corps/Eco-clubs programmes and technical studies such as (i) impact of climate change on small villages and (ii) vehicular air pollution besides supporting the implementation of policies on use of coloured recycled polythene carry bags under the HP Non-Biodegradable Garbage Control Act, 1995 and Roof top rain water harvesting in buildings. The major objectives of the HPCSTE are given below.

- To advise State Government on Science, Technology & Environmental policy issues & interventions.
- To develop, demonstrate & transfer appropriate technologies for hilly regions.
- To exchange scientific knowledge with national & international scientific Institutions / organisations.
- To promote, popularise and disseminate scientific & technological innovations.
- To create and strengthen science & technology facilities in the State.
- To promote research & development studies relevant to State needs.
- To establish linkages with universities, R & D Institutions.
- To provide consultancy services in successfully demonstrated/developed technologies.

Department of Transport: This department assists in regulating number of vehicles in the State and thus has a direct impact on air pollution levels as large number of trucks and other vehicles are deployed for transportation

of various horticulture produce. Besides, there are a number of stakeholders Government Departments related to natural resources namely Agriculture, Fisheries, Animal Husbandry and Forest & Wildlife.

Training Programme: Training and extension is an important programme for the transfer of technology to the farmers for increasing horticultural production This programme is also very important for human resource development to meet the skilled manpower need of the horticulture industry. This scheme aims at organizing training camps/ workshops/ seminars/courses/ study tours etc. for the farmers as well as to the technical officers and field functionaries of the Department of

**Table 32: Training Programs during 2007-12**

Sr. No.	Training Programme	Duration	No. of farmers to be trained
1	Village/Block and Distt. Level training camps	1-2 days	200000
2	Training Courses		
	1.Mushroom Cultivation	5-10 days	2000
	2.Beekeeping		1000
	3.Horticulture		2000
3	Study tours		
	1.Within State (40 farmers/tour)		1000
	2.Outside the State (40 farmers/ tour)		1000

ii) Training Courses for Technical Officers: Specialized training courses are required for up gradation of skills of the existing technical staff posted at various Progeny-cum-Demonstration orchards/Nurseries and other departmental units. Therefore, to achieve the above objectives, work shops, refresher training courses, seminars, etc. are organized in collaboration with the State Horticulture University, Nauni District Solan for technical officers/ field functionaries of the Department of Horticulture.

Horticulture. Therefore, this scheme has the following aspects.

i) Training of Farmers: Training is an important tool for the transfer of technology by “Learning and Doing” method. The importance of training is realized more in an avocation like horticulture whose specialized practices like pruning, plant protection, fruit preservation, beekeeping, mushroom production, floriculture, hops production, medicinal and aromatic plant cultivation etc. can be effectively learnt only through practical training. Table 32 describes the training programmes which are being organized for the farmers during the 11<sup>th</sup> Five year Plan 2007-12 under the scheme.

iii. Organization of Exposure visit of farmers /departmental officers to foreign countries: This scheme, organizes exposure visits/study tours of the farmers as well as the technical officers and field functionaries of the department to foreign countries to expose them to the modern horticulture technologies being adopted by the advanced countries in order to provide them with opportunities to augment their knowledge and understanding through the concept of ‘Seeing is believing’. This scheme has following two features.

Exposure visit of the farmers to the foreign countries: It is proposed that during the 11<sup>th</sup> Five year Plan 2007-12, 80 farmers (4 farmers per group) be sent for exposure visit to different countries. Exposure visit of the technical officers/field functionaries of the Department of Horticulture to the foreign countries: It is proposed that during 11<sup>th</sup> Five year Plan 2007-12, 60 officers (3 officers per group) be sent for exposure visit to different countries.

## 5.5 Critical environment issues /hotspots associated with the sector

During the year 1950-51, the total area under all kinds of fruits was 792 ha, with an annual production of 1200 tonnes which has increased to 1.92 lakh ha with production of 6.96 lakh MT in the year 2005-2006. The major environmental and social issues and problems related to horticulture in Himachal Pradesh are given below.

1. Predominant rainfed horticultural crops: - Rainfall is a crucial factor for the success of crop production. In Himachal Pradesh 81.3 % of the area is still not irrigated and is totally rain dependent. The abnormal pattern of rainfall over the past few years has caused great fluctuations in crop production. The performance of crops is directly related to rainfall received during the crop season. The rainfall in different districts is shown in Table 33. It has shown variation in different districts, in some it was excess while in others it was deficient.

**Table 33: District wise Rainfall (in mm)**

District	2005	2006	2007	2008
Bilaspur	724.8	1069.4	786.6	867.9
Chamba	1,952.7	1583.7	706.4	857.2
Hamirpur	1,162.4	1570.0	1448.2	1414.6
Kangra	1,765.1	1930.0	1756.3	1947.9
Kinnaur	1316.4	348.6	310.9	354.1
Kullu	992.2	814.8	886.6	1215.3
Lahaul & Spiti	795.4	490.8	336.0	411.6
Mandi	1309.0	1313.3	1169.7	1173.8
Shimla	1133.8	1177.1	967.4	1211.4
Sirmaur	1244.4	1299.1	1431.0	1432.6
Solan	921.6	829.8	1076.4	1368.2
Una	956.8	69.2	1131.0	1437.4
HP	1189.6	1102.5	1000.5	1141.0

Source: Statistical Outline HP-2008-09

2. Shift in cropping pattern by market driven forces: According to economic survey 2009-10, there is a shift in the land use pattern from agriculture to horticulture (fruit crops) in the past few decades. The area under fruits, which was 792 ha in 1950-51 increased to 2,04,629 ha during 2008-09. During 2009-10, it was envisaged to bring 4,000 ha of additional area

under fruit plants against which 3,612 ha of area was brought under plantations. About 8.74 lakh fruit plants of different species were distributed up to 31 December 2009. Area under apple has increased from 400 ha in 1950-51 to 3,025 ha in 1960-61 and 97, 438 ha in 2008-09. The area under temperate fruits other than apple has increased from 900 ha in 1960-61 to 26, 546 ha in 2008-09. Nuts and dry fruits exhibit area increase from 231 ha in 1960- 61 to 11,096 ha in 2008-09. Citrus and other sub tropical fruits have increased from 1,225 ha and 623 ha in 1960-61 to 21,588 ha and 47, 961 ha in 2008-09, respectively. Unfortunately, production of other fruits has not steadily increased over the years.

3. Threats of wildlife to horticultural crops: In the past, wild animals used to feed on wild fruits and other natural food resources and did not interfere with the horticulture crops. However, due to increases in their population and less of their natural food resources, wild animals have become more aggressive resulting in human animal confrontation. Monkey Sterilization has been set up in the State to check monkey menace. About 30,000 monkeys have been sterilized and released.

4. Inadequate soil and water conservation measures: A study conducted by National Bureau of Soil Survey on “Soils of Himachal Pradesh: Land capability classification and assessment of soil degradation status for suggested land use” established that only 21.4% of the States land area was moderately and marginally suitable for growing climatically adopted crops.

HP Horticulture University, Solan, in a separate study ‘Erodibility Status of Soils under different land uses in Shiwalik Hills of Himachal Pradesh’ recommended that ‘marginal lands such as barren and scrub lands in Shiwalik hills need special management practices for soil and water conservation to check further degradation. More effective soil and water resource conserving systems like agro-forestry,

agrihorticulture, silvi-pasture, controlled and rotational grazing and enclosure of degraded sites for natural regeneration needs to be done. About 78% of the population in the State sustains on agriculture or horticulture. Impact on 34% soil is so immense that it is on the verge of losing its fertility. Use of agrihorticulture crop species can assist to promote soil conservation. Inadequacy of knowledge on this issue has not catalyzed its wide spread usage.

5. Use of Agro Chemicals in horticultural crops: Widely used chemicals in the State include agriculture fertilizers (N+P+K), chemical pesticides, fungicides and herbicides or

**Table 34: Consumption of Fertilizer (MT)**

Year	Kharif (N+P+K)	Rabi (N+P+K)	Total
2004-05	18244	28009	46253
2005-06	19197	28776	47973
2006-07	18592	30389	48981
2007-08	20597	29361	49958
2008-09	23768	33595	57363

Source: Statistical Outline- HP, 2008-09

The use of pesticides, herbicides or weedicides has shown a sharp rise particularly in vegetable crops. The use of pesticides has two concerns (i) sub standard or outdated pesticides act as booster and not as killer and (ii) toxic residual effects remain unnoticed. Higher use of pesticides causes pollution both during manufacturing & process of handling and application in the field. Average use of pesticides is low in Himachal Pradesh but their use is high in areas where cash crops are grown.

Pesticides residues in food in Himachal Pradesh are increasing because use of pesticides is increasing at the rate of 10-15% per annum. In 1977-78, 50630 kgs pesticides were used which went up to 260000 Kgs in 1995-96. In 1990, fruits & vegetables were grown on 1,93,490 ha of land and 97,500 kgs pesticides were sprayed of which 65,000 kgs was Mancozeb. Residues of various pesticides have been recorded in milk, milk products & various fruits from the

weedicides. These are playing havoc because of their indiscriminate use, excessive quantities and substandard quality or quantity. For pesticides, toxicity level is hardly taken care of. Substandard fungicides and pesticides are on sale because of their cheap rates and used by farmers in large amounts.

The use of fertilizers has increased production in the State to a great extent since the late fifties when fertilizer use was introduced in the State. The consumption of fertilizers in 1985-86 was 23,664 tonnes, which increased to 57,363 MT in 2008-09. The trend in the use of fertilizers is depicted in the Table 34 given below.

Fields in Shimla, Solan, Sirmaur, Bilaspur, Hamirpur, Una, Kangra, Kullu, Lahaul & Spiti, Kinnaur and Chamba Districts for organochlorine, organophosphorus, carbamate, dieldrin etc.

6. Threat from obnoxious weeds: In the recent year, crop growing has faced a serious threat from rogues. These are Lantana, Ageratum conyzoides, Parthenium hysterophorus among plants and wild animals. Their population has increased tremendously but no data has been available on them.

7. Genetically modified seeds: There is a need of good quality seeds and disease-free planting material, including in-vitro cultured propagules which are essential for crop productivity and security for the future. Agricultural and horticulture universities should be encouraged to organise courses on seed technology and business, and mainstream business principles in all applied courses. A national seed grid needs to be established to ensure supply of seeds across the State, as per the area specific requirement. There is a need to assess the risks and benefits associated with GM crops in a credible and transparent manner. Priority should be given for genetic modification to incorporate genes which can help impart resistance to drought, salinity and other stresses. Water-use efficiency as well as

improvement of both nutritive and processing quality should also be accorded priority in the research agenda. Training and awareness in agronomic management procedures in respect of GM crop/GM Seeds varieties should be introduced.

8. Low adoption of latest technology by farmers and deceleration in extension activities: Inadequacy of education and understanding of farmers has been instrumental in wrong and unbalanced applications of chemical fertilizers and usage of Farm Yard Manure (FYM). The use of inferior quality or low dosage pesticides resulted in the evolution of new strains of crop insect-pests and diseases. The small and marginal farmers reveal that traditional varieties or crops could do better under adverse conditions than high yielding varieties or crops bred for better conditions. Besides this, The Department of Horticulture is also taking steps to introduce new technologies in the development of horticulture. Introduction of technologies like micro-irrigation, protected cover cultivation, use of bio-fertilizer in horticulture, improved horticulture tools, implements and machinery and field diagnostic facilities for diagnosing pathological and nutritional disorders are being promoted.

9. Generation of Waste due to spoilage/ disposal of horticultural produce because of lack of Road & Transportation/ Storage Facility: Due to delay in reaching the markets in Delhi and other cities, fruits grown by farmers get damaged. The storage of fruits and vegetables require special maintenance which includes temperature, relative humidity, etc. Without the maintenance of these factors, the protection of produce during storage is difficult.

Freezing perishable commodities are generally high in water content, and possess large highly vacuolated cells. The freezing point of their tissues is relatively high (ranging from -3 °C to -0.5 °C), and disruption caused by freezing generally results in immediate collapse of their



tissues and a total loss of cellular integrity. Freezing occurs in cold storage systems either due to inadequate refrigerator design, or due to thermostat failure.

Chilling injury is manifested in a variety of symptoms including surface and internal discoloration, pitting, water soaking, failure to ripen, uneven ripening, development of off flavors and heightened susceptibility to pathogen attack.

Relative Humidity (RH): RH can influence water loss, decay development, the incidence of some physiological disorders, and uniformity of fruit ripening. Condensation of moisture on the commodity (sweating) over long periods of time is probably more important in enhancing decay than is the RH of ambient air.

Drying: Inadequacy of moisture in apple, peach, plum, apricot and almond orchards because of inadequate snow and rain during this season is not good for the crops. The sudden rise in day temperature in March has further reduced the moisture content of the soil.

10. Use of chemicals for enhancing the size, color and ripening of produce: Most farmers in apple-growing areas are under pressure from middlemen to ensure regular supply of apple much before its due time as early arrival is highly remunerative. In order to achieve their target, they start ripening the fruit well in advance by using certain chemicals. For this, they are spraying an overdose of chemicals on the plants to enhance colour development (of the fruit) and to speed up its ripening process. Ethylene - a naturally occurring plant hormone - is a chemical commonly used by farmers to enhance colour development in apples. It is commonly available in the market under the brand names Ethefon and Ethereal. Fruit colour starts developing nearly 15 to 20 days before attainment of maturity of fruits.

However, The Department of Horticulture is raising awareness among farmers about the

need for adopting organic farming instead of chemical farming in apple orchards. "Though use of chemicals stimulates or regulates various plant processes, including the opening of flowers and shedding of leaves, its overuse at this stage (when the fruit is naturally attaining colour and ripening) has a negative impact both on the fruit and the plant."

11. Inadequate use of Hitech Horticulture: Hi-tech horticulture includes the deployment of modern technology, which is capital intensive, less environment dependent, having capacity to improve the productivity and quality of produce. Hi-tech interventions in horticulture are not new. The sector, by itself is highly technology driven, needs deployment of modern technologies like micro propagation, micro irrigation, protected cultivation, organic farming etc. which require skilled manpower as well as instruments. While the Indian Council of Agricultural Research (ICAR) and State Agricultural Universities (SAUs) have been addressing the research and training aspects of hi-tech applications, some of them are introduced at the farmers' fields by the Department of Agriculture and Cooperation (DAC) since 8<sup>th</sup> Plan. Prominent among these include micro propagation, drip irrigation, green-house cultivation, plastic mulching, low tunnels, shading nets etc. The areas of hi-tech horticulture that have scope for adoption are fertigation, use of biofertilizer, vermiculture, organic farming, hi-tech mechanisation, soil-less culture and biological control. The Department of Horticulture is also promoting hitech-horticulture technologies like micro propagation, micro irrigation, protected cultivation, organic farming etc in the State.

12. Dwelling of Soil Health: The soils in the State not only show deficiency of NPK (low to medium) but also of secondary nutrients (Sulphur, Calcium and Magnesium) and micro nutrients (Boron, Zinc, Copper and Iron etc.) in most parts of the country. Besides the three primary nutrients (N, P, K), deficiency of Sulphur and micro nutrients like Zinc and

Boron is observed in many district areas like Shimla, and Bilaspur (Block-Jukhala). Intensive farming practices leave little time between harvesting of one crop and sowing of the next. As a result, soils do not get adequate rest to replenish its lost fertility in a natural process while increasing food production, has caused second generation problems in respect of nutrient imbalance. Some such problems include:

- Emerging deficiencies of secondary and micronutrients,
- Decline of water Table and its quality of water,
- Decreasing organic carbon content, and
- Overall deterioration in soil health

For the benefits of farmers, the Department of Agriculture has established 12 soil-testing labs and has also deployed 3 mobile soil-testing labs. During the 11<sup>th</sup> Five year plan, the Department of Agriculture proposes to cover all the farmers in the State with soil health cards and it is proposed to distribute 125,000 number of soil health cards during Rabi and Kharif Season 2010-11.

13. Suffering of farmers due to loss of crops on account of weather risk: Himachal Pradesh is a mountainous State comprising large Himalayan ranges with complex geological structures. The topography and climatic conditions make it particularly prone to natural disasters caused by drought avalanches, floods, cloudbursts/flash floods, and glacial lake bursts etc. The extent of the of the damage caused by drought is given in Table 35.

**Table 35: Damage Due to Drought Conditions in Himachal Pradesh**

Main Affected Crops	Qty. in (000,MT)	Estimated Value ( in Crores)
During the Year 2000 - 2001 (Rabi Season)		
Damage to Agriculture Crops	411.00	238.79
Damage to Horticulture Crops	226.34	122.06
<b>Total Loss</b>	<b>637.34</b>	<b>360.85</b>
During the Year 2002-03 (Kharif Season)		
Damage to Agriculture Crops	612393.00	366.00
Damage to Horticulture Crops	225382.00	341.21
<b>Total Loss</b>	<b>837775.00</b>	<b>707.21</b>
During the Year 2005-06 (Rabi Season)		
Damage to Agriculture Crops	356.02	235.00
Damage to Horticulture Crops	2.25	90.00

Source: State of the Environment Report on Himachal Pradesh (undated), released in October 09

14. Poor post harvest management: Lack of sorting facilities, inappropriate packaging, slow transport systems and inadequate storage facilities add to the deterioration of these perishables. There are 11 grading and packing centres in Himachal Pradesh with an installed capacity of 37,500 tonnes. Grading is generally not followed at the producer's level. As a whole, grading facilities of the desired level have not been created. High post-harvest due to:

- Lack of modern post harvest management system
- Very high temperature differentials in the produce in areas and the consuming markets, especially for temperate fruits, during the marketing period
- High perishable percent of most temperate fruits causing severe post-harvest losses during transport
- Orchards located from the main roads necessitating manual/animal transportation of the produce.

It is difficult to maintain the quality and safety of horticulture crops during packaging. Packaging protects the produce from mechanical injury, and contamination during marketing. Packaging accessories such as trays, cups, wraps, liners, and pads may be used to

help immobilize the produce within the packaging container while serving the purpose of facilitating moisture retention, chemical treatment and ethylene absorption.

15. Inadequate marketing and post harvest infrastructure: The agro-climatic conditions of North-western Hilly Region of India are conducive for cultivation of various fruits and vegetables, which give very high returns to farmers as compared to traditional crops. These fruits and vegetables are highly perishable and require immediate disposal especially in absence of cold storages. This requires elaborate arrangements for marketing of these perishable products. Due to the increasing volume of production, the marketing problems are aggravating. The post harvest facilities such as packing and grading houses and cold storage facilities are also awfully short but highly skewed as well. For example, total packing and grading (combined) houses capacity in the State stood at 25,000 MT. Of this, while 80% capacity was found in Shimla District, main production area, another 20% was located in

Kullu District (Table 36). Here it is worth mentioning that though Shimla is the major apple producing district, this fruit crop is grown in eight other districts of the State. In addition to this, grading houses with capacity of 6,000 MT with are spread across apple producing areas also exist in the State. Another crucial component of infrastructural support for the production of fruits and vegetables is the existence of cold storage facilities. Of the total cold storage capacity of 16,250 MT, 50% lies outside the State in distant places such as Delhi, Chennai and Mumbai. If one excludes the exit point cold storage facility (18.46%) at Parwanoo in Solan district, then only about 30% of the total cold storage is within the State. Further, whatever is within the State, 80% of that lies in Shimla District only, while nearly one-fifth is found in Kullu district. Thus, the fact that cold storage facilities are not only short to a large extent but also non existing in areas other than Shimla indicates lack of infrastructure. The distribution of post harvest facilities in the State is given Table 36.

**Table 36: Distribution of Post Harvest Facilities in Himachal Pradesh, 2005-06**

Particulars	Total capacity (MT)	Capacity distribution (percent)						
		Shimla	Kullu	Sirmaur	Mandi	Kinnaur	Exit points	Outside State
Packing and grading houses	25,000	80.00	20.00	-	-	-	-	-
Grading houses	6,000	16.67	16.67	16.67	33.33	16.67	-	-
Cold storages	16,250	24.62	6.15	-	-	-	18.46	50.77

Source:- State Agriculture Plan- HP

16. Impact of Climate change on horticultural crop: Studies by the Himachal Pradesh Agricultural University give some indications on the average impact of climate change in the Himachal Pradesh uplands and lowlands. From the studies covering over 30 years of records, average air temperatures were found to be 0.7°C to 2.4°C higher than that in the 1980s, as against the global average of 0.5°C. The Himachal Pradesh trend indicates an increase of 0.06°C per year. An analysis of rainfall data over the period 1976 to 2006 show increasing trends of rainfall in Lahaul & Spiti, Chamba and Kangra but decreasing trends in Solan and Kinnaur. Other districts showed no significant trends. Crops are showing shorter periods of flowering and maturity. The changes in climate

are now affecting farmers. Low rainfall and reduced snowfall are affecting crops. Planting of winter crops is frequently delayed and affected by erratic rainfall. Higher temperature in cold-season may lead to earlier ripening of annual crops, diminishing yields per crop, but would allow locally for the growth of more crops per year due to lengthening of growing season. Winter kill of pest is likely to be reduced at high latitudes, resulting in greater crop losses and higher need for pest control. Higher temperature will allow for more plants growth at latitudes and altitudes. Soil, as a medium for plant growth, would be affected in several ways. Increased temperatures could lead to denitrification and more decomposition of soil organic matter.

## 5.6 Environment initiatives taken by the sector to address critical environment issues

A. State Government has established a full-fledged State Horticulture University at Nauni, District Solan with the following objectives:

1. Creation of infrastructural facilities for the research and education programme of the State Horticulture University.
2. Making provision for imparting education in horticulture, forestry and other allied services of learning and scholarships.
3. Furthering the advancement of learning and publishing of research both basic and applied in various fields of horticulture and forestry.
4. Undertaking the spread of education of such sciences especially to the rural people of the State.
5. Such other purpose as the University may determine from time to time.

The Government of Himachal Pradesh has approved the implementation of Weather Based Crop Insurance Scheme (WBCIS) for Apple fruit crop in the State, from Rabi, 2009-10 season. Five blocks viz. Theog, Narkanda, Jubbal, Rohru and Chirgaon of District Shimla and Ani Block of District Kullu have been covered under the scheme on pilot basis. Similarly for mango crop, this scheme is implemented in four blocks of Kangra viz. Indora, Nurpur, Nagrotasurian and Fatehpur blocks. The scheme would be implemented through Agriculture Insurance Company of India Ltd. The amount of premium shall be paid @ 11.5 % with 10.30% Service Tax for total sum insured per tree and shall be shared in the ratio of 50:25:25 by Farmers, Central Government and State Government respectively. The Scheme is compulsory for farmers availing loans (from any commercial banks or financial institutions) and optional for non-loanee farmers.

### Extension and advisory service:

a. For advisory services in fruit plant nutrition, three Plant Tissue Analysis Laboratories have been established at Shimla, Kullu and Dharmshala in which around 10000 to 13000 plant tissue samples are analyzed annually for the diagnosis of the nutritional disorders and recommendations for dosages for fertilizer application. This has helped the orchardists in making judicious use of chemical fertilizers.

b. The supply of the pesticides is arranged through 337 sales outlets established in the fruit growing areas by the Horticulture Department. Every year about, 2.25 lakhs ha of area is covered under plant protection activities. The pesticides for the same (technical grade material) area are distributed to the farmers every year. A Biological Control Laboratory to decrease the chemical use in pests control has also been established at Shimla.

c. The horticulture extension services have been strengthened up to the grass root level. In addition, the programme related to the farmers training, demonstrations, fruit shows, exhibitions, seminars and workshops are organized for the dissemination of the technical know how to the farmers.

B. Production and Supply of Elite Planting Material: Production and supply of planting material is arranged through 112 Progeny-cum-Demonstration Orchards (PCDOs) and nurseries and 629 private nurseries. The State is self-sufficient in the production and supply of most temperate fruit plants but is deficient in planting material for mango, citrus and other sub-tropical fruits, some nuts particularly grafted walnuts, pecan nuts, kiwi fruits, cherry and spur type of apples. Various programmes have been initiated for increasing the production of the plant material for these fruits in Himachal Pradesh. Two plant tissue laboratories, one each in the public and private sectors, have been established for the rapid

propagation of the fruit plants, wherever the protocols are available. To supply improved planting material and root stocks, the State Department of Horticulture has imported root stocks of apple, pear, plum and cherry, which are being multiplied in the PCDOs of the State.

C. Introduction to Improved Plant Material: The Department of Horticulture has been making efforts from the 7th Five-Year Plan for the introduction of the improved varieties of fruits from the advanced countries as well as the other States of India for i) improving the quality and the productivity of fruit crops ii) diversification in crop production and iii) improving the economic viability of fruit farms.

D. Use of Pesticides: Non-judicious use of pesticides for the control of insects, pests and diseases in horticultural crops has led to:

1. Pests that have developed resistance to the chemicals used.
2. Pesticides which have entered into the plant body and the soil.
3. Pesticides have entered into the human and animal bodies through plants & fruits.

E. Moisture Conservation: In Himachal Pradesh fruit production in general is carried out under rainfed conditions and almost no irrigation is given to orchards. In the higher hills and mid hills, there is no arrangement for irrigation as there are no permanent sources for supplying water to fruit trees. In some areas, particularly in valley areas, irrigation is possible.

For raising flowers and ornamental plants, limited irrigational facilities are available in valley areas. Mulching is being practiced in many areas. Water harvesting technology has also been adopted by growers. According to available statistics, the total area under cultivation is 6.15 lakh ha, and out of this 1,02,617 ha is under irrigation while 5,12,383 ha is rainfed.

F. Soil Conservation: Plantations made in the past are mostly on the gentle slopes, and the trees have small or large basins depending upon the availability of space. Almost the area near the tree trunks and basins are being used for grasses or for other agricultural purposes. Moreover, growers are aware of the soil erosion by water in such areas and they protect their trees' orchards from it. Natural calamities are major cause of soil erosion near the orchards.

G. Organic Horticulture: Organic produce fetches better prices in and outside the country. Much organic material in and around the orchards is being wasted for want of awareness about the use of this product. Vermi compost, Green Manure and the like practices need to be followed.

H. Strategies: The main thrust of future strategies for the development of horticulture in Himachal Pradesh will comprise measures for the improvement of productivity in existing horticulture plantations; improving the quality of horticulture produce; diversification of the horticulture industry, value addition of horticulture produce through improved post-harvest management practices; diversification in the processing industry through the production of high value products such as fruit based alcoholic beverages: fruit wines and ciders, dehydrated fruit products, and market promotion through branding and advertising.

The nursery production programme needs to be modernized for the production of virus-free certified planting material on suitable rootstock. The planting density of fruit orchards will require new orientation from the present low-density plantation to medium and high density plantations to obtain higher productivity of high quality fruits per unit area.

As a result of extensive field trials, new fruit crops such as olive, pomegranate, fig, pistachio nut, pecan nut, hazel nut, strawberry and Chinese gooseberry (Kiwi fruit), which could

form an important component of the product mix of the State's fruit industry in future.

The development of horticulture in the wastelands will be promoted for the production of fruits like walnut, hazel nut, apricot, olive and aonla. The use of "in situ" plantation technique will be promoted for the development of mango plantations in sub-tropical areas of the State.

Plant protection programmes in future years will be based on minimal use of pesticides with emphasis on the Integrated Pest Management and biological control of the pests and diseases of horticulture crops. Technical advances made by the country in Information Technology will be used for the dissemination of technical knowledge in horticulture and the collection and dissemination of market information.

Water management practices in the orchards will improve by adopting scientific water harvesting practices, water conservation through mulching, other agronomic practices and also scientific water application techniques like micro irrigation.

Priority will be given to programmes relating to the creation of post-harvest management infrastructure like grading and packing houses, cold storages, pre cooling systems, cold chain preferably under the cooperative and public sectors.

The processing sector will diversify to introduce value added products like fruit wines, ciders, dehydrated fruit products, fruit toffees and health products. The use of media publicity for the popularization of the fresh and processed fruits of Himachal origin will be encouraged.

The ultimate objective of the future strategy for horticulture is to develop this activity as an environmentfriendly enterprise with the three-dimensional objective of economic development, environmental conservation and

the development of tourism in the State.

*Source: State of the Environment Report on Himachal Pradesh (undated), released in October 09*

I. Infrastructural Support to Horticulture: Horticulture commodities, especially fruits and vegetables, are highly perishable. Among several production processing and trade related constraints, the awfully inadequate supply chain infrastructure is perhaps the biggest impediment in boosting the performance of horticulture sector. The infrastructure and institutional support for the development of fruit and vegetable production in the State consist of 98 PCDOs for different fruits under the direct control of the Horticulture Department of the State Government. These PCDOs serve as growth centres for the development of horticulture in their impact zone of 10 km radius. These units act as stocking sites for trees of outstanding merit, pedigree multiplication centres, and demonstration orchards besides extension and training units for the farmers. Additionally, there are 662 private registered nurseries. Additionally, Plant Protection Centres (PPC) provide various plant protection chemicals and equipments to the fruit growers along with necessary technical know-how.

There are 337 such centres existing in the State. The post harvest facilities such as packing and grading houses and cold storage facilities, total packing and grading (combined) have capacity of 25,000 MT. In addition to this, the State has grading houses with capacity of 6,000 MT. Another crucial infrastructure support for the production of fruits and vegetables is the existence of cold storage facilities. The State has at present cold storage capacity of 16,250 MT of which fifty percent lies outside the State in distant places such as Delhi, Chennai and Mumbai. In the areas of processing facilities, the State has 82 processing units with a capacity of 83,160 MT of which nearly 64.0% is in the cooperative/ joint/ private sector.

A district-wise distribution of area under different fruits revealed that Kangra, which incidentally happens to be the largest district geographically, accounted for the largest share (18.90%) of total area under fruits in the State. Main fruit crops grown here include subtropical crops such as mango, citrus and litchi. Shimla, the most important district from horticulture perspective, account for 18.71% share. Here, apple is the main fruit crop besides stray patches of other temperate fruits. The production scenario, however, is dominated by Shimla (45.60%) alone, followed by Kullu (14.79%) and Kinnaur (11.05%). The four districts of Kangra, Shimla, Mandi and Kullu accounted for two-thirds of entire area under fruits. On the production side, Shimla, Kullu, Kinnaur and Kangra accounted for 82.51% of total fruit production. In addition to this lopsided distribution of area and production of fruits across districts, the most revealing point is that districts like Chamba and Sirmaur which have quite a large area under fruits contributed dismally to the overall fruit production. In order to capture the disparities across districts for these facilities, average fruit area served by one PCDO and Private Nursery (PN) was computed. Though at the State level one such PCDO catered to an area of 1907 ha, there were glaring disparities across districts. For instance, while in Kullu, Una and Kangra one such PCDO covered 4853, 4851 and 4417 ha, respectively; in others like Solan, Hamirpur, Bilaspur and Chamba it was below 1000 ha per PCDO.

The case for private nurseries was, though, different wherein the disparities were not as glaring. Similarly, the PCDO and PN (combined) attended to 246 ha on an average at the State level. Here also, the disparities were not very high. However, these findings prove that only existence of such facilities does not automatically translate into higher output. There is a need to have effective service providers. For instance, these facilities abound in the districts of Chamba and Sirmaur which have sufficient area under horticulture. However, the share in production of fruits in these districts is just 1.25% and 3.59%, respectively. As regards the Plant Protection Centres (PPCs), juxtaposing such centres against the area under fruits across districts revealed that their distribution was also quite skewed. For example, one such PPC in Kangra had to attend four times the area under fruits as against the State average of 555 ha. Similar was the case for Sirmaur wherein one PPC attended to the plant protection needs of 1156 ha. Some districts like Solan, Chamba and Hamirpur were, however, better equipped to fight against the diseases and insect pests as these have lower fruit area to serve per PPC. But this did not translate into increased fruit output which needs further scrutiny.

As regards the post harvest facilities such as packing and grading houses and cold storage facilities, these appear to be not only awfully short but highly skewed as well. For example, total packing and grading (combined) houses capacity in the State stood at 25,000 MT. Of this, while 80% capacity was found in Shimla district, main production area, another 20% was located in Kullu district. Here it is worth mentioning that though Shimla is the major apple producing district, this fruit crop is grown in eight other districts of the State. In addition to this, grading houses with capacity of 6,000 MT with more equitable spread across apple producing areas also existed in the State. Another crucial component of infrastructural support for the production of fruits and vegetables is the existence of cold storage facilities. Of the total cold storage capacity of 16,250 MT, 50% lies outside the State in distant places such as Delhi, Chennai and Mumbai. If one excludes the exit point cold storage facility (18.46%) at Parwanoo in Solan district, then only about 30% of the total cold storage is within the State. Furthermore, whatever is within the State, 80% of that lies in Shimla district only while nearly one fifth is found in Kullu district. Thus, the fact that cold storage facilities are not only short to a large extent but also non existing in areas other than Shimla bring home the point of lacking infrastructure.

As regards the fruit processing facilities, the State has 82 processing units with a capacity of 83,160 MT of which nearly 64.0% is in the cooperative/ joint/ private sector. This is spread throughout the State and as such is desirable from the perspective of broad based processing facilities. Of the remaining capacity, 35.0% is under the control of HP Horticultural Produce Marketing and Processing Corporation Limited (HPMC) which have three units of which two are in Solan district at Parwanoo and Jabli and one at Jarol in Mandi district.

Source: State Agriculture Plan, Himachal Pradesh, 2009

J. Subsidy for Mushroom Development: The scheme aims at providing incentives to farmers and unemployed graduates in the form of subsidy on the items given in Table 37, which are required for mushroom production.

**Table 37: Subsidy / Incentives for Mushroom Developments**

Sr. No.	Item	Incentives
1	Subsidy on compost for maximum 400 trays	₹20/- per tray to small/marginal farmers and unemployed graduates & ₹40/-per tray to SC/ST and IRDP
2	Transport subsidy on pasteurized compost.	100% to all the above categories

K. Popularization of Organic Farming and use of Bio-fertilizers: In order to reduce the use of chemical fertilizers, pesticides and insecticides, organic farming is being encouraged. Groups of farmers will be provided assistance for obtaining the certification of their organic produce. The financial assistance available is given below.

- @ ₹10,000 per ha for adopting organic farming.
- @ 90% of cost limited to ₹5 lakh per year for Certification.
- @ ₹30,000 for making Vermi-compost Unit.

L. Promotion of Integrated Pest Management: - For the promotion of integrated pest management, units for disease and pest forecast are being established to forewarn about the outbreak of diseases and pests. The assistance being provided under this programme is given below.

- @ `1,000 per ha per farmer for adoption of Biopesticides.
- @ ` 80 lakhs (Public Sector) and @ 50% of the cost with a maximum limit of ` 40 lakhs (Private Sector) for setting up of Bio Control Laboratories.
- @ ` 4 lakhs for establishing Disease Forecast Centre (Public Sector).

### 5.7 Environment related studies carried out in the sector

#### 1. Chemical use:

Some results of survey on awareness of chemicals use & precautions while using them is given in Table 38 to Table 45.

**Table 38: Farmers Response (%) for the use of chemicals**

Name of crops	Jigala	Jhiri	Jater
Fruit Trees			
Apple	80	93.3	86.7
Plum	20	53.3	33.3
Pear	-	-	-
Almond	-	-	-
Vegetable	-	80	40
Food crops	-	-	-

Source: Department of Horticulture, Himachal Pradesh

**Table 39: Intensity of chemicals used for the different variety of apple trees & vegetable being grown**

Apple	Chemical Use	Market value
Commercial	High	High
Early royal	High	High
Golden	Low	Low
Green	Low	Low
Jonathan	Low	Low
Kalidevi	Low	Low
Red	Low	Medium
Red Golden	Medium	High
Red June	High	Medium
Rika Red	Medium	Low
Royal	High	High
Vinter	High	Low
Vegetables	Chemical use	Market Value
Cabbage	High	High
Tomato	High	High
Brinjal	Medium	High
Chilli	Low	High

Source: Department of Horticulture Himachal Pradesh

**Table 40: Farmer's response (%) on awareness of chemicals use & precautions while using them**

Parameters	Jigala	Jhiri	Jater
Use of recommended 'does'	-	26.7	40
Purchased from privately owned shop	100	66.6	100
Purchased from Government recognized shop	-	34.4	20
Recommendation of Use of chemicals by privately owned shop	100	73.3	86.7
Recommendation of use of chemicals by Government recognized shop	-	26.7	13.4
Use of mask	-	-	-
Use of goggles	-	-	-
Washing of clothes after spray	26.7	46.7	53.3
Taking bath after spray	20	60	60
Washing of apple before eating	-	-	-
Washing of apple before packing	-	-	-
Reuse of packets/ bottles	60	73.3	60
Do you bury empty chemicals packets/ bottles	13.3	6.7	20
Ineffective chemicals	53.3	40	40
Visit of officer	-	-	-
Exact mixing of prescribed chemicals	6.7	20	20

Source: Department of Horticulture, Himachal Pradesh

**Table 41: Farmer's response (%) on health imbalances/problems caused by chemicals**

Parameters	Jigala	Jhiri	Jater
Headache & giddiness	94.6	100	94.6
Vomiting	20.3	13.3	13.4
Stomach Pain	46.6	40.0	40.0
Dysentery	52.6	40	46.6
Skin allergy	60	46.7	53.3
Eye problem	40	26.7	40
Respiratory/breathing difficulty	46.6	73.3	60
Weakness	80	93.3	100
Body pain	80	100	93.3
Suicide attempt*	13.3	40	46.6

\*= around the village

Source: Department of Horticulture Himachal Pradesh



**Table 42: Possible introduction of diseases**

Parameters	Jigala	Jhiri	Jater
Introduction of fruit trees	1980s	1960s	1970s
Invasion of new born diseases on human beings	13.33	66.7	46.7
Disease on fruit trees	40	93.3	86.6
Disease on vegetables	-	86.7	13.3
Dysentery	6.67	46.7	40
Stomach Problems	6.67	26.7	33.3

Source: Department of Horticulture Himachal Pradesh

**Table 43: Salt tolerance of crops**

Salt tolerance of crops	Anonymous	1983
Sensitive	Peach, Apricot, Pear, Apple, Plum, Strawberry, Blackberry, Pineapple	Celery, Radish (English varieties) Beans
Semi-tolerant	Grape,olive, Fig, Guava, Mango, Banana, Orange, Lemon, Grape, Pomegranate, Almond	Tomato, cabbage, Cauliflower, Lettuce, potato, radish, carrot, Onion, Peas, Cucumber, Pumpkin, Sweet potato, squash
Tolerant	Datepalm, Coconut, Phalsa	Beetroot, Asparagus, Kale, Spinach, Turnip

Source: Department of Horticulture Himachal Pradesh

2. Impact of Ornamental Horticulture & landscaping on the Environment: During the 8<sup>th</sup> Five Year Plan, the Government of India recognized floriculture as “Extreme Focus Segment Item”. At present, total area under floricultural crops is 50 ha & this is increasing at an annual rate of 10%. The rapid

**Table 44: Suitable plants for different pH**

pH range	Fruits	Vegetables	Ornamental Plants
4.0-5.0	Blueberry, Cranberry		Azalea, philodendron
5.0-6.8	Apple, Pear, Peach, Plum, Peas, grape, grapefruit, Sweet cherry, Raspberry, blackberry, Strawberry	Snapbean, Potato, Sweet potato, Water melon, Spinach, Asparagus, Beetroot, Lima bean, Celery, lettuce, Onion, carrot, Tomato, Pepper, cabbage	Aster, lily, orchid, Juniper, rose, snapdragon, Sweet pea, ryanthemum

Source: Department of Horticulture, Himachal Pradesh

Consumption of pesticides in the State since 1995 is given in Table 45.

**Table 45: Consumption of Pesticides**

Year	Pesticides (Tonnes)
1995-1996	203.17
1996-1997	243.46
1997-1998	244.50
1998-1999	192.50
1999-2000	234.62
2000-2001	248.60
2001-2002	677.00
2002-2003	417.01

industrialization in India has resulted in increased air pollution. Automobile exhaust contribute 60%, industries 20-30% & fossil fuel 10%. To control pollution, landscaping with pollution tolerant trees in & around industrial areas, is one of the most effective measure (Table 46).

**Table 46: List of tolerant trees in and around industrial areas**

Trees tolerant to Sulphur Dioxide for the hills	Trees tolerant to NO & NO <sub>2</sub>	Trees tolerant to O <sub>2</sub>	Trees against Peroxyacetyl nitrate (PAN)	Trees against Fluorides
<ul style="list-style-type: none"> <li>• <i>Acer plantanoides</i>.</li> <li>• <i>A saccharinum</i></li> <li>• <i>A negundo</i></li> <li>• <i>A rubrum</i></li> <li>• <i>Forsythia suspense</i></li> <li>• <i>Quercus palustris</i></li> <li>• <i>Quercus rubra</i></li> <li>• <i>Betula pendula</i></li> <li>• <i>Ligerstrum vulgare</i></li> <li>• <i>Liquidambar styraciflua</i></li> <li>• <i>Pyracantha coccinea</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Fagus orientalis</i></li> <li>• <i>Quercus rober</i></li> <li>• <i>Robinia pseudocasia</i></li> <li>• <i>Sambucus nigra</i></li> <li>• <i>Ulnus spp.</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Acer plantanoides</i></li> <li>• <i>A negundo</i></li> <li>• <i>A rubrum</i></li> <li>• <i>Quercus robur</i></li> <li>• <i>Quercus rubra</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Acer nugundo</i></li> <li>• <i>A saccharinum</i></li> <li>• <i>A platanoides</i></li> <li>• <i>Quercus palustris</i></li> <li>• <i>Q. rubra</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Betula pendula</i></li> <li>• <i>Forsythia suspense</i></li> <li>• <i>Gleditsia tricanthus</i></li> <li>• <i>Liquidambar styraciflua</i></li> </ul>

**Other Studies**

1. Grading & Packing of Apples by Harbans Singh & H.L.Kochar.
2. Fertilizing Fruit Crops in H.P. by Dr.K.C.Azad & Dr.R.P.Sharma
3. Evaluation Criteria of fruit trees in H.P.
4. Cold Storage of Apples by S. Harbans Singh

**5.8 Environment monitoring (key parameters such as air and water pollution) carried out for activities related to the sector**

No documentation is available which indicates monitoring of air and water pollution because of horticulture. However, some documentation on horticulture crops exists in terms of relation to climate and soils.

**1. Climate & soils in relation to horticultural crops:**

- A) Effect of Frost on Crop Yield :
- Severe loss of crop yield.
  - Shape & appearance of fruit affected.
  - Damage at blossom time causes russet rings.
  - Skin on Pedices split if frost occurs at green cluster stage.

B) Effect of Wind on Crop Yield:

- Fallen fruits
- Tattered leaves
- Broken branches

C) Effect of Rainfall on Crop Yield:

- Temporary suffocation of roots
- Temporary nutrient deficiency.
- Fruit cracking.
- Hastened fruit maturity

D) Effect of Hailstorm on Crop Yield:

- Tattering or stripping of leaves.
- Deformed fruits.

E) Effect of Drought on Crop Yield:

- Restricted fruit Size.

**2. Drought Control Measures:** Mulching is the most effective method for conservation of moisture. Commonly used mulching materials are Black alkathene film, Pine needles, Oak leaves etc. Foliar spray of urea & micronutrients can also be used.

**3. Soils for fruit growing:** Soil should have good water holding capacity eg. Loamy soil.

**4. Orchard Soil Management:** In Sod culture system grass/Sod cover is grown in orchard to check soil erosion.

**5. Horticultural Economics and Statistics:** For the preparation of realistic horticultural development programme/schemes/ projects a dependable data on various aspects of

horticultural production is required to be generated and maintained at the directorate level under this scheme. The scheme has the following objectives:

- Regular monitoring and evaluation of progress under various departmental schemes.
- To conduct field surveys for pre harvest forecasting of fruit yield annually.
- Collection of data at the exit points of the state for export of fruit produce from the state for the estimation of actual fruit production in the state.
- To conduct field trails for the preparation of cost of production of various fruit crops.
- To conduct field experiments for the estimation of fruit crop yield in different parts of the State.
- To conduct horticultural census to know the actual area under different fruit crops.
- To conduct potential survey and analytical studies for the preparation of techno-economic feasibility studies for various schemes/projects etc.
- Establishment of modern electronic telecommunication system for scientific data management and information dissemination.

### **5.9 Institutional mechanisms within the sector to address identified environment issues**

#### **Department of Horticulture**

The Department of Horticulture is the nodal department for carrying out all activities connected with Horticulture in the State of Himachal Pradesh. The department is headed by Director of Horticulture. S/he is assisted by Additional Director, Joint Director. The existing institutional framework of Department of Horticulture is shown in Figure 4 and responsibilities of the officers are described below:-

**Director:-** Director of Horticulture, being administrative and professional head of the Horticulture Department in the State is responsible for the efficient working of the Department and shall exercise all administrative financial and technical powers as exercised by the Heads of the Department in Himachal Government. S/he is also act as Advisor to the State Government on all technical matters relating to Horticulture and allied subjects.

**Additional Director: -** The Additional Director of Horticulture whose office is situated at Dharamsala is the overall Controlling Officer of six Districts of the North zone i.e. Kangra, Chamba, Una, Hamirpur, Kullu and Lahaul & Spiti. All the Administrative and Financial matters of the offices under his control shall be routed through him along with proper recommendations.

**Joint Director: -** The Joint Director Horticulture (HQ.) assists the Director of Horticulture in the performance of his duties and responsibilities. S/ he is assisted by Fruit technologist, Quality Control Officer, Food Microbiologist, Procurement & Sales Office, A.O. and AC (F& A). S/he is responsible to deal with and finalize all the Establishment/Budget/Accounts/Audit and legal matters and whatsoever other related duties entrusted to him.

**Deputy Director (Planning & Projects):-** The Deputy Director of Horticulture (Project & Planning) In-charge of Branch-IV (Technical Branch) and all planning process in the department. S/he is assisted by the Assistant Project Officer, Subject Matter Specialists and Horticulture Development Officers posted in the Directorate. S/he is responsible for preparations of plans, projects and strategies for the development of horticulture in the State. S/he is also responsible for training of officers in the department in Human Resources development and maintenance of progeny orchards, nursery production work and execution of all developmental schemes run by the department.

Deputy Director (Information):- The Deputy Director of Horticulture (Information) look after the entire publication work viz. farm bulletins, technical pamphlets, booklets, posters, handouts, newsletters etc. S/he is assisted by Photo Officer. He is the spokes man for the department in media and all the press notes and publication work relating to departmental activities; will be done under his guidance and supervision.

Deputy Director (In Districts):- The Deputy Director of Horticulture will be the Head of Office, Drawing and disbursing his respective District. S/he is assisted by District Horticulture Officer, Subject Matter Specialist and Fruit Technologist. The Deputy Director of Horticulture posted in the District level implement and co-ordinate all the horticulture development and extension activities in their respective District. S/he is responsible for the supply of horticulture inputs, pesticides, tools and plant protection equipments to the public and execution all the programmes in his respective District with the help of the supporting staff.

Senior Plant Protection Officer: - Senior Plant Protection Officer is responsible for the entire plant protection/Beekeeping development activities related to horticulture in the State, the procurement and timely supply of the pesticides & Plant Protection equipments to the farmers of the Pradesh. S/he prepare the Spray Schedule for the control of Pests & Diseases, organize the campaign against any outbreak of diseases and pests in epidemic form, S/he promote the integrated pests management to reduce the use of chemicals and will act as controlling officer of the Biological Control Laboratory, Rajhana.

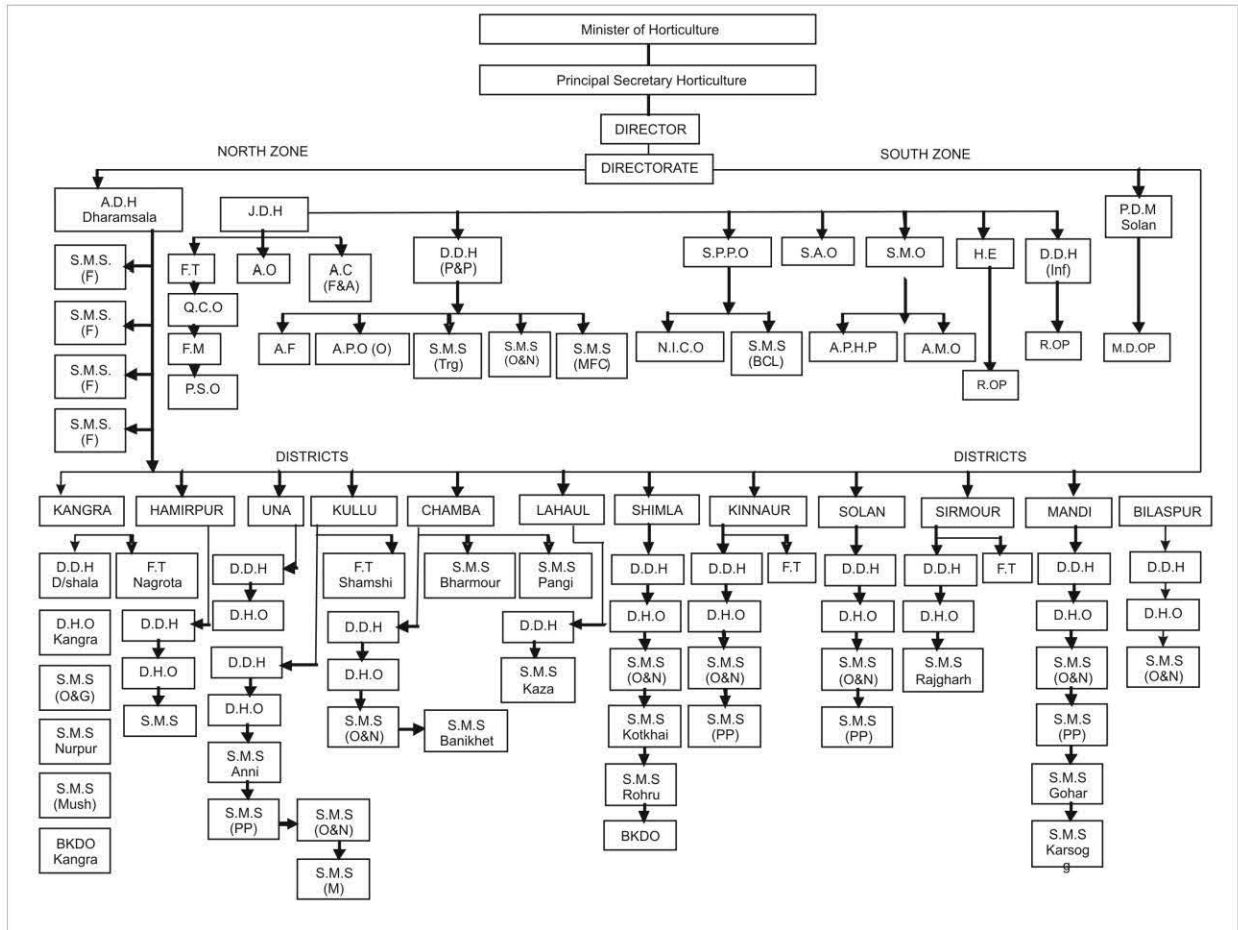
Senior analytical officer: - Senior Analytical Officer look the work for preparation of optimum and economic fertilizer schedule for fruit orchards based upon the plant issue analysis. S/he provide advisory services to the fruit growers in the field, conduct survey in the

different fruit areas to assess the nutritional status of the orchards, conduct adaptive trials regarding efficiency of various fertilizers and organic manures with the help of Senior Chemical / Research / Laboratory Assistants.

Senior Marketing Officer: - Senior Marketing Officer is responsible for the entire horticulture marketing activities and development of horticulture marketing infrastructure in the State. S/he is assisted by Assistant Marketing Officer and Assistant Post Harvest Physiologist. S/he looks after the implementation of Market Intervention Scheme and arrangement of packaging material. S/he provides technical expertise to the fruit growers with regard to the maturity standards, scientific harvesting, grading, packing and marketing of horticulture product.

Horticulture Extension Officer: - S/he is assisted by research officer and function as In-charge, Progeny-cum Demonstration Orchards/Nurseries / Horticulture Extension Centre/Plant Protection Sub Centre/Flower Nurseries where posted independently. S/he assist the Horticulture Development Officer of the area in implementation of the schemes of the department and verification of works carried out by the farmers in the field for release of subsidy.

Project Director (Mushroom):- The Project Director (Mushroom) assists the Director of Horticulture in performance of his duties and responsibilities. S/he is assisted by Mushroom Development Officer, Assistant Project Officer (Mushroom), Subject Matter Specialist (Mushroom) and supporting staff provided under the Mushroom Development Scheme. S/he is responsible for the development and promotion of Mushroom cultivation/marketing activities in the State.



**Figure 4: Organisational Chart Department of Horticulture**

Himachal Pradesh Horticultural Produce Marketing and Processing Corporation Ltd.

Himachal Pradesh Horticultural Produce Marketing and Processing Corporation (HPMC) Ltd. Popularly known as HPMC, was established in the year 1974 as State Public Undertaking with the objective of marketing of fresh fruits and processing of all types of surplus fruits. It has developed the most modern system of marketing in the country. The unique characteristics of this organization are that it provides all the services to the fruit growers, which are required for marketing of fruits. The Corporation has set up two modern Fruit Processing Plants and has acquired them on lease basis from the HIMPROCESS and has a vast range of processed products.

Therefore, based on the above institutional structure, gaps have been identified within the

existing institutional framework and is described in Institutional Mechanism report.

Further, institutional responsibilities to implement actions identified and approved by the nodal department and line departments have also been described in Institutional Mechanism report. In order to address environmental issues identified in concerned sectoral guidelines, a number of innovations are required from the nodal department with identified line departments.

**Table 47: Gross Value Added of Horticulture, 1999-2000 to 2006-07 in Himachal Pradesh (at 1999-2000 prices)**

S. No.	Years	Gross Value Added of Horticulture	Growth Rates in Gross Value Added (% per annum)
1	1999-2000	84376 (25.21)	13.7*
2	2000-01	154839 (40.44)	
3	2001-02	134683 (32.46)	
4	2002-03	174007 (41.60)	
5	2003-04	205258 (43.31)	
6	2004-05	226275 (43.54)	
7	2005-06	241292 (46.50)	
8	2006-07	224497 (40.67)	

Note: Figures in parentheses are percentages of total value in agriculture. \*' denotes significance at 5 per cent level probability level.

2000 to 2006-07)', Directorate of Economics and Statistics, Government of Himachal Pradesh.

Source: 'Gross Domestic Product of Himachal Pradesh (1999-

**5.10 Data / documentation pertaining to addressing demographic issues in the context of the sectors, such as population changes; requirements of populations and changing lifestyles; migratory populations including tourists; transhumants; transit labour population; pressures felt by communities due to degraded environment conditions.**

Documentation related to horticulture sector of the State is given below:

Fruit Production and Yields: Himachal Pradesh has long been regarded as a Horticultural State due to its magnificent achievements in the production of fruits, mainly apple. The other fruit crops grown in the State include temperate fruits such as peach, pear, plum, apricot and the subtropical fruit crops such as mango, citrus,

litchi, etc. Area under all fruits in the State has more than doubled from 86.23 thousand ha in 1980-81 to 186.90 thousand metric tonnes by 2005-06. The corresponding production has gone up 2.5 times from 1.46 lakh metric tonnes to 3.68 lakh metric tonnes during the same period. However, the large gains in this production have come from area as the productivity increased marginally from 1.69 MT/ ha in 1980-81 to 1.97 MT in 2005-06. The share of apple in the total area under fruits and consequent production was 48.66 % and 85.62 %, respectively in 1980-81. By 2005-06, its share fell marginally to 46.12 %. Consequently, the area share of other fruits has gone up to 53.88 % during the same period. Contrarily, while the share of apple production came down to 72.83 %, the same for other fruits increased to 27.17 % by 2005-06.

The compound growth rates in area, production and yields of these crops were computed for the period 1980-81 to 2005-06. The area under all fruit crops registered negative growth rate of 2.88 % between 2000-01 and 2005-06. The negative growth rate was more pronounced for other fruit crops at 4.65 per cent per annum as compared to apple (-0.57 %). As regards the production, these growth trends were mostly positive except for other crops during the period 1990-91 to 1994-95. These other fruit crops exhibited negative growth rates during the decades of 1980s and 90s.

Vegetable Production and Yields: Earlier, the production of vegetables in the State was dominated by potato that was confined to select high hill pockets. However, since early 80s the focus shifted to vegetable crops other than potato. These included crops such as green peas, tomato, cabbage, cauliflower and capsicum and their cultivation was mainly restricted to mid to high hill pockets. However, realizing the importance of off-season vegetable growing, even the farmers in low-mid hill locations started growing vegetables during the 90s. Furthermore, new crops (e.g. garlic) are

being grown in quite a few of the districts. These changes have been aptly captured by the following figures. The area under all vegetables increased from 2.10 % to 3.60 % of the total cropped area during 1972-2004 while that under potato remained around 1.5%.

In other words, all the increase in area under vegetables went to vegetables other than potato. At present, the State is producing 9.91 lakh metric tonnes of vegetables from an area of 52,000 ha with an average productivity of 19.05 MT/ha (2006-07). This yield level is higher than the national yield of 17.0 metric tonnes per hectare. The Compounded Growth Rate (CGR) of area under vegetables during the past one and a half decade has been 5.90% per annum. The production of vegetables registered an annual growth rate of 6.95% during the same period. The growth rate of vegetable yields, however, was 1.0 % per annum.

Thus, there is a strong need to increase the productivity of vegetables in the State as the shifting of area from main food grain crops will have its own ramifications. However, identification of suitable pockets with congenial climate for vegetable growing can go a long way in increasing the vegetable production in the State provided appropriate back up support is provided along with suitable marketing environment.

**Yield Gap Analysis of Fruit Crops:** The yield gap analysis for various fruit crops grown in the State was carried out to find out the scope of increasing yield levels of these fruits. Mango is the main fruit crop of the low hill districts of Kangra, Hamirpur, Bilaspur, parts of Mandi, Solan and Sirmaur. The farmers in Kullu and Shimla have also started growing mango wherever agro-climatic conditions permit. The yield gap of mango varied from 3.75 q/ha in Bilaspur to 11.30 q/ha in Kangra. However, the progressive farmers' yield in Kangra was 2.0-4.0 times higher as compared to the yields of the progressive farmers in Mandi, Bilaspur and Hamirpur districts. Similarly, the citrus fruits

constitute the second most important subtropical fruit crop of the State. The yield gap between the average and the progressive farmers' ranged from 0.4 q/ha in Shimla to 24.58 q/ha in Mandi district. In Kangra district which is known for citrus cultivation, the yield gap was moderate at 7.40 q/ha. For another important subtropical fruit of litchi whose cultivation is confined to Kangra, Mandi, Hamirpur and Bilaspur districts the observed yield gap stood at 6.90, 9.55, 2.96 and 3.32 q/ha, respectively.

Among the temperate fruits, apple occupies the most important place. It is grown in eight out of the twelve districts of the State. The gap in productivity of the average farmer and the progressive farmer varied from 10.0 q/ha in Solan to 118.0 q/ha in Kullu district. The inter-district variations in the yield levels of even progressive farmers were quite wide. For example, against the yield of 13.0 q/ha in Solan or 30.0 q/ha in Sirmaur, the same was 250.0 q/ha in Kullu and 150.0 q/ha in Lahaul & Spiti. Such variations present immense scope to increase the productivity of the apple crop in the State by adopting appropriate location specific technologies. The yield gaps for other temperate fruits such as apricot, peach, plum, nuts, etc. were also quite high in these districts.

*Source: State Agriculture Plan, Himachal Pradesh, 2009*

**5.10.1 Decadal Trend of Production and Area of fruits:** Fruits area in Himachal Pradesh has significantly increased during the last four decades. The area under fruits was 4432 ha in the year, 1970-1971, which has increased to 223035 ha in the year 2001-02, thereafter it declined all of sudden to 18244 ha in the year 2003-04. The data in the Table 48 show the patterns of area of different fruits in the State.

**Table 48: Decadal Variation of Areas under different fruits**

Name of Fruit	1970-71	1980-81	1990-91	1998-99	1999-2000	2000-01	2001-02	2003-04
<b>A. Temperate Fr uit s</b>								
(a) Apples	26735	43331	62828	85631	88673	90347	92820	84112
(b) Other temperate fruits	7563	17464	28483	31925	32400	32801	33161	24378
(c) Nuts and dry fruits	1745	6892	13154	16061	16396	16619	16956	10939
Sub Total (A)	36043	67687	104465	133617	137469	139767	142937	119429
<b>B. Sub-Tropical Fruits</b>								
(a) Citrus fruits	5495	14471	36005	38711	39138	39627	40174	20261
(b) Other sub tropical fruits	2791	10267	22880	34912	36344	37832	39924	42751
Sub Total (B)	8286	24738	58885	73623	75482	77459	80098	63012
GRAND TOTAL	44329	92425	163330	207240	212951	217226	223035	182441

The production of fruits was 13982 MT in 1980-81 which increased to 446684 MT in 1998-99 but in the year 1999-2000 declined to 89415 MT during. In the year 2004-05 the

production increased to 559977 MT. Table 49 gives year wise production of fruits crops in MT:-

**Table 49: Decadal Variation in production of different fruits**

Name of Fruits	1980-81	1990-91	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04
<b>A. Temperate Fruits</b>								
(a) Apples	118013	342071	393653	49129	376736	180528	348263	459492
(b) Other temperate fruits	9264	14934	17974	17901	20450	29236	63026	40652
(c) Nuts and dry fruits	1782	3105	3025	1895	2755	2911	3256	3570
Sub Total (A)	129059	360110	414702	68925	399941	212675	414545	503714
<b>B. Sub-Tropical Fruits</b>								
(a) Citrus fruits	4400	12100	13111	9257	11068	20465	16027	28121
(b) Other sub tropical fruits	6369	13604	19871	11233	17040	30306	29051	28142
Sub Total (B)	10769	26204	31982	20490	28108	50771	45078	56263
Grand Total	139828	386314	446684	89415	428049	263446	459623	559977

As per estimates of Department of Horticulture, Himachal Pradesh the total area under fruit plantation in 1995-96 stood at 1.96 lakh ha & production in 1996 was 3.12 lakh tonnes. Table 50 showing year wise area & production of different fruits in Himachal Pradesh.

Among the various fruits, area used for the cultivation of apples is largest and maximum area during the year 2001-02. The incremental increase in the apple cultivation is 26.7% from the year 1993 to 2007. The area under Citrus fruit and Nuts and Dry fruits has declined from the year 1993 to 2007 (Table 51).

**Table 50: Year wise Area & Production of different fruits in Himachal Pradesh**

Year	Total Area (Km <sup>2</sup> )	Total production (Tonnes)
1980-81	924.25	139828
1981-82	1000.42	341943
1982-83	1086.76	177854
1983-84	1140.51	304275
1984-85	1205.80	215920
1985-86	1287.70	207742
1986-87	1349.85	400508
1987-88	1420.51	308693
1988-89	1492.84	197355
1989-90	1564.69	459990
1990-91	1633.30	386314
1991-92	1707.68	342303
1992-93	1768.91	324855
1993-94	1828.66	325477
1994-95	1896.89	170541
1995-96	1956.84	311889

Source: Horticulture Development in Himachal Pradesh, A.K. Dwivedi & others, May, 1997 Department of Horticulture, H.P.

**Table 51: Area under Fruits 1994-2007 (Km<sup>2</sup>)**

Year	Apple	Citrus	Nuts & dry fruits	Other fruits	Total
1993-94	724.06	379.61	145.53	579.46	1828.66
1994-95	754.69	383.23	149.35	609.62	1896.89
1995-96	782.92	385.95	152.37	635.60	1956.84
1996-97	803.38	383.69	154.78	620.27	1962.12
1997-98	830.56	386.35	158.32	648.39	2023.62
1998-99	856.31	387.11	160.61	668.37	2072.40
1999-00	886.73	391.38	163.96	687.44	2129.51
2000-01	903.47	396.27	166.19	706.33	2172.26
2001-02	928.20	401.74	169.56	730.85	2230.35
2002-03	816.30	197.84	107.00	640.92	1762.06
2003-04	841.12	202.61	109.39	671.29	1824.41
2004-05	862.02	204.02	111.00	691.99	1869.03
2005-06	885.60	207.29	112.10	711.69	1916.68
2006-07	918.04	211.18	113.28	731.95	1974.45

Source: Horticulture Department, Himachal Pradesh



**Table 52: Production of Fruits ('000 tonnes)**

Year	Apple	Citrus	Nuts & Dry fruits	Other fruits	Total
1993-94	294.73	4.41	2.21	24.12	325.47
1993-95	122.78	6.67	2.37	38.72	170.54
1995-96	276.68	5.84	2.47	26.90	311.89
1996-97	288.54	13.83	3.35	45.91	351.63
1997-98	234.25	11.76	2.45	31.23	279.69
1998-99	393.65	13.11	3.07	37.85	447.68
1999-00	49.13	9.26	1.89	29.13	89.41
2000-01	376.73	11.06	2.75	37.49	428.03
2001-02	180.53	20.46	2.91	59.55	263.45
2002-03	348.26	16.03	3.25	92.08	459.62
2003-04	459.49	28.12	3.57	68.79	559.97
2004-05	527.60	28.55	3.73	132.13	692.01
2005-06	540.36	29.16	3.92	122.08	695.52
2006-07	268.40	12.67	2.91	85.12	369.10
2007-08	592.57	24.67	2.90	92.70	712.84

Source: Horticulture Department, Himachal Pradesh

**Table 53: District wise fruit production in 2005-06 (in tonnes)**

District	Apple	Plum	Peach	Pear	Almond	Mango	Lime	Orange	Total Fruit
Bilaspur	0	37	72	209	1	3173	88	16	4297
Chamba	10367	356	140	345	35	361	272	15	3953
Hamirpur	0	67	104	248	12	2196	151	110	5143
Kangra	650	1232	648	2045	314	49885	4367	16789	86308
Kinnaur	41101	3	2	24	225	0	0	0	41632
Kullu	140633	6452	18	14988	12	4	10	0	162328
Lahaul & Spiti	193	9	0	2	4	0	0	0	227
Mandi	36421	1232	175	908	350	870	400	198	43084
Shimla	310252	557	147	2632	273	51	63	1	315200
Sirmaur	680	761	6367	437	74	2799	289	154	13996
Solan	59	991	133	1251	3	1027	245	36	6006
Una	0	16	17	903	0	2725	37	1078	5406
State	540356	11713	7823	23992	1303	63091	5922	18397	695517

Source: Department of Horticulture, Himachal Pradesh

**Table 54: Production of fruits (2006-07) (in tonnes)**

Name of fruit	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmaur	Solan	Una	Total
Apple	4	3533	0	443	40277	43730	191	16625	163301	245	53	0	268402
Plum	13	150	99	1106	2	6770	3	612	557	315	898	21	10546
Peach	13	70	119	578	2	6	0	240	147	6855	126	17	8173
Apricot	0	132	0	43	166	21	13	353	269	325	1446	0	2768
Pear	306	152	320	1843	42	3961	2	967	2632	350	732	932	12239
Cherry	0	3	0	0	1	12	1	0	421	0	0	0	438
Green Almond	0	20	0	0	0	17	0	235	289	0	0	4	665
Persimmon	0	5	1	1	0	11	0	72	58	25	1	0	174
Olive	0	1	0	0	0	2	0	4	1	0	0	0	8
Kiwi	1	14	0	5	0	1	0	7	33	4	12	0	77
Strawberry	0	0	0	5	0	4	0	0	0	515	0	0	-
O.T.F.	333	547	539	3581	213	10805	19	2490	4507	8389	3215	974	35612
Almond	1	28	15	160	191	8	1	112	641	47	7	0	1211
Walnut	6	245	10	60	53	37	1	94	37	905	107	0	1555
Pica nut	1	11	1	122	2	2	0	5	0	0	2	0	144
Nuts & Dry fruits	8	284	26	342	246	47	2	211	678	952	116	0	2912
Orange	55	9	144	3258	0	0	0	172	1	153	30	828	4650

Name of fruit	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmaur	Solan	Una	Total
Malta	28	1	61	715	0	0	0	0	0	4	9	115	933
K.lime	81	10	198	1698	0	6	0	244	62	220	333	125	2977
Galgal	274	10	583	1129	0	1	0	463	28	20	234	120	2862
Other	3	0	38	1201	0	0	0	0	4	0	2	0	1248
Citrus	441	30	1024	8001	0	7	0	879	95	397	608	1188	12670
Mango	2924	140	3954	22640	0	2	0	881	52	2520	1166	5680	40159
Litchi	84	41	131	2013	0	0	0	234	3	310	31	4	2851
Guava	110	38	182	852	0	0	0	271	3	240	291	220	2207
Papaya	183	1	150	642	0	0	0	14	1	90	67	103	1251
Loquat	13	1	6	22	0	0	0	0	0	0	2	5	49
Aonala	309	3	164	751	0	1	0	50	4	18	43	22	1365
Grapes	4	1	17	26	55	1	0	8	0	0	4	12	128
Pomegranate	4	1	12	36	0	14	0	26	38	0	28	24	183
Jack fruit	12	0	32	239	0	0	0	0	0	90	1	4	378
Other	49	1	96	920	0	0	0	15	0	0	34	21	1136
O.S.T.F.	3692	227	4744	28141	55	18	0	1499	101	3268	1667	6095	49507
Total	4478	4621	6333	40508	40791	54607	212	21704	168682	13251	5659	8257	369103

O.T.F. – Other temperate fruits , O.S.T.F. – Other Sub Tropical fruits

Source: Directorate of Horticulture

**Table 55: Crop wise production in tonnes (2008-09)**

Name of fruit	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmaur	Solan	Una	Total
Apple	1	8640	0	502	55169	77409	577	30300	336753	776	34	0	51061
Plum	8	133	46	1113	2	5154	3	430	551	795	1317	39	9591
Peach	18	97	62	553	2	4	0	304	178	8578	99	40	9935
Apricot	0	185	0	40	156	24	4	380	295	478	1662	0	3224
Pear	335	176	217	1637	38	6863	3	885	2710	553	803	1230	15450
Cherry	0	1	0	0	1	11	0	0	440	0	0	0	453
Kiwi	0	2	0	6	0	4	0	10	35	29	32	0	118
Pomegranate	19	6	26	37	0	31	0	82	42	1	35	32	311
Olive	0	0	0	0	0	1	0	5	1	2	0	0	9
Perssimon	0	1	1	5	0	10	0	105	60	42	0	0	224
Strawberry	0	0	0	6	0	4	0	0	0	425	0	0	435
Green almond	0	0	0	0	0	6	0	0	116	0	0	2	124
Almond	4	19	10	145	188	3	2	255	901	90	6	0	1623
Walnut	3	341	2	113	49	46	0	132	46	927	116	0	1776
Picanut	0	4	2	126	0	3	0	9	0	0	2	0	146
Hazelnut	0	0	0	0	3	0	0	0	0	0	0	0	3
Chestnut	0	0	0	0	0	0	1	0	0	0	0	0	1
Orange	26	3	84	12935	0	3	0	291	2	171	64	1718	15360
Malta	6	4	39	1346	0	0	0	25	0	7	10	465	1902
K.Lime	55	355	179	2749	0	3	0	312	75	522	297	292	4839
Galgal	77	590	373	1437	0	3	0	385	29	184	220	315	3613
Other	2	0	16	268	0	0	0	0	4	0	0	3	293
Mango	3040	392	2742	21028	0	7	0	3003	44	2323	422	5750	38751
Litchi	49	70	121	2044	0	1	0	830	3	203	38	4	3363
Guava	129	48	142	745	0	1	0	422	4	215	282	438	2426
Aonala	439	8	298	1026	0	1	0	82	4	26	81	52	2017
Jack Fruit	8	0	18	149	0	0	0	9	0	28	2	8	222
Papaya	90	3	85	223	0	0	0	33	1	46	45	160	686
Grapes	0	2	8	35	59	1	0	0	0	0	6	8	119
Loquat	9	1	7	35	0	0	0	0	0	0	2	6	60
Karonda	0	0	0	3	0	0	0	0	0	0	0	0	3
Ber	0	0	5	6	0	0	0	0	0	0	3	1	15
Sapota	0	0	2	3	0	0	0	0	0	0	2	1	8
Fig	4	0	0	0	0	0	0	0	0	0	0	0	4
Banana	10	0	46	205	0	0	0	37	0	0	0	10	308
Jamun	16	0	12	289	0	0	0	0	0	0	15	50	382
Bael	0	0	0	16	0	0	0	0	0	0	0	0	16
Deun	0	0	5	97	0	0	0	0	0	0	2	2	106
Total	4348	11081	4548	48922	55667	89593	590	38326	342294	16421	5597	10689	628076

**Table 56: District wise area under different fruits (2005-06) (in Km<sup>2</sup>)**

Name of fruit	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmaur	Solan	Una	Total
Apple	0.04	104.41	0	4.30	81.51	208.21	6.21	148.32	296.71	34.77	1.12	0	885.60
Plum	0.89	3.79	1.46	4.10	0.08	20.04	0.07	26.73	5.91	13.48	6.25	0.80	83.60
Peach	1.24	2.14	1.07	2.12	0.67	0.34	0	7.34	2.98	28.49	2.70	0.91	50.00
Apricot	0	3.78	0.01	0.34	2.45	2.22	0.15	2.13	6.38	4.21	8.67	0	30.34
Pear	4.96	3.56	1.12	4.21	0.42	4.71	0.06	17.96	14.54	5.75	11.19	7.48	75.96
Cherry	0	0.05	0	0	0.04	0.58	0.05	0.25	2.16	0	0	0	3.13
Kiwi	0.01	0.03	0	0.11	0	0.26	0	0.30	0.14	0.11	0.17	0	1.13
Pomegranate	0.38	0.18	0.49	0.62	0	0.94	0	1.30	0.82	0.25	0.76	0.62	6.36
Olive	0	0.03	0	0	0	0.10	0	0.10	0.30	0.01	0	0	0.54
Perssimon	0.03	0.05	0.01	0.04	0	1.53	0	1.52	0.26	0.08	0.05	0.01	3.58
Strawberry	0	0	0	0.02	0	0.05	-	0.02	0	0.44	0.04	0	0.57
O.T.F.	8.51	13.61	4.16	11.56	3.66	30.77	0.33	57.65	33.49	52.82	29.83	9.82	255.21
Almond	0.31	2.90	1.94	4.16	9.87	3.83	0.06	14.86	15.23	2.06	1.35	1.09	57.66
Walnut	0.34	13.23	0.74	1.99	2.34	0.78	0.01	9.87	3.08	13.68	1.69	0.10	47.85
Picanut	0.19	0.22	0.12	1.82	0	0.33	0	3.45	0.04	0.08	0.12	0.09	6.46
Hazelnut	0	0.03	0	0	0.05	0	0	0	0.05	0	0	0	0.13
Nuts& Dry fruits	0.84	16.38	2.80	7.97	12.26	4.94	0.07	28.18	18.40	15.82	3.16	1.28	112.10
Orange	2.42	0.21	1.94	53.26	0	0.23	0	7.14	0.33	4.75	2.70	7.35	80.33
Malta	0.56	0.01	0.54	6.25	0	0.04	0	1.50	0	0.17	0.07	0.54	9.68
K.lime	3.67	3.29	8.36	26.40	0	0.50	0	28.46	4.26	9.01	3.85	5.56	93.36
Galgal	2.19	2.80	1.54	4.84	0	0.08	0	5.34	0.73	2.25	1.75	1.86	23.38
Other	0.12	0	0.17	0.14	0	0	0	0.03	0	0.06	0.01	0.02	0.55
Citrus	8.96	6.31	12.55	90.89	0	0.85	0	42.47	5.32	16.24	8.38	15.33	207.30
Mango	38.21	4.37	26.05	204.00	0	1.24	0	32.31	2.25	28.39	18.38	18.88	374.08
Litchi	2.59	0.65	2.08	25.07	0	0.02	0	1.98	0.24	1.25	0.43	1.08	35.42
Guava	0.70	0.38	1.51	6.59	0	0.14	0	6.55	0.14	1.20	3.32	1.62	22.15
Aonala	1.31	0.18	1.50	5.37	0	0.04	0	0.60	0.22	0.51	0.63	0.84	11.20
Jack fruit	0.83	0	0.34	0.84	0	0.01	0	0.60	0.01	0.36	0.26	0.51	3.76
Papaya	0.30	0.01	0.08	0.95	0	0	0	0.22	0.01	0.17	0.18	0.36	2.28
Grapes	0.27	0.02	0.14	0.16	0.12	0.03	0	0.04	0.07	0	0.05	0.43	1.33
Loquat	0.09	0.01	0.02	0.48	0	0	0	0.04	0.03	0.01	0.01	0.01	0.70
Others	0.67	0.01	0.20	4.05	0	0	0	0.09	0.03	0.07	0.27	0.19	5.58
O.S.T.F.	44.97	5.63	31.92	247.51	0.12	1.48	0	42.43	3.00	31.96	23.53	23.92	456.47
Total	62.32	146.34	51.43	362.23	97.55	246.25	6.61	319.05	356.92	151.61	66.02	50.35	1916.68

O.T.F. – Other temperate fruits , O.S.T.F. – Other Sub Tropical fruits

Source: Directorate of Horticulture

**Table 57: Crop wise Area in ha (2007-08)**

Name of fruit	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmaur	Solan	Una	Total
Apple	4	11473	0	453	8874	23179	734	15135	31323	3443	108	0	94726
Plum	89	385	154	416	9	2051	9	2689	598	1312	632	84	8428
Peach	125	217	109	217	68	41	0	754	302	2965	279	98	5175
Apricot	0	389	1	37	248	236	18	229	679	467	926	0	3230
Pear	496	358	115	421	61	483	7	1807	1505	471	1081	756	7561
Cherry	0	5	0	0	11	62	5	25	266	0	0	0	374
Kiwi	1	4	0	11	0	30	0	33	16	8	17	0	120
Pomegranate	51	17	94	69	1	215	0	198	91	49	82	69	936
Olive	0	3	0	0	0	10	0	10	29	1	0	0	53
Perssimon	3	5	2	4	1	167	0	176	28	6	4	1	397
Strawberry	0	0	0	2	0	5	0	2	0	44	2	0	55
Almond	32	290	194	417	990	390	6	1503	1500	134	135	110	5701
Walnut	34	1343	74	201	237	88	2	1016	303	1240	170	10	4718
Hazelnut	20	31	29	196	0	39	0	387	6	6	14	19	747
Mango	0	3	0	1	7	0	0	0	5	0	0	0	15
Litchi	3088	469	2730	21245	0	133	0	3807	300	2381	1873	1814	37840
Guava	74	41	149	663	0	15	0	656	20	88	340	172	2218
Aonala	135	23	216	668	0	4	0	89	30	66	70	174	1475
Jack Fruit	83	0	53	109	0	2	0	84	3	36	27	60	457
Papaya	23	1	8	101	0	0	0	27	1	14	19	36	230
Grapes	27	2	14	16	12	3	0	4	7	0	5	43	133
Loquat	9	1	2	48	0	0	0	4	3	0	1	1	69
Karonda	3	0	1	5	0	0	0	1	0	0	1	3	14
Ber	18	0	1	5	0	0	0	3	1	0	3	1	32
Sapota	9	0	14	10	0	0	0	0	0	1	6	14	54
Fig	13	0	0	2	0	0	0	0	0	0	0	0	15
Banana	18	0	6	86	0	0	0	3	0	0	2	4	119
Jamun	3	1	1	254	0	0	0	2	0	1	8	8	278

Name of fruit	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmaur	Solan	Una	Total
Bael	2	0	0	12	0	0	0	0	0	0	0	0	14
Deon	3	0	2	33	0	0	0	0	0	0	1	4	43
Orange/ Kinnu	242	21	214	5544	0	23	0	731	37	441	273	853	8359
Malta/ Musambi	56	1	112	667	0	4	0	169	2	11	8	83	1113
K.Lime	386	343	940	2749	0	51	0	2821	461	783	430	567	9531
Galgal	219	289	140	491	0	8	0	533	74	195	175	192	2316
Grapefruits	12	0	16	14	0	0	0	3	0	6	1	2	54
Harar	0	0	1	0	0	0	0	0	0	0	0	1	2
Total	5537	15796	5653	37878	10519	27241	781	33158	37623	14271	6740	5305	200502

**Table 58: Comparison of Area Production and Productivity of fruits in the Himachal Pradesh**

Fruit	1980-81			1990-91			2000-01		
	Area (km <sup>2</sup> )	Production (MT)	Productivity (Kg/ha)	Area (Km <sup>2</sup> )	Production (MT)	Productivity (Kg/ha)	Area (Km)	Production (MT)	Productivity (Kg/ha)
Apple	43.3	118.1	2727	62.8	342.1	5447	83.7	376.7	4500
Other temperate Fruits	17.5	9.3	531	28.5	14.9	523	32.4	20.5	633
Nuts & Dry fruits	6.9	1.8	261	13.2	3.1	235	16.4	2.7	165
Citrus	14.5	4.4	303	36	12.6	350	39.1	11.1	284
Other Sub tropical fruits	10.3	6.4	621	22.9	13.6	594	36.3	17	468
Total	92.5	140	1574	163.4	386.3	2364	207.9	428	2059

Source: Work Plan for Accelerated Growth of Agriculture & Horticulture in H.P. (2002-2003)

Temperate fruit covers about 64% of total cultivated area of State out of which more than 40% is under Apple cultivation. Shimla & Kullu are dominant areas of apple production while in Sirmaur peach is the main fruit crop. Kullu district grows Plum & Pear. Citrus, mango & Litchi are main fruits of Kangra. Area under, mango is about 39% of total area under sub-tropical fruits in lower hill region & 6% of total area under all fruits in State as compared to 19% under Citrus fruits.

About one-seventh of fresh fruit trees are non-bearing while in case of dry fruits it is one-eighth covering about 16% of area under fruits.

Shimla & Kinnaur have largest numbers of non-bearing trees of fresh as well as dry fruits. Fruit production which was 1200 MT in 1950-51 increased to 4.3 lakh metric tonnes in 2000-01. According to time series data average productivity of Apple is 5830 kgs/ha, other temperate fruits 990 Kg/ha, nuts & dry fruits 450 kgs/ha, Citrus 510 Kg/ha & Other sub Tropical fruits 1370 kgs/ha.

(Source: Work Plan for Accelerated Growth of Agriculture & Horticulture in H.P. 2002-2003).

District wise Bearing & Non bearing Area (Km<sup>2</sup>) under Fresh fruits, Dry fruits & Vegetables (1988-99) is given in Table 59.

**Table 59: District wise Bearing & Non bearing Area (Km<sup>2</sup>) under Fresh fruits, Dry fruits & Vegetables (1988-99)**

District	Fresh Fruits		Dry Fruits		Vegetables		
	Bearing	Non-Bearing	Bearing	Non Bearing	Potato Kharif	Rabi	Others
Bilaspur	3.38	0.75	0.02	-	-	0.13	4.98
Chamba	21.47	-	-	-	5.33	0.26	6.98
Hamirpur	0.84	-	-	-	-	0.13	1.99
Kangra	60.92	-	0.09	-	1.22	12.46	22.29
Kinnaur	15.97	3.18	5.52	0.57	2.44	-	9.21
Kullu	87.44	2.72	0.58	0.03	8.50	1.39	23.08
L&S	0.19	0.40	-	-	8.74	-	9.00
Mandi	57.57	-	-	-	16.35	1.95	49.04
Shimla	203.37	68.15	3.08	0.93	51.30	8.17	130.62
Sirmaur	14.89	1.00	0.33	0.05	10.82	3.84	33.95
Solan	7.45	1.37	0.04	-	0.18	1.25	31.97
Una	5.38	-	-	-	0.89	2.93	9.27
Himachal Pradesh	478.87	77.57	9.66	1.58	105.77	32.51	332.38

Source: Annual Season & Crop Report 1988-99. Commissioner (Revenue) Himachal Pradesh

Himachal Pradesh is a rich repository of Medicinal & Aromatic plants because of its situational advantage. About 500 medicinal, 150 aromatic and large numbers of potent, alternative and drug plant species are available in this area. There are 70 units in State which manufacture Ayurvedic medicines. 2 bigger units are set up at Joginder Nagar & Majra to procure raw material from Market. Department of Ayurveda, Government of Himachal Pradesh has set up one herbal garden in each of 4 agro-climatic zones of the State to raise germplasm nurseries. An Ayurvedic Herbarium has been set up at Joginder nagar to keep specimens of medicinal plants in a systematic manner. Among the cultivated medicinal plants Saussurea lappa (Kuth), Bunium persicum (Kala Zira), Crocus sativus (Kesar) & Humulus lupulus (Hops) are important. Following species exported from Himachal Pradesh are given in Table 60.

**Table 60: Major Medicinal Herbs Exported From Himachal Pradesh (Quintal)**

Name	1988-89	1989-90	1991-92	1994-95
<i>Jurinea</i> sp.	5884	4064	4939	3260
<i>Dioscorea</i> s p.	1672	180	380	4
<i>Gentiana kurroo</i>	1468	199	2899	343
<i>Valeriana</i> sp.	1954	1247	2014	1642
<i>Cinnamomum camphora</i>	1430	849	-	675
<i>Centella asiatica</i>	417	166	335	921
<i>Saussurea lappa</i>	3	648	667	321
<i>Morchella</i> sp.	402	137	2800	490
<i>Viola</i> sp.	26	195	-	71
<i>Pistachia integerima</i>	129	437	278	17
<i>Aconitum violaceum</i>	60	12	48	-
<i>Aconitum heterophyllum</i>	189	1	2	25
<i>Bunium persicum</i>	70	5	5	-
<i>Berberis</i> sp.	2981	11195	12824	-
<i>Pinus gerardiana</i>	656	568	600	403
<i>Agaricus bisporus</i>	37	15	-	-
Other sp.	4239	4913	10328	684

Source: Biotechnology Policy of Himachal Pradesh, Department of Biotechnology & Govt. of H.P. Brochures.2001

### **5.11 Information on human resource management issues (which may have relevance to environment management) in the sector such as: manpower, vocational training, awareness levels etc.**

The Department of Horticulture functions under the administrative control of the Principal Secretary (Horticulture) to the Government of Himachal Pradesh. The Director of Horticulture is the Head of the Department and is assisted by the Joint Director of Horticulture, Deputy Directors of Horticulture and Subject Matter Specialists at the Directorate level. There are seven specified divisions in the Directorate, namely:-

- General Horticulture
- Plant Nutrition
- Plant Protection
- Marketing and Post harvest Management
- Fruit Processing and Utilization
- Horticulture Economics and Statistics
- Horticulture Information Services

For the implementation of the horticulture development programmes and activities, the State has been divided into two zones namely the North Zone and South Zone.

The Additional Director of Horticulture posted at Dharamshala, District Kangra, supervises the horticulture development activities in the North Zone of the State which comprises of Chamba, Hamirpur, Kangra, Kullu, Lahaul & Spiti and Una Districts, under the overall control of the Director of Horticulture.

Deputy Directors of Horticulture have been posted in each district to implement and co-ordinate all the horticulture activities in their respective districts. They are assisted by District Horticulture Officer in extension and input

supply and Subject Matter Specialists in the field of orchards and nurseries, plant protection, floriculture and marketing, depending upon the scope of activities in the concerned district.

Horticulture Development Officers have been provided at each Development Block Horticulture Centre for implementation of the Horticulture Development

Schemes and providing extension services to the fruit growers. They are assisted by Horticulture Extension Officers provided in each Horticulture Extension Circle who are the grass root functionaries of the Department.

### **5.12 Regulatory analysis to identify any regulations that have environment implications (negative or positive), and compliance**

Horticulture sector is regulated by policy and regulatory framework as described below:-

- National Agriculture Policy, 2000
- National Policy for Farmers, 2007
- National Seed Policy, 2002
- The Seeds Act, 1966
- The Seeds Rules, 1968
- The Seeds (Control), Order, 1983
- National Oilseeds and Vegetable Oils Development Board Act, 1983 (29 of 1983)
- The National Oilseeds and Vegetable Oils Development Board Rules, 1984
- Pandit Deen Dayal Kisan Bagwan Samridhi Yojna
- Diversification of Crops Programme (Government of India and JICA)
- Quality Seed Multiplication and Distribution (Cereals, Pulses, and Vegetables)
- Wildlife Protection Act, 1972
- Forest Conservation Act, 1980

- Water Pollution (Prevention & Control) Act, 1974
- Soil and Water Conservation Programme
- Integrated Waste Land Development Programme (National Wasteland Development Board), 1989
- Grassland ecosystem and grazing policy
- Grazing policy
- National Watershed Development Project for Rainfed Areas (NWDPA)
- Land reforms
- IPM Act & Regulation 2004
- Insecticides Act, 1968
- The HP Agricultural Pests, Diseases & Noxious Weeds Act, 1969
- Fertilizer Control Order, 1985
- Destructive Insects and Pests Act, 1914
- Environment Protection Act, 1986
- National Environment Policy, 2006
- Fruit Protection Act, 1935
- Air pollution (Prevention & Control) Act, 1981
- The Himachal Pradesh Agricultural, Pests, Diseases and Noxious Weeds Act, 1969
- National Horticulture Mission
- National Policy on Education, 1986.
- District Institutes of Education and Training (DIETs)
- Sarva Shiksha Abhiyan
- Pradhan Mantri Gramodya Yojana (PMGY)
- Fruit Product Order (FPO), 1955
- Essential Commodities Act, 1955
- Fruit Nurseries Registration Act, 1973
- The Himachal Pradesh Warehouses Rules, 1987
- The Himachal Pradesh Warehouses Act, 1976
- The Himachal Pradesh Holdings (Consolidation & Prevention of Fragmentation) Act, 1971
- Horticulture Development Scheme
- Post harvest handling and cold chain management and procession
- National Horticultural Mission (NHM) was launched in 2005 mission adopts a cluster approach and promotes specific commodities in specific regions.
- The Himachal Pradesh Agricultural and Horticultural Produce Marketing (Development and Regulation) Act, 2005
- Himachal Pradesh Agricultural Produce Markets Act, 1969
- Agricultural Produce (Grading & Marking) Act, 1937
- Agriculture Produce Marketing Committee (APMC) Model Act, 2003
- The Agricultural and Processed Food Products Export Development Authority Act, 1985
- Agricultural Produce (Grading and Marking) Act, 1937 (Act No. 1 of 1937) as amended up to 1986.
- Ozone Depleting Substances (Regulation And Control) Rules, 2000

## References

- Work Plan for accelerated growth of Agriculture and Horticulture, 2002-2003
- Economic Survey Report, HP-2009-10
- Annual Season and Crop Report, 1998-99
- Department of Horticulture
- Department of Agriculture
- District Statistical Abstract
- State Agriculture Plan, 2009
- State Environment Report (Year not mentioned)
- 11th Five year Plan of HP
- HP Horticulture Produce Marketing & Processing Corporation Ltd.
- HP State Council of Science, Technology and Environment
- Statistical Outline of HP, 2008-09
- Gross Domestic Product of HP-1999-2000 to 2006-07
- Horticulture Development in HP by A.K. Dwivedi & Others-1997
- Biotechnology Policy of HP

## CHAPTER 6 ANIMAL HUSBANDRY & LIVESTOCK

### 6.1 Resource inventory of the existing assets of the sector

Livestock plays an important role in boosting the rural economy. Livestock are an important natural resource which contributes to the total income from the agriculture sector. Livestock sector contributes 5.59% of India's GDP. It provides regular employment to about 11 million in principal status and 8 million in subsidiary status. Women constitute 69% of the labour force in livestock section

(Source: Economic Survey, India, 2002-03).

As per Economic survey 2009-10, the contribution of major livestock products during the year 2008-09 was 8.84 lakh tonnes of milk, 1,617 tonnes of wool, 98.00 million eggs and 3,309 tonnes of meat which will likely to be of the order of 8.90 lakh tonnes of milk, 1,665 tonnes of wool, 105.00 million eggs and 3,400 tonnes of meat during 2009-10. Himachal Pradesh has a variety of large livestock population for meeting the growing needs of the people, particularly in respect of livestock products such as milk, eggs, meat and wool.

**Table 1: Livestock Development (1972-2007) Himachal Pradesh**

Census Years	Livestock Population (in million)
1972-73	4.7
1977-78	4.8
1982-83	5.0
1992-93	5.0
1997-98	4.5
2002-03	5.04
2007-08	5.2

Source: Integrated Sample Survey for Estimation of Animal Products, Milk, Eggs, Wool and Meat, 2001-2002, Directorate of Animal Husbandry, Himachal Pradesh, Pasudban Bhawan, Shimla, and Census of Livestock, 2003 & 2007

More than 80% livestock of the State is with small and marginal farmers including nomadic/migratory tribes who have been rearing livestock as means of livelihood as well as supplementary profession. Most of the livestock being indigenous and local breeds, there has been a tendency to keep large herds to compensate the low productivity of animals. More than 90% of rural population rear livestock which caters to the needs of the entire population in the form of milk and milk products. Due to the hilly topography of the State and climatic variation, most of the people rear indigenous cattle, sheep and goats whereas in plain areas of the State people have switched over entirely to cross breeding. Average daily milk production varies from 1.5 litres in case of indigenous cows to 3 litres in crossbred and improved cows.

The first livestock census in Himachal Pradesh was conducted in 1972. A total of 5.2 million livestock was estimated by the livestock census of 2007. Increase in the population of livestock from the year 1972 to 2007 is shown in Table 1. Districtwise concentration of livestock from 1982 to 2003 has been described in Table 2.

**Table 2: District-wise Livestock (1982-2003), Himachal Pradesh**

District	Total population of livestock, 1992	Total population of livestock, 1997	Total population of livestock, 2003	Trend in the total livestock
Bilaspur	237582	238448	208935	Decline
Chamba	727149	739036	804942	Increase
Hamirpur	250236	232521	192720	Decline
Kangra	809434	981483	885455	Increase
Kinnaur	93869	123179	136189	Increase
Kullu	332314	327628	386456	Increase
Lahaul & Spiti	68023	62172	69903	Increase
Mandi	871093	996565	849461	Decline
Shimla	630695	560647	527551	Decline
Sirmaur	410276	430083	460009	Increase
Solan	317703	329953	319881	Increase
Una	240166	202352	204542	Decline
Total	4988540	5224067	5046044	

Source: Statistical Outline, Himachal Pradesh



Above census can be compared giving the break up of the various types of livestock.

Table 3 compares the various types of livestock for the census years 1992, 1997, 2003 and 2007.

**Table 3: Comparison of population of Livestock in Himachal Pradesh (1992-2007)**

Livestock and poultry	Livestock Census Year			
	1992	1997	2003	2007
(I) Cattle				
(a) Cross Bred Cattle	2,80,393	5,38,402	6,50,743	8,02,683
1. Bulls	84,819	1,56,614	1,34,779	1,50,767
(i) Under 1 Year	14,360	23,452	42,040	61,545
(ii) Up to 1 to 2.5 years	11,540	24,679	21,354	19,803
(iii) Over 2.5 Years	58,919	1,08,483	71,385	69,419
Used for breeding only	2,095	8,037	2,777	2,810
Used for work only	52,764	84,408	65,767	52,352
Others	4,060	16,038	2,841	14,257
2. Cows	1,95,574	3,81,788	5,15,964	6,51,916
(i) Under 1 Year	40,848	74,021	1,02,638	1,24,486
(ii) Up to 1 to 2.5 years	30,300	62,251	70,514	88,127
(iii) Over 2.5 Years	124,426	2,45,516	3,42,812	4,39,303
In milk	83,591	175,180	2,43,206	3,15,965
Dry	28,331	55,020	76,142	93,296
Others	12,504	15,316	44,277	30,042
(b) Indigenous Cattle	18,84,641	14,63,424	15,45,795	14,76,197
1. Bulls	9,91,224	7,72,639	7,90,356	7,42,280
(i) Under 1 Year	82,227	64,217	63,078	70,493
(ii) Up to 1 to 2.5 years	1,13,600	94,196	78,676	84,720
(iii) Over 2.5 Years	7,95,347	6,14,226	648,602	5,87,067
Used for breeding only	14,368	50,794	9,738	10,505
Used for work only	7,2,467	4,77,549	6,11,053	4,91,415
Others	54,512	85,833	27,811	85,147
2. Cows	8,93,417	6,90,785	7,55,439	7,33,917
(i) Under 1 Year	1,45,952	1,25,971	1,29,182	1,28,005
(ii) Up to 1 to 2.5 years	1,32,465	1,15,826	1,08,944	97,872
(iii) Over 2.5 Years	6,15,000	4,48,988	5,17,313	5,08,040
In milk	3,01,230	2,88,693	2,77,948	2,91,247
Dry	2,34,527	1,20,404	1,97,860	1,68,684
Others	79,243	39,891	41,505	48,109
Total Cattle (a+b)	21,65,034	20,01,826	21,96,538	22,78,880
II Buffaloes				
(a) Male	33,250	43,820	41,140	58,179
(i) Under 1 Year	17,169	21,280	33,122	45,780
(ii) Upto 1 to 3 years	8,328	14,169	8,299	6,926
(iii) Over 3 Years	7,753	8,371	5,719	5,473
Used for breeding only	4,423	4,633	4,235	3,857
Used for work only	2,319	2,316	981	1,139
Others	1,011	1,602	503	477
(b) Females	6,70,299	6,08,533	7,26,089	7,03,410
(i) Under 1 Year	98,323	84,785	1,23,745	1,22,965
(ii) Upto 1 to 3 years	97,497	98,666	1,02,149	1,03,550
(iii) Over 3 Years	4,74,479	4,25,102	5,00,195	4,76,895
In milk	2,99,909	3,02,299	3,39,338	3,34,114
Dry	1,36,485	1,02,096	1,26,244	1,13,523
Others	38,085	20,707	34,613	29,258
Total Buffaloes (a+b)	7,03,549	6,52,373	7,73,229	7,61,589
III Sheep	10,78,940	9,08,831	9,06,027	9,01,299
IV Goats	11,18,094	9,46,529	11,15,587	12,40,836
V Horses and ponies	14,055	22,026	17,144	13,155
VI Other livestock				
(i) Mules	16,390	24,404	23,938	18,985
(ii) Donkeys	7,522	6,639	8,859	7,376
(iii) Camels	367	168	137	56
(iv) Pigs	7,286	4,670	2,795	2,493
(v) Yaks	5,690	2,548	1,590	1,705
(vi) Mithuns	6	731	200	14
(vii) Rabbits	-	-	4,393	6,620
Total Livestock	51,16,933	45,70,745	50,46,044	52,26,388
VII. Poultry	7,22,596	3,84,880	7,64,136	8,09,132
VIII. Dogs	1,45,771	1,70,147	2,08,254	2,11,900

Source: Statistical Outline 2005-06, H.P.

Table 4 describes district wise hospitals & dispensaries. Himachal Pradesh has in all 1927 different centres providing veterinary care. There were only nine veterinary hospitals functioning in 1948. The number of centres has

multiplied manifold since then. Of the 303 veterinary hospitals in the State, 52 are confined to Kangra District alone which is shown in Table 4. Therefore, the distribution is, however, highly uneven.

**Table 4: District wise Hospital & Dispensaries, H.P**

Districts	Hospitals*			Dispensary			Mobile Dispensary		
	2001-02	2006-07	2007-08	2001-02	2006-07	2007-08	2001-02	2006-07	2007-08
Bilaspur	20	20	21	86	98	97	1	1	1
Chamba	33	34	36	143	163	164	1	1	1
Hamirpur	17	17	17	104	118	117	1	1	1
Kangra	59	59	61	301	245	339	2	2	2
Kinnaur	20	20	20	37	38	38	1	1	1
Kullu	16	16	16	79	88	88	1	1	1
Lahaul & Spiti	13	13	13	39	43	43	1	1	1
Mandi	38	38	39	241	271	268	1	1	1
Shimla	44	46	49	230	255	252	2	2	2
Sirmaur	29	29	31	112	126	124	1	1	1
Solan	22	22	23	120	135	131	1	1	1
Una	17	17	19	93	106	104	1	1	1
State	328	331	345	1585	1786	1765	14	14	14

Source: Annual Administrative Report, 2002-03, Animal Husbandry, Himachal Pradesh

\* Including those run by the Central Government

### 6.1.1 District wise Status of Animal Husbandry

a) Bilaspur: According to the 1992 cattle census, the total livestock in the district were 236,617 out of which there were 60,461 cattles,

86,858 buffaloes, 24,615 sheeps, 63,372 goats and 1131 other types of livestock. The total poultry birds in the district were 59,654. Tehsil wise detail of livestock as per 1992 cattle Census is given in Table 5.

**Table 5: Tehsil/ Sub-Tehsil wise number of livestock and poultry in district Bilaspur**

Tehsil/Sub-Tehsil	Cattle	Buffaloes	Sheeps	Goats	Other	Total livestock	Poultry
Ghumarwin (T)	24,830	43,497	16,046	25,638	663	1,10,674	15,796
Jhanduta (ST)	7,689	13,900	2,438	9,971	96	34,094	1,699
Naina Devi (ST)	7,617	13,635	357	12,408	196	34,213	3626
Bilaspur Sadar (T)	20,325	15,826	5,774	15,355	356	57,636	5,894

Source: District Statistical Abstract-2000 (p-66)

The Animal Husbandry Department has taken up various schemes to develop better breeds of cattles, poultry farms in the district. During the year 2000-01 there were 20 veterinary hospitals, 88 dispensaries functioning in the district.

Dairy: Because of the small size of holdings and low income, majority of the rural population is living below the poverty line. Dairy farming and other allied activities, therefore, have great significance in economic upliftment of the rural masses. The department of Animal Husbandry

is providing training to farmers for dairy farming. Loans are provided by banks for purchase of good quality cattles. There is one Jersey cow breeding livestock farm at Kothipura. Keeping in view the per capita demand for milk and its availability, there is a good scope for this activity in the district. Further it has large scale employment potential in case all the infrastructural requirements are provided for small as well as large commercial dairy farms.

Other allied activities: Other allied activities being carried out in the district are sheep rearing, goat rearing, pig rearing and bullock/mules etc. for transportation. Assistance for these activities is provided through District Rural Development Agency (DRDA) and other sponsoring agencies. During the recent year sericulture, floriculture and mushroom production activities have been started under the Gold Mine Project.

b) Chamba: According to the Livestock Census 1992, total livestock in the district was 723,024 out of which total cattle were 243,673; buffaloes were 35,765, sheep 261,523, goats 176,867 and other 5,196 animals.

The improvement of the breed of livestock remains the main concern of the Department of Animal Husbandry in the district which, indeed, has taken a considerable stride in this direction. At the end of 1998-99, there were 19 veterinary hospitals and 113 veterinary dispensaries in the district. The rearing of Jersey Cows is finding favour with the people due to high yield of milk and long period of lactation.

Sheep: Sheep not only provide wool, but also mutton and manure. Most of the sheep in Pangi and Bharmaur areas are being reared as migratory flocks. Due to excessive snowfall, the

breeders move on to lower areas during winter months. To develop a suitable breed of sheep carrying a higher yield and superior quality of wool, a sheep breeding farm was established at Sarol. Various incentives are provided to the breeder under Scheduled Castes and Scheduled Tribes Component Plan in the district.

Poultry Farming: In order to supplement the income of small and marginal farmers various schemes have been formulated for encouraging poultry farming in the district. The department is providing birds at subsidised rates along with the feed to the breeders and also deputing the breeders for various training programmes in poultry management. According to Livestock Census of 1992, there were 68,249 poultry birds in the district.

Dairy Farming: In order to improve the standard of living, the department is making strenuous efforts in increasing the production of milk in the district. With this objective in view, milk supply scheme was introduced in the district during December, 1978. The milk is procured through the Co-Operative Milk Societies and a nominal commission is being charged from the suppliers. The details of livestock as per 1992 Cattle Census is given in Table 6.

**Table 6: Number of livestock and poultry in district Chamba**

Total Cattle	Cows	Buffaloes	Sheep	Goats	Others	Poultry Birds
7,23,024	243,673	35,765	261,523	176,867	5,196	68,249

Source: District Statistical Abstract, 2000

c) Kangra: Livestock is the main wealth next to agriculture of the rural population. The slope of Dhauladhar has concentration of Gaddi population and rearing of sheep and goats is the main occupation of people. Almost every household in rural areas invariably keeps a few cows, buffaloes, sheep and goats. Besides, some

also rear pigs and keep poultry birds. Animals are kept for milk, meat and providing manure to the fields. Kangra District has a large number of livestock. As per the livestock Census of 1992, the total number of live stock in the district is given below in Table 7.

**Table 7: Number of livestock and poultry in district Kangra**

S. No.	Particular of Livestock and Poultry	Total
1	Cattle	399,398
2	Buffaloes	147,858
3	Sheep	154,590
4	Goats	206,039
5	Pigs	1,543
6	Others(including Horses and Ponies)	9,040
	Total	918,468
	Poultry	281,585

Source: District Statistical Abstract, Kangra-2000.

For prevention of common infectious diseases of livestock, veterinary aid is of great importance. In all there are 341 veterinary institutions in the district, which include 52 hospitals, 287 dispensaries, 2 mobile dispensaries. These institutions are providing veterinary aid for common ailment and also help in prevention and control of contagious diseases.

In order to improve the life standard of the people, all round efforts are being made to improve the quality of milch animals and production of milk. In Kangra district, 6 chilling plants are functioning at Dagwar, Darkoti, Kotla, Bindraban, Milwa, and Raja-ka-Talab as shown in Table 8.

**Table 8: Number of milk chilling plant in district Kangra**

Sr. No.	Milk Chilling Plant	Date of Function	Chilling Capacity (in litres)	Storage Capacity (in litres) during 1999-2000.
1	Darkoti	02.06.1973	2,000	83,272.5
2	Kotla	13.08.1973	2,000	N.A.
3	Bindraban	09.10.1973	2,000	N.A.
4	Dagwar	15.05.1986	10,000	1,287,112.5
5	Raja-ka-Talab	11.02.1987	2,000	15,829.0
6	Milwa	01.09.1987	2,000	62,735.0

Source: District Statistical abstract, Kangra, 2000.

d) Kinnaur: Livestock is the main wealth next to agriculture of the rural population. As per Livestock Census of 1992, the total number of livestock in the district is given in Table 9.

**Table 9: Number of livestock and poultry in district Kinnaur**

S. No.	Livestock and Poultry	Number
1	Cows	22,256
2	Buffaloes	3
3	Sheep	57,720
4	Goats	28,622
5	Others	6,540
6	Poultry Birds	5,795

Source: District Statistical Abstract, Kinnaur-2000.

For prevention of common infectious diseases of livestock, veterinary aid is of great importance. In all there are 58 veterinary institutions in the district, which include 19 hospitals, 37 dispensaries, one mobile dispensary, one C.V.D. These institutions are providing veterinary aid for common ailments and also helping in prevention and control of contagious diseases.

The improvement of the breed of livestock is the main concern of the department of animal husbandry in the district. Cross breed jersey cow and merino breed of sheep have become very popular among the progressive farmers. Artificial insemination centres are also functioning at different places. Sheep breeding farm at Karchham and a yak breeding centre at Sangla are also functioning.

Fodder development farms have been established by the Animal husbandry department at Thangkarma and Nakomaling. To solve the fodder problem the department is providing improved variety of fodder feeds like lucern, berseen, orchard grass and grass roots to the farmers.

e) Kullu: Livestock is an important source of income in the district. As per the Livestock Census of 1992, the position of livestock in the district is given in Table 10.

**Table 10: Number of livestock and poultry in district Kullu**

S. No.	Particulars of Livestock and Poultry	Rural	Urban	Total
1	Cattle	158,010	883	158,893
2	Buffaloes	771	1	772
3	Sheep	110,581	88	10,669
4	Goats	56,579	36	56,615
5	Horses and Ponies	871	81	952
6	Others	317	83	400
7	Poultry	19,384	2,245	21,629

Source: *Statistical Abstract, Kullu- 2000.*

For prevention of common infectious diseases of livestock, veterinary aid is of paramount importance. The district has wide net of veterinary institutions and has 15 veterinary hospitals, 72 dispensaries, one mobile veterinary dispensary and 6 other institutions during 1998-99. These institutions are providing veterinary aid for common ailment and also helping in prevention and control of contagious diseases. The district has five

artificial insemination centres and two poultry and sheep breeding farms.

f) Lahaul & Spiti: Table 11 describes the status of livestock and associated institutions in Lahaul & Spiti. According to Livestock Census of 1992, there were 63,440 livestock in the district as compared to 69,564 in 1988. This shows a decrease of 6,124 livestock during the five years. The main livestock comprises sheep, goats, cows and pack animals. The numbers of sheep were 38,776, goats 11,180, cows 8,117, horses and ponies 1,140, mules 288, donkeys 1,926, yaks 1,997 and pigs 16. Apart from this, there were 4,361 poultry birds in the district. There were 13 veterinary hospitals, 37 veterinary dispensaries, and 2 mobile dispensaries in the district up to 1999-2000. The declining trend of livestock is perhaps due to the diversification of occupational structure in the district and attention of people is attracted towards raising of off season vegetables which fetches enumerative returns in the market. Besides this, supply of fodder to the cattle is also one of the biggest problems which is a discouraging factor.

**Table 11: Statement showing the livestock and institutions in Lahaul & Spiti district as on 31.3.1999**

S. No.	Animals & Poultry	Number	S. No.	Animals & Poultry	Number
1	Buffalo	-	5	Goats	11,180
	Cattle		6	Pigs	16
	Cross	3,124	7	Others	5,351
	Indigenous	4,994	8	Total	63,440
2	Total	8,118	9	Poultry	4,361
	Breedable		10	Vety. Hosp.	13
	Cross	1,989	11	Vety. Dis.	39
	Cows		12	C. V. D.	1
	Indigenous	2,509			
3	Total	4,498			
4	Sheep	38,776			

g) Mandi: According to Cattle Census of 1992, the total number of cattle and poultry birds in the district was 942,473 and 81,456 respectively. There were 430,331 cows, 107,676 buffaloes, 2,014 horses and ponies, 315 donkeys, 2,607 mules, 196,041 sheep, 203,270 goats and 219 pigs in the district in 1992. At the end of the year 1998-99, there were 36 veterinary hospitals, 205 dispensaries, one mobile

dispensary, two C.V.D. and nine other veterinary institutions functioning in the district besides various artificial insemination centres for cows and buffaloes. Artificial insemination is being done by deep freezing technique by the superior gonaplaza of Jersey breed in cows and by murrah breed in buffaloes. It also covers castration of scrub bulls; provide general health cover to animal, prophylactic vaccination

against contagious diseases and other allied extension work. The cattle and poultry food are also supplied to the farmers under no profit no loss basis through these institutions. Two jersey cattle breeding farms at Kamand and Karsog have been functioning to supply improved breed animals and two feed and fodder development centres are functioning at Kamand and Sinog to supply green fodders as well as barseem in the district.

One sheep breeding station for pure merino sheep which was started at Nagwain to improve

the breed of sheep under Indo-German programme is functioning in the district. German merino sheep were kept at the station for the production of pure German merino lambs. The Government has also established a hatching centre at Sundarnagar. The main poultry farm was established at Chauntra with four extension centres at Sundarnagar, Padhar, Tikole and Mandi with a poultry farm attached to each. Table 12 & Table 13 describe the status of livestock & poultry and associated institutions in the district.

**Table 12: Number of live stock and poultry in district Mandi**

S. No.	Livestock & Poultry	Number	S. No.	Livestock & Poultry	Number
1	Cows	430,331	6	Sheep	196,041
2	Buffaloes	107,676	7	Goats	203,270
3	Horses and Ponies	2,014	8	Pigs	219
4	Donkeys	315	9	Total	942,473
5	Mules	2,607	10	Poultry	81,456

Source: District Statistical Abstract, Mandi-2000

**Table 13: Number of Institutions and Production of milk products in 1998-99**

Institutions	Number	Item	Quantity
Vet. Hospital	36	Milk Received (in Litre)	1,763,821
Vet. Disp.	205	Milk sold (in Kg.)	1,707,863
Mobile Vet. Disp.	1	Production of Ghee (in Kg.)	20,373
CVD	2	Ghee sold (in Kg.)	17,744
Other Institutions	9	Production of Table butter (in Kg.)	880
Total	253	Table butter sold (in Kg.)	872

Source: District Statistical Abstract, Mandi-2000

h) Shimla: As per Livestock Census of 1992, the total number of livestock in the district was 582,368 as compared to 649,052 in 1982. It included 327,690 cattle, 22,450 buffaloes, 1,150 horses and ponies, 364 donkeys, 3,329 mules, 129,949 sheep, 96,378 goats, 1,031 pigs and 27 other types of animals in the district. Besides these, 45,050 poultry birds were also recorded during the Livestock Census of 1992 as against the 59,657 poultry birds recorded in the cattle Census of 1982. It seems that the decrease in the number of livestock and poultry birds in the district is due to lack of interest by the people, shortage of fodder and grazing land due to uncertainty of rains and fencing of grazing land by the forest land and restrictions imposed by the department in grazing cattle in the reserved

and demarcated forests as well as implementation of improved methodology and technique in agriculture and easy availability of milk products, meat, wool and other products like chemical fertilizers etc. on cheap rates in the market.

The mute animals are prone to many diseases and they also need proper medical care. For this purpose there are in all 271 veterinary institutions functioning in the district which include 38 veterinary hospitals, 191 veterinary dispensaries, 2 mobile veterinary dispensaries, 5 C.V.D. and 35 other institutions. Apart from these artificial insemination institutes, centres are also functioning in some places of the district for breeding purposes. The Animal

Husbandry Department is maintaining bulls for natural services almost in all the hospitals. At some places, the Panchayats have been provided with bulls and the maintenance charges are being borne by them. However, as an alternate to the natural services by the bulls,

artificial insemination has been introduced in all the hospitals and dispensaries for which semen is supplied from the selected centres on nominal charges. Table 14 & Table 15 describe the status of livestock and associated institution in the district.

**Table 14: Number of Livestock and poultry in Shimla District**

Livestock as per 1992 cattle Census					
S. No.	Livestock & Poultry	Number	S. No.	Livestock & Poultry	Number
1	Cows	3 27,690	7	Goats	96,378
2	Buffaloes	22,450	8	Pigs	1,031
3	Horses and ponies	1,150	9	Others	27
4	Donkeys	364	10	Total	582,368
5	Mules	3,329	11	Poultry	45,050
6	Sheep	129,949			

Source: Statistical Abstract Shimla, 2000

**Table 15: Number of Institutions in Shimla District**

District	Institutions during 1998-99					Total
	Vety. Hospital	Vety. Dispensary	Mobile vety. Dispensary	C.V.D	Other Institution	
Shimla	38	191	2	5	35	271

Source: Statistical Abstract Shimla, 2000

**Dairy:** The Department of Animal Husbandry is also maintaining dairy development activities in the district. But at present due to a major increase in the population of the district, 90% supply of milk is from neighbouring States i.e. Punjab and Haryana which are mainly feeding Shimla town and other parts of the district. Moreover, in few places, milk Co-operative Societies are functioning in the district which supply milk to the dairy plant at Tutoo.

**Poultry Farming:** Activities of poultry farming is also carried out by the Department of Animal Husbandry in the district which supplies exotic birds to the breeders and also arranges training programmes off and on and provide technical know-how. The central poultry farm Kamlahi was established during the second plan and eggs and dressed chicken are supplied by the farm for sale through the Cooperative Consumer Store. Besides, poultry units are also attached to veterinary hospitals at Seoni. Eggs and chicken are also supplied to the market by the private breeders and the Co-operative Societies. The department also undertakes the work of distribution of improved breeds like white leghorn and Rhode Island Red to the breeders through block agencies in order to

improve the local breed. As per livestock Census of 1992, there were 45,050 birds and fowls in the district.

i) Sirmaur: The livestock census shows that the growth of livestock is gradual and steady. According to livestock census in 1966 there were 389,889 animals including mules and camels in the district. This number according to 1982 and 1992 Census rose to 410,276 and 437,668 respectively. As per 1992 Census, there were 40,059 buffaloes, 234,405 cows, 27,621 sheep, 115,892 goats, 2,310 pigs, 2,826 other animals and 34,287 poultry birds in the district (Table 16).

The improvement of breed livestock is the main concern of the department of animal husbandry in the district which has improved considerably. There were 26 veterinary hospitals, 90 veterinary dispensaries, one mobile veterinary dispensary, five C.V.D. and 18 other veterinary institutions functioning in the district as on 2000. There are as many as 12 artificial Insemination centres in the district which provided insemination to 15,298 cows and 4,654 buffaloes in the year 1999-2000 (Table 16.)

**Table 16: Number of livestock and poultry in district Sirmaur**

Total Cattle	Cows	Buffaloes	Sheep	Goats	Horse & Ponies	Dog	Others	Poultry Birds.
437,668	234,405	40,059	115,892	27,621	686	14,855	4,150	34,287

Source: District Statistical Abstract, Sirmaur-2001

Dairy: In order to improve the over all standard of living of the people, the Animal Husbandry Department has been focusing its attention on dairy milk in the district. The dairy development activities in the district are being carried out on the line of Anand pattern of dairy co-operative which is an organization collectively owned, operated, controlled and managed by the primary milk producers by joining hands for the procurement, processing and marketing of milk for their own benefit, thus ensuring equitable distribution of all economic gains. In all, 29 Anand pattern co-operative societies have been formed under sub unit Nahan with a total membership of 2,600. The Himachal Pradesh Milk Federation is supplying balanced cattle feed to the societies at a subsidized rate. The Himachal Pradesh Milk Federation is also supplying mini kits of fodder seeds to its members free of cost.

Poultry: For the first time in December, 1960, central poultry farm was established by the Animal Husbandry Department with a view to improve breed/strains of poultry birds and distribute these birds to the farmers of the district. It is fast emerging as an important activity for enhancing nutrition and providing employment in the district. One central poultry farm at Nahan and one poultry extension centre at Paonta Sahib is functioning in the district in addition to six poultry farms located at or around Nahan, Paonta Sahib, Kolar, Maginand, Sarahan and Rajgarh area. Before the opening of the hatchery at Nahan, the farmers were solely dependent on hatcheries of the adjoining States of Punjab, Haryana and Union Territory of Chandigarh. Training in poultry farming is also imparted at Nahan and Paonta Sahib.

j) Solan: As per the Livestock Census 1992,

total livestock population was 3, 33,440 as compared to 3, 26, 098 in 1982 livestock census. Total cows were 1,43,491 both in cross and indigenous breeds, 74,349 buffaloes, 19,713 sheep, 82,541 goats, 1,128 pigs, 1,047 ponies and the number of other type of animals is meagre. The total number of poultry birds was 46,167 in the district. There were 162 veterinary institutions functioning in the district during the year 2002 to prevent the common ailment and control of infectious diseases of livestock. Out of these, the number of veterinary hospitals headed by veterinary Asstt. Surgeon is 22 and 132 Veterinary Dispensaries and 8 mobile veterinary dispensaries.

Dairy: For providing remunerative rates to the milk producers and wholesale milk at reasonable rates to the consumers, jersey cows were distributed to the farmers by the department. Different agencies have also distributed the crossed and graded jersey cows amongst the farmers to supplement their income as the graded cows give more milk than the local cows as such and there is a definite increase in the milk yield in the district. Artificial insemination facilities are available in all the areas located on the road side. The operation of white flood scheme of operation flood under the name of H.P. Co-operative Milk Producers Federation is working smoothly in the State under the control of MilkFed. The milk chilling plants are in operation at Darlaghat, Nalagarh and Maryog which are being run by H.P. State Milk Producers Cooperative Federation since 1983. The State Department of Animal Husbandry has been focussing its attention on increasing the dairy milk in the district.

Poultry: For providing improved poultry birds and hatching eggs, 14 poultry farms/centres are



functioning in the district. Under special livestock (poultry) production programme, one hundred poultry units are proposed to be established with the financial assistance of the Government of India for the benefit of the small and marginal farmers in Shimla, Solan, Bilaspur and Una districts

k) Una: As per the Livestock Census of 1992, the number of livestock in the district is given

**Table 17: Number of Livestock and Poultry in District Una**

S. No.	Livestock and Poultry	Total	S. No.	Livestock and Poultry	Total
1	Cattle	67,492	5	Pigs	66
2	Buffaloes	91,736	6	Others	768
3	Sheep	5,983	7	Total	213,019
4	Goats	46,974	8	Poultry birds	21,847

Source: District Statistical Abstract, Una-2001

Dairy: At present DCSO department is collecting milk at 3 milk chilling plants i.e. Bangana, Jhelera and Pekhubella.

The district is surplus in milk supply and Gujjars living in this district are mainly engaged in the rearing of milch animals. At present there are 8 routes in the district through which milk is collected from the rural areas and supplied to the milk chilling plants. Cattle fairs are regularly organized in each block and animals of good quality are being supplied. 16 centres are functioning in this district for breeding of Murrah buffaloes.

Poultry: Two poultry farms at Ajouli and Jalgran are existing and supplying poultry birds. Poultry feed is being purchased from the Punjab Poultry Corporation, Chandigarh and Himachal Pradesh, Agro-industries, Parwanoo. Poultry Development Officer, Ajouli and Poultry Manager, Una are imparting training to the farmers engaged in poultry farming

**Table 18: Livestock (1972-1997), Himachal Pradesh**

Census years	Livestock (In Million)
1972	4.7
1977	4.8
1982	5
1992	5.1
1997	5.2

in Table 17. For the prevention of common infectious diseases of livestock, veterinary aid is of great importance. During the year 1999, there were 16 veterinary hospitals, 76 veterinary dispensaries, one mobile dispensary, one C.V.D. and 14 other institutions in the district. These institutions provide veterinary aid for common ailment and also help in prevention and control of contagious diseases.

### 6.1.2 Status of Livestock and Animal Husbandry

Livestock sector contributes 5.59% of India's GDP. It provides regular employment to about 11 million in principal status and 8 million in subsidiary status. Women constitute 69% of the labour force in livestock section (Economic Survey, India, 2002-03, p.163).

In India, livestock population is recorded quinquennially, for example in 1992, 1997 and 2002. The First livestock Census in Himachal Pradesh was conducted in 1972. It completed its seventh count in 2002. The available data, as projected, is only up to the year 1997.

A total of 5.2 million livestock was estimated by the Livestock Census of 1997 as given in Table 18. This number was close to that of human population in the State. It accounted for 1% of the total livestock population in the country.

Source: Integrated Sample Survey for Estimation of Animal Products, Milk, Eggs, Wool and Meat, 2001-2002, Directorate of Animal Husbandry, Himachal Pradesh, Pasudhan Bhawan, Shimla, pp.9-10.

Livestock keeping is very common in Himachal Pradesh 19 out of every 20 households keep at least one of the species of livestock. Bovine is the most common species. Of the total

households in the State, 91.39% have bovine. Goat is the next important livestock. Nearly one-fourth of the total households keep goat. Similarly, two out of every five households keep a sheep. Rearing of pigs is rare. However,

households keeping poultry accounted for 5.54% of the total households in the State. In 1992, the State accounted for 1.1% of India's livestock population while its human population was 0.6 % as given in Table 19.

**Table19: Comparison of Livestock in India and Himachal Pradesh, 1992**

Category	All India ('000)	Himachal Pradesh ('000)	Percentage to total of India
Cattle	204533	2165	1.06
Buffaloes	83499	704	0.84
Sheep	50799	1079	2.12
Goat	115278	1118	0.96
Pigs	12795	-	-
Horses and ponies	826	14	1.7
Others	2415	37	1.54
Total	470145	5117	1.08
Total Poultry	307075	722	0.24

Source: Integrated Sample Survey for Estimation of Animal Products, Milk, Eggs, Wool and Meat, 2001-2002, Directorate of Animal Husbandry, Himachal Pradesh, Pasudhan Bhawan, Shimh, pp.9-10.

The composition of the State's livestock population underwent some change during 1972-97 (Table 20). While the percentage share of cattle declined from 46.3 to 41.6, and buffaloes increased from 11.6 to 14.3. Similarly, while the percentage share of sheep went down

from 21.1 to 20.7, that of goats experienced a rise from 19.3 to 22.4. The number of horses and ponies had come down by one-fifth. However, poultry recorded 4.6 times multiplication from 1,87, 000 in 1972 to 8,64, 000 in 1997.

**Table 20: Composition of Livestock, 1972 and 1997**

Livestock	Total		Percentage to Total Livestock		Trend
	1972	1997	1972	1997	
Cattle	2175690	2173575	46.26	41.6	Decline
Buffaloes	543887	748246	11.56	14.32	Increase
Sheep	1039946	1080464	22.11	20.68	Decline
Goat	906415	1167992	19.27	22.35	Increase
Horses and ponies	16234	12884	0.34	0.24	Decline
Others	20283	40906	0.43	0.78	Increase
Total	4702455	5224067	100	100	

Source: Integrated Sample Survey for Estimation of Animal Products, Milk, Eggs, Wool and Meat, 2001-2002, Directorate of Animal Husbandry, Himachal Pradesh, Pasudhan Bhawan, Shimla, pp.9-10 Distribution Pattern

While there is a general increase in livestock population of the State during 1982-97 period, five out of twelve districts registered an absolute decline. These are Hamirpur, Kullu,

Lahaul & Spiti, Shimla and Una. Nearly 20% of the total livestock was concentrated in Mandi. It was followed very closely by Kangra district (Table 21).

**Table21: District-wise Concentration of Livestock, 1982-1997**

Districts	1982		1997		Trend in Proportion to Total Livestock
	Total population of Livestock	Percentage to Total Livestock in the State	Total population of Livestock	Percentage to Total Livestock in the State	
Bilaspur	237582	4.76	238448	4.56	Decline
Chamba	727149	14.57	739036	14.14	Decline
Hamirpur	250236	5.01	232521	4.45	Decline
Kangra	809434	16.22	981483	18.78	Increase
Kinnaur	93869	1.88	123179	2.35	Increase
Kullu	332314	6.66	327628	6.27	Decline
Lahaul & Spiti	68023	1.36	62172	1.19	Decline
Mandi	871093	17.46	996565	19.70	Increase
Shimla	630695	12.64	560647	10.70	Decline
Sirmaur	410276	8.22	430083	8.20	Unchanged
Solan	317703	6.36	329953	6.30	Unchanged
Una	240166	4.80	202352	3.87	Decline
Total	4988540	100	5224067	100	

Source: Statistical Outline, Himachal Pradesh, 1992, p.85.

### 6.1.3 Livestock Species

Various livestock combination (district wise) is given in Table 22, which reveals that low altitude, gentle sloping terrain of districts adjoining Punjab, such as Bilaspur, Hamirpur and Una, have dominance of buffaloes in their livestock. Kangra, Kullu, Mandi, Shimla, Sirmaur and Solan have dominance of cattle and high altitude cold climate districts of Chamba, Lahaul & Spiti and Kinnaur have a dominance of sheep in their total livestock.

**Table 22: District-wise Livestock Combination, 1997, Himachal Pradesh**

Districts	Major Species	Districts	Major Species
Bilaspur	Buffalo, Goat, Cattle	Lahaul & Spiti	Sheep, Goat, Cattle
Chamba	Sheep, Cattle, Goat	Mandi	Cattle, Goat, Sheep
Hamirpur	Buffalo, Cattle, Sheep	Shimla	Cattle, Sheep, Goat
Kangra	Cattle, Goat, Sheep	Sirmaur	Cattle, Goat, Buffalo
Kinnaur	Sheep, Goat, Cattle	Solan	Cattle, Goat, Buffalo
Kullu	Cattle, Sheep, Goat	Una	Buffalo, Cattle, Goat

Source: Integrated Sample Survey for Estimation of Animal Products, Milk, Eggs, Wool and Meat, 2001-2002, Directorate of Animal Husbandry, Himachal Pradesh, Pasudhan Bhawan, Shimla.

A. Cattle (*Bos indicus*): Cattle in the State account for 43.85% of total livestock population. Cattle are mainly reared in the all the districts of the State.

#### 1) Indigenous

i) Hilly Cattle: This type of Cattle accounts for 80% of the total cattle population in the State. The male cattle have a conspicuous hump. These cattle occur almost throughout the State, predominantly in districts of Chamba, Sirmaur, Kullu, and Shimla. Pure hilly cattle can be found in far-flung remote areas of Bharmour, Pangi, Dodra-Kwar and the interior of Rampur Tehsil.

ii) Red Sindhi & its crosses: Red Sindhi thorough breed of Punjab/Sindh is being used for upgradation of local hilly cattle for its high milk fat. Moreover, it cannot withstand cold climate. These animals are found in valley areas and lower altitudes.

iii) Sahiwal and its crosses: These were initially introduced for up-gradation of local cattle. It is found in valley and lower altitudes due to their heftiness and less tolerance to cold climate.

iv) Haryana & its crosses: These are found in a few numbers in areas adjoining to Punjab and Haryana.

#### 2) Hybrid breeds of Cow

i) Jersey: This breed originated on the Island of Jersey (off the coast of the British Isles). They are being reared in Government livestock farms (Kamand, Palampur, Kothipura, Bhangrotu). Few progressive farmers have also acquired pure jersey cows from livestock farms. Climatically, this animal is suited for mid & high hills of the State. It is being used for up-gradation of local hilly cattle for its high milk yielding and efficient breeding qualities. These animals are susceptible to diseases and parasitic attack hence pure breed is not being encouraged.

ii) Jersey crosses: Jersey crosses with 50% exotic blood have been found highly suitable for the State, hence being encouraged through cross breeding. With artificial insemination crosses have become very popular with milk producers. About 80% of cross-bred cattle of the State are jersey crosses.

iii) Holstein-Friesian: This breed originated in the Netherlands (province of Friesland) and Northern Germany. It is the second oldest of the pure dairy breeds. They are being reared at Government livestock farm at Bagthan (District Sirmaur) and Bhangrotu (District Mandi). This breed is being used for cross breeding with local and indigenous cattle in valley areas. They

are heavy, have low fat percentage but are high milk yielders.

iv) Holstein crosses: Holstein with local cows and other indigenous breed are being reared by progressive farmers in valley and mid-hills.

B. Buffaloes (*Bubalus bubalis*): Buffaloes in the State account for 13.8% of the total livestock population. Buffaloes are mainly reared for milk, predominantly in valleys and mid-hills of Kangra, Una, Hamirpur, Solan, Mandi and Sirmaur. Most of the livestock with migratory Gujjar is the buffalo. Buffalo grazing has resulted in severe soil erosion in pastures/forest lands in high hills. Cold climate is not conducive for buffalo breeding.

i) Murrah: Murrah breed of buffalo, which is the pride of Haryana, is also found in the State. This breed is basically reared for milk and milk products.

ii) Neeli Ravi: This breed is introduced from Plains in the State. Population of pure Murrah & Neeli Ravi breeds is not ascertained due to non accountability.

iii) Mixed crosses: Most of the population comprises of crosses of Murrah & Neeli Ravi breeds. The department of animal husbandry is encouraging upgradation of these mixed herds with Murrah/ Neeli Ravi through artificial insemination.

C. Yak (*Bos mutus and Bos grunniens*): Yak population in the State is estimated at 0.1% of the total livestock population and predominantly reared in tribal areas of Lahaul & Spiti, Kinnaur and Pangti.

Yak is used as draught as well as pack animal in the tribal areas. Females are the source of milk and milk products. Yaks are generally brought and traded from Ladakh and Tibet. Long turf of yak tails particularly white, is a highly prized item.

Yak Crosses: Yak crossed with hilly cattle is known as Churu/ Churi. Yak cross with Jersey

has also been developed by Krishi Vishvavidyalaya University Research Station at Sangla, H.P.

D. Sheep (*Ovis sp.*): Sheep is reared for its valuable fiber and mutton. It accounts for 21% of the total livestock population. It is the main livestock of the tribal belt of Chamba, Kangra, Lahaul & Spiti, Kinnaur and high hills of Shimla and Kullu Districts. In other areas also farmers are keeping few heads to meet the domestic requirement of wool. Sheep population in the State is declining due to change of profession by traditional sheep rearing families as well as shrinking pastures.

1) Indigenous sheep:

i) Gaddi Sheep: These types of sheep are predominantly found in Kangra, Chamba, Mandi and parts of Kullu Districts. These Animals are of medium stature and hardy. Wool formed from these sheep is medium to fine staple, length-7cm & fiber dia-32.1 micron. These wools are suitable for carpets and woolen blankets and garments used by the traditional shepherds. Pure gaddi herd are declining due to cross breeding with improved exotic breeds.

ii) Rampur Bushahri sheep: These sheep are reared in Kinnaur, Spiti, Shimla and Outer Seraj of Kullu district for wool and mutton. Pure herds are declining due to cross breeding with exotic breeds. Wool diameter is 34.35 micron with length of 7.7 cm.

iii) Biangi: It is a sparse breed found in Kinnaur district adjoining Tibet. Wool has long staple and is of fine quality.

2) Exotic sheep

i) Polwarth: Introduced in 1956-57 from Australia and was reared at Sheep Breeding Farm, Jeori district Shimla). These breeds of sheep are generally used for intercrossing with other breeds.

ii) Rambouillet: This breed is introduced from USA. These are being maintained at Sheep Breeding Farm, Jeori District Shimla, Chamba and Tal, District Hamirpur.

iii) Merino: Initially Spanish Merino rams were introduced in 1961-62 from Spain and German Land Merino rams in 1963-64 from West Germany for up gradation programme. Later on Russian Merino was introduced in 1964-65 and 1971-72 from the then USSR. This breed has been found suitable for the State. It is being maintained at Sheep Breeding Farm Karcham, District Kinnaur, Ram Center, Nagwain, District Mandi Sheep Breeding farm, Chamba, and Sheep Breeding Farm, Tal District Hamirpur.

3) Crosses of Indigenous and Exotic Sheep: For the purpose of upgradation undertaken by the Animal Husbandry Department, crosses of Gaddi and Bushehri sheep with Rambouillet Merino and

Polwarth with varying degree of exotic blood have been raised by sheep rearing farmers which leads to declining the population of pure Gaddi and Bushehri breed.

E. Goats (*Capra* spp.): Goats account for 21.9% of the total livestock population of the State generally reared for its meat, to some extent for milk and fiber. Kangra, Mandi, and Chamba districts have the largest concentration. Together, these districts share more than half of the State's goat population. Geographically, the distribution of sheep and goats overlap each other.

i) White Himalayan Goat: These types of goat are predominant in Kangra, Chamba, Kullu, Sirmaur, Mandi, Shimla, Kinnaur and Lahaul & Spiti Districts, though prevalent all over the State in small number.

ii) Beetle goats: Introduced from Punjab and reared in border districts of Una, Hamirpur,

Solan, Bilaspur and Sirmaur. It is mainly reared for milk and meat.

iii) Jamnapari Goat: Few farmers are rearing few heads of Jamnapari goats mainly for milk and meat.

It is larger than beetle goat.

iv) Chigu Goats: This goat is known for fine lustrous fiber Pashmina used for the manufacture of fine quality shawls and appeals. It is reared in Spiti Valley and Hangrang Tehsil of Kinnaur district. Population of Chigu Goat is declining as it is being used for meat purpose in winter and there is a restriction imposed on replacement from Tibet for the same.

#### F. Horse (*Equus caballus*)

i) Chamurthi Horse: These horses are predominantly reared in Spiti Sub-division of Lahaul & Spiti district and Pooh sub-division of Kinnaur district. Initially, this breed was introduced from Tibet. Total number of Chammurthi is estimated around 5000. The animal is stout and sure-footed. The breed is being maintained in Horse Breeding Farm at Kamand (district Mandi).

ii) Other mixed Horse races: Other mixed races of horses introduced from other States are also being reared in the State mainly by migratory/nomadic tribes and few animals by other farmers for carrying households as well as joy rides. Total population of horses and ponies in the State is 14055.

G. Mules: Mule's population in the State is about 16000 found almost in all the districts, predominantly in Kangra, Shimla and Mandi. These are reared for agricultural produce and other mineral and forest produce. The animals are traded in market of adjoining States.

H. Donkeys (*Equus vulgaris*): These are predominantly found in Kinnaur and Lahaul & Spiti districts as they can sustain harsh conditions. Some farmers in other districts also

keep donkeys to carry water and household goods and other materials. Large herds are also found in the vicinity of brick kilns. Its population is about 7500 in the State.

I. Pigs (*Sus spp.*): Pig population in the State is about 7000. These are mainly reared in Sirmaur, Kangra and Solan districts.

J. Camel: Few Camels are being reared by farmers in bordering areas Una, Solan, Sirmaur and Kangra districts.

#### K. Other Pet Animals

i) Domesticated dogs (*Canis familiaris*): Various races of domesticated dogs are reared in the State. Gaddi dog is reared by migratory flock owners. Other prominent breeds are Pomeranian, Lhasa apso, Labrador, Alsatian, Doberman, Cocker Spaniel, Dalmation, Pinscher and Dashchund. Total population of domesticated dog is about 1, 50, 000.

ii) House cat (*Felis domesticus*): Grey, spotted white and black cats are found in many households reared mainly to ward off rats and mice.

iii) Rabbits (*Lepus spp.*): Angora rabbits are being reared for its fine wool quality. Angora rabbit farming is concentrated in pockets of

Kullu Valley. German Angora rabbits are being maintained in Government farms at Kandbari, Kangra district and Nagwain, Mandi district and I.C.A.R. Research Station at Garsa, Kullu district. Broiler Strains of Chinchla are also reared in few pockets. Total population of Angora Rabbits is about 50,000.

#### L. Fowls

i) Poultry (*Gallus domesticus*): Total population of poultry in the State is about 7.2 lakhs. Kangra is the leading district in poultry, followed by Mandi and Solan. Lahaul & Spiti and Kinnaur districts have few poultry birds. Poultry is more popular in districts which adjoin Punjab.

ii) Ducks/Turkeys: Very few ducks are found in natural lakes/ponds and zoo. Total number is below 1000.

### 6.1.4 Animal Husbandry and Livestock Produce in Himachal Pradesh

Milk: Milk is the most important produce of cow, buffalo and goat. In 1984-85, the total milk production of the State was 4,04,000 tonnes, which increased to 7,63, 000 tonnes in 2001-02. This represents a nearly two-fold increase (Table 23) in the production.

**Table 23: Animal Produce (1987-2002)**

Milk ('000 tonnes)	1984-85	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	2001-02
Cow	166.58	218.13	242.18	257.56	264.75	260.66	292.27	303.55	350.55
Buffalo	227.63	265.88	278.82	300.84	311.67	319.95	355.39	331.35	380.29
Goat	9.62	15.74	8.19	14.20	20.44	29.47	26.19	28.00	32.02
Total	404.13	499.75	529.19	572.60	596.86	610.08	653.85	662.90	762.86
Wool (in tonnes)	1270.00	1351.00	1405.00	1452.00	1567.00	1510.00	1532.00	1533.00	1586.00
Egg (Lakh)	338.00	485.00	491.00	532.00	580.00	697.00	714.00	669.00	822.00
Meat ('000 kgs.)	3392.00	3670.00	4026.00	4049.00	4406.00	4163.00	4664.00	3646.00	3548.00

Source: (i) Statistical Outline of different years, Himachal Pradesh.

(ii) Integrated Sample Survey for Estimation of Animal Products, Milk, Eggs, Wool and Meat, 2001-2002, Directorate of Animal Husbandry, Pradesb, Pasudhan Bhawan, Shimla.

Buffaloes are the major milk producing livestock. They contribute nearly half of the State's milk production and cattle make nearly an equal contribution. Then average milk produce per cow is only 2 litres and that of a buffalo is 3 litres. Goats contribute hardly 4% of the total milk production. Kangra is the largest milk-producing district in the State. It is followed by Mandi (Table 24).

**Table 24: District-wise Annual Milk Production 2000-2001 and 2001-02**

District	2000-01 ('000 Tonnes)	2001-02 ('000 Tonnes)
Bilaspur	37.35	35.11
Chamba	55.67	61.57
Hamirpur	74.69	60.33
Kangra	145.35	143.94
Kinnaur	5.59	6.38
Kullu	35.4	30.41
Lahaul & Spiti	6.55	6.91
Mandi	124.06	120.63
Shimla	71.69	79.25
Sirmaur	63.41	71.82
Solan	68.82	73.78
Una	71.78	72.68
Total	760.41	762.86

Source: Integrated Sample Survey for Estimation of Animal Products, Milk, Eggs, Wool and Meat, 2001-2002, Directorate of Animal Husbandry, Himachal Pradesh, Pasudban Bhawan, Shimla, p. 49.

Wool: Chamba, with the largest sheep population, is also the biggest producer of wool in the State. Mandi and Kullu are next

important producers (Table 25). Wool production increased about 25% during 1984-85 to 2001-02. The annual yield per sheep is only 1.2 kgs.

**Table 25: District-wise Annual Wool Production 2000-2001 and 2001-02**

District	2000-01 ('000 kgs)	2001-02 ('000 kgs)
Bilaspur	37.34	29.52
Chamba	343.15	381.79
Hamirpur	78.55	65.87
Kangra	224.35	201.63
Kinnaur	93.11	80.58
Kullu	200.23	218.72
Lahaul & Spiti	71.73	60.74
Mandi	261.71	266.92
Shimla	200.38	175.91
Sirmaur	34.78	61.8
Solan	25.93	28.98
Una	7.24	9.96
Total	1578.56	1582.45

Source: Integrated Sample Survey for Estimation of Animal Products, Milk, Eggs, Wool and Meat, 2001-2002, Directorate of Animal Husbandry, Himachal Pradesh, Pasudban Bhawan, Shimla, p. 55.

Meat: The meat production in the State recorded a marginal increase from 3392 tonnes in 1984-85 to 3548 tonnes in 2001-02. Goats contribute two thirds of the total meat produced. Meat of sheep is next in importance. Pigs are relatively insignificant in this respect. Shimla, Kangra and Mandi are the largest producers of goat meat. The largest producer of sheep meat is Kangra. Pork is produced mostly in Solan and Shimla districts (Table 26).

**Table 26: Meat Production by Districts, 2001-02 (in tonnes)**

District	Goat	Sheep	Pig	Total
Bilaspur	46.95	10.78	1.84	59.57
Chamba	107.72	76.02	-	183.75
Hamirpur	82.41	36.92	-	119.33
Kangra	415.68	260.51	15.41	691.60
Kinnaur	52.43	40.32	-	92.75
Kullu	179.93	122.85	-	302.78
Lahaul & Spiti	102.00	155.66	-	257.67
Mandi	262.36	122.06	14.00	398.43
Shimla	911.55	113.99	88.86	1114.41
Sirmaur	82.78	19.50	35.80	138.17
Solan	25.03	4.57	115.29	144.90
Una	42.13	2.75	-	44.88
Total	2311.11	965.98	271.20	3548.30

Source: Integrated Sample Survey for Estimation of Animal Products, Milk, Eggs, Wool and Meat, 2001-2002, Directorate of Animal Husbandry, Himachal Pradesh, Pasudban Bhawan, Shimla, p. 64.

Eggs: Egg production was 38 million in 1984-85 which increased to 82.2 million in 2001-02. Kangra

is the major egg producer while Kinnaur is the smallest (Table 27). It accounts for about 42% of the total eggs produced in the State.

**Table 27: Egg Production by Districts, 2001-02 (in Million)**

District	2000-01 (million)	2001-02 (million)
Bilaspur	6.8	7.5
Chamba	9.1	10.4
Hamirpur	3.7	2.9
Kangra	33.8	34.5
Kinnaur	0.6	0.5
Kullu	3.0	2.0
Lahaul & Spiti	0.6	1.8
Mandi	12.4	10.3
Shimla	4.7	4.8
Sirmaur	2.3	2.1
Solan	1.6	2.3
Una	2.9	3.1
Total	81.6	82.2

Source: Integrated Sample Survey for Estimation of Animal Products, Milk, Eggs, Wool and Meat, 2001-2002, Directorate of Animal Husbandry, Himachal Pradesh, Pasudban Bhawan, Shimla, p. 60.

As per biodiversity report, HP, More than 80% livestock of the State is owned by small and marginal farmers including nomadic/migratory tribes who have been rearing livestock as means of livelihood as well as supplementary profession. Most of the livestock being indigenous and local breeds, there has been a

tendency to keep large herds to compensate the low productivity of animals. Average daily milk production varies from 1.5 litres in case of indigenous cows to 3 litres in crossbred and improved cows. The productivity of livestock between 2003-04 and 2005-06 is given in Table 28.

**Table 28: Livestock Productivity in Himachal Pradesh**

Sr. No.	Item	Unit	2003-04	2004-05	2005-06
1.	Average milk production per cow per day	Gram	2,345	2,527	2,536
2.	Average milk production per buffalo per day	Gram	3,243	2,695	2,746
3.	Milk production Cow Buffalo Goat Total	000 Tonnes	375.918	449.993	505.593
			378.369	339.461	335.065
			30.935	30.056	28.356
			786.222	869.510	869.014
4.	Wool production per sheep per year	Gram	1,127	1,445	1,475
5.	Total wool production	Tonnes	1,598,643	1,599,648	1,603,491
6.	Production of eggs	Lakhs	839,864	811,345	752,671
7.	Total No. of animals slaughtered for purpose of meat (sheep, goat & pig)	000` Nos.	174	160	157
8.	Total meat production	000` kgs	3,213,191	2,915,416	2,934

The contribution of major livestock products during the year 2008-09 was 8.84 lakh tonnes of milk, 1,617 tonnes of wool, 98.00 million eggs and 3,309 tonnes of meat which is expected to increase to 8.90 lakh tonnes of milk, 1,665

tonnes of wool, 105.00 million eggs and 3,400 tonnes of meat during 2009-10. Milk Production and Per Capita availability are shown in Table 29.



**Table 29: Milk Production and Per Capita Availability**

Year	Milk Production(lakh tonnes)	Per Capita Availability (gm./Day)
2008-09	8.84	398
2009-10	8.90	400

Source: Economic Survey Report, 2009-10

**6.1.5 Current Status of Livestock and Animal husbandry:** Rearing of livestock is an integral component of rural economy. In Himachal Pradesh, there is a dynamic relationship between Common Property Resources (CPRs) such as forests, water and grazing land, livestock and crops. Livestock depend to a certain extent on fodder and grass grown on CPRs as well as on crops and residues. Animal Husbandry plays an important role to boost the rural economy and as such for livestock development programme attention is paid in the State by way of:

- (I) Animal Health & Disease control.
- (ii) Cattle Development.
- (iii) Sheep breeding and Development of Wool.
- (iv) Poultry Development.
- (v) Feed and Fodder Development.
- (vi) Veterinary Education.
- (vii) Livestock Census.

Under Animal Health and Disease Control, 1 State level Veterinary Hospital, 7 Polyclinics, 45 Sub-Divisional Veterinary Hospitals, 284 Veterinary Hospitals, 30 Central Veterinary Dispensaries and 1,760 Veterinary Dispensaries/ Centres exist in the State as on 31-12-2009. Besides this, 6 Veterinary Check

posts are operating to provide immediate veterinary aid.

For improving the quality of sheep and wool, Government Sheep Breeding Farms at Jeori (Shimla), Sarol (Chamba), Tal (Hamirpur) and Karchham (Kinnaur) are supplying improved sheep to the breeders of the State. During the year 2009-10 the wool production was 16.65 lakh kgs. Angora rabbit farms for distribution of rabbits to the breeders are functioning at Kandwari (Kangra) and Nagwain (Mandi).

## 6.2 Patterns of planning and development in the livestock sector

Animal Husbandry and dairying activities continue to be an integral part of human life. As a sequel to the age old practices and dependence of population on livestock, Himachal Pradesh is endowed with the large livestock population. According to 2003 Census, total livestock population of H.P. is 50.46 lakh which includes 21.96 lakh cattle, 7.73 lakh buffaloes, 9.06 lakh sheep, 11.15 lakh goats and 0.17 lakh horses and ponies. Poultry population of the State is 7.64 lakh. Salient achievements recorded during the last two five year plans are described in Table 30.

**Table 30: Development in the livestock population, production and their health programmes for year 1997 to 2007, H.P.**

Sr. No.	Item/Unit	Unit	Achievement up to 9th Five Year Plan (1997-2002)	Target for 10th Five Year Plan (2002-2007)	Achievement up to 10 <sup>th</sup> Five Year Plan (2002-2007)
A) Livestock Production:					
1	Milk	'000Tonnes	762.864	840	872.39
2	Eggs	Millions	82.24	99	77.2
3	Wool	Lakh Kg.	15.86	16.5	16.05
B) Cattle/ Buffaloes Development:					
1	Artificial Insemination Performed with Frozen Semen	Lakh No.	3.95	4.5	5.25

Sr. No.	Item/Unit	Unit	Achievement up to 9th Five Year Plan (1997-2002)	Target for 10th Five Year Plan (2002-2007)	Achievement up to 10th Five Year Plan (2002-2007)
2	Crossbred Cows Available	Lakh No.	1.9	1.9	3.6
C) Livestock Health Programme:					
1	Veterinary Hospitals	No.	303	-	306
2	Veterinary Dispensary	No.	1585	-	1787
3	Central Veterinary Dispensary	No.	25	-	25
4	Mobile Veterinary Dispensary	No.	14	-	14
5	Poly Clinics	No.	7	-	7

A number of plans & schemes at the State level indicating patterns of planning and development are given below.

#### State Plan Schemes

##### 1. Veterinary Services and Animal Health

To protect the livestock from epidemics and to provide timely veterinary aid, the department has a network of veterinary institutions in the State. During the last 56 years, polyclinics, veterinary hospitals, central veterinary dispensaries and veterinary dispensaries have been opened. The growth of these institutions till March, 2007 had reached 2139.

Efforts to strengthen the existing veterinary institutions by providing laboratory and other diagnostic aid facilities will be made so that quality veterinary services could be provided.

- To protect animals against contagious diseases like Foot and Mouth Disease, HS, BQ and PPR diseases. The Government of India will be requested to provide sufficient grant under Centrally Sponsored Scheme "Assistance to Control Animal Diseases" (ASCAD) for purchase of vaccines to cover entire population of the State.
- Sero Surveillance programme for detection and monitoring of other diseases like Brucellosis, TB, JD and CRD etc. will be started in the State in addition to continuation of ongoing surveillance programme.

- To maintain cold chain for vaccines efforts to provide refrigerator up to grass root level institution (Veterinary Dispensary) will be made.

##### 2. Cattle and Buffalo Development

Indigenous cows (non-descript local) are being upgraded by cross breeding programme by breeding with Jersey and Holstein bulls so that the exotic blood level is maintained. The artificial insemination by frozen semen technology is being adopted in cows and buffaloes. Three Cattle farms located at Kothipura (Bilaspur), Kamand (Mandi) & Palampur (Kangra) are being run by the department to produce genetically superior breeding bulls. At Bhangrotu district Mandi young Bulls which are to be used for semen collection are being served. These bulls are used for semen straw production at sperm station of the department at Palampur (Kangra).

Artificial insemination facility is being provided from 1725 Veterinary Institutions in the State. In the remote areas, where it is not possible to introduce artificial insemination technique, natural service with improved breed of bulls is being carried out. To give boost to cross breeding programme, the State Government has formed "HP Livestock Development Board" by getting 100% grant from Govt. of India. This grant-in-aid is being spent on strengthening of artificial insemination facilities in the State. The department is planning to

provide 100% coverage of breed-able cows and buffaloes mainly through artificial insemination.

Castration of indigenous bulls is also being undertaken by the department so that more and more cows are covered through artificial insemination programme and are not bred with indigenous bulls.

According to breeding policy of the State, inheritance of exotic blood i.e. Jersey/Holstein is to be maintained at 50% and remaining 50% inheritance will be contributed by Pahari/Hilly cattle. This policy will ensure the benefit of higher milk production potential of exotic breed and as well as disease resistance and hardiness traits of Hilly and Pahari Cattle to farmers of the State.

3. Poultry Development: During 2009-10, under the Backyard Poultry Scheme 2.77 lakh chicks was distributed and 2.77 lakh broiler chicks were hatched and 500 persons were targeted to impart training in poultry farming. Backyard Poultry Scheme for Schedule Cast and Schedule Tribes families is 100% subsidy scheme for the benefit of these families. Climatically, poultry has limited scope in the State. However, the department is encouraging poultry – Layers and broilers in Shimla, Bilaspur and Una districts by implementing Poultry Development Project. The day old chicks produced in departmental hatcheries are provided at the doorstep of interested farmers. A programme has been contemplated to popularize backyard poultry in the State. The poultry farming in Himachal Pradesh plays an important role in improving the socio-economic status of rural population.

Objectives of poultry development

- To provide good diet to the people of the State. The per capita availability of eggs in Himachal Pradesh is merely 13 eggs per annum as compared to all India average of 36 eggs per annum. Large rural populations face the

problem of protein-calorie malnutrition, thus needing animal proteins with high biological values which can be met through eggs and poultry meat.

- To augment the income of the rural people where poultry farming along with the livestock, rearing is being carried out as a mixed farming complementary to the crop production.
- To increase the employment opportunities for the rural population since most of them are unemployed or grossly underemployed, hence to generate self-employment.
- To produce manure of high grade at minimal cost.

Six poultry farms, 6 extension centres and 2 hatcheries are working in the State for the benefit of the farmers. A project for poultry development is also functioning in the State covering 3 districts namely Shimla, Una and Bilaspur.

Following programmes are being under taken under Poultry Development by the department:

- Existing backyard poultry scheme of 10-50 Chicks unit of coloured stain of low input technology will be continued during the 11th Five Year Plan also for self-employment generation and boosting of nutritional status.
- Self help groups under backyard poultry farming to adopt poultry farming will be encouraged.
- Transportation of Chicks from hatcheries to nearest road head point of beneficiaries to give boost to rural backyard poultry in the State will be continued.

- Efforts will be put to extend 200 broiler unit schemes to the entire State under SC Sub-Plan.

4. Sheep & Wool Development: Sheep rearing is one of the main occupations of the people in Himachal Pradesh. Rampur bushari and Gaddi breeds of Himachal Pradesh are famous for indigenous carpet wool production in the country. In rural areas, 37% of agricultural families rear sheep. The local sheep is crossed with good quality rams of Rambouillet, Russian Merino so that the quality as well as quantity of wool production is increased. To bring desired increase in quality and quantity of wool produced by the indigenous sheep, the department has maintained 4 sheep Breeding Farms and one Ram Center. These farms are located at Karchham (Kinnaur) Jeori (Shimla) Tal (Hamirpur) and Sarol (Chamba). High yielding rams of exotic Russian Merino and Rambouillet breeds are sold at nominal rates from these farms to interested sheep breeders to carry out cross breeding of indigenous sheep with these exotic breeds. Ram Centre, Nagwain (Mandi district) provides Rams during breeding season to sheep breeders and at the end of breeding season, these rams are brought back to the Ram Centre, so that farmers are saved from the cost of maintaining these Rams. Apart from these farms, there are 10 sheep and wool extension centres in various parts of the State. These extension centres are also making available pure exotic rams from the State farms or cross breed ram from improved flock of sheep breeders to interested farmers. These extension centres also manage health care of sheep flocks of their respective regions. Two wool analysis laboratories located at Tal (Hamirpur) and Sarol (Chamba) are also working in the State. These laboratories help in grading of wool and thereby ensuring good price to the sheep owners.

To bring improvement in the quality and quantity of wool yield per sheep, a cross-breeding programme is being carried out in the State. Fine woolen rams of Rambouillet and Russian Merino breeds of sheep are used for this cross breeding. Till date, only 20% of the

sheep population in the State is cross-breed and for so many years the Government could not import the quality germplasm. As per prescribed norm, 4% rams are provided for 100% coverage of the total sheep. Therefore, the department needs 15,000 rams to cover all the breed-able sheep population. With the present status, the department is only able to produce 300 rams per year. In order to produce more rams, the department needs extra budget in this scheme so as to raise the strength of the farms to their carrying capacity and to meet the increasing demands for breeding rams.

#### 5. Other Livestock Development

a) Angora Rabbit Scheme: The climate of the State is favorable for rearing of Angora Rabbits as it is good source of income and self employment. With the assistance of UNDP, department has established a germplasm centre at Nagwain (Mandi district) where pure breeds are being bred on scientific lines. At this centre, training to interested breeders is being imparted and trained persons are being provided infrastructure and rabbits for starting their own rabbit breeding farms. Another rabbit farm at Kandwari in Palampur is also being run by the department where German Angora Rabbits are being reared. Presently the population of the rabbit for the State is 4393.

b) Horse/Yak Breeding Programme: Spiti (Chamurthi) is a recognized breed of horses found in Pin Valley of Lahaul & Spiti and Hungrang Tehsil of Kinnaur district. This breed of horse is sure footed and the best mode of transportation in remote and hard areas. The department is running a horse breeding farm at Lari in district Lahaul & Spiti to preserve this breed of the horse.

Since the population of both the species (Horse Chamurthi/Yak) is declining at an alarming rate, for conservation of these species existing horse breeding farm at Lari will be strengthened, so that Chamurthi Ponies and Yaks are maintained and reared at Lari farm and their surplus

progeny is distributed to the interested breeders.

6. Feed and Fodder Development: The State Department of Animal Husbandry is motivating the farmers to provide adequate nutritious fodder to harness the benefits of improved livestock. The department is distributing quality fodder grasses seeds and planting material for introduction on the field bunds and overheads. Fodder seeds and grass nurseries are being raised at Fodder Seed multiplication farms of the department. Coordinated efforts of various agencies – Forest, Agriculture, Animals Husbandry and R&D are required to undertake fodder and pasture development programmes with the involvement of farmers/villagers in their watershed development and other programmes. Veterinary aid institutions are providing following facilities to livestock owners for development of fodder:

Department is supplying certified seed of cultivable fodder crops to farmers at full cost to all farmers and at 50% subsidy to IRDP, SC/ST and women.

- Department is supplying improved fodder grass roots and plants to the farmers.
- Two seed multiplication farms are also being run by the department at Sunni (Shimla) and Kotla Barog (Solan).
- The pasture land in the State is decreasing day by day due to rapid growth of weeds which is adversely effecting the sheep population of the State. In order to overcome this difficulty dweeding and regeneration of pasture land by seedling with temperate grasses and fodder trees will be carried out.
- Fodder plant nurseries will be raised so that parent stock of grass roots and fodder trees are maintained and further distributed to the farmers.

## Centrally Sponsored Schemes in Animal Husbandry Sector

This scheme has been implemented to provide 100% coverage of Artificial Insemination to breed-able cattle & buffaloes of the State and to provide door step delivery of Artificial Insemination services at farmer's premises.

## 7. National Project on Cattle and Buffalo Development

National Project on Cattle and Buffaloes Development has been sanctioned by Govt. of India on 100% Central Assistance for 3 years. Total amount sanctioned under this project for Himachal Pradesh is ` 12.75 Crores. Grant -in-aid for implementing first phase of the project amounting to `3.20 Crores has been released. Project aims at strengthening of following activities of Animal Husbandry Department.

- Strengthening of Liquid Nitrogen Storage, transport and distribution.
- Strengthening of Sperm Stations, Semen Banks and Artificial Insemination Centres.
- Acquisition of high pedigree bulls for Sperm Stations and for Natural Service in remote areas.
- Strengthening of training facilities.
- Computerization.

8. Assistance to State for Control of Animal Diseases (ASCAD): Due to large scale InterState Migration from adjoining States and lack of Nutritional grasses and fodder due to hilly topography most of the animals are prone to various livestock diseases. Central Government has provided assistance to State Government for control of contagious diseases under ASCAD which is on the pattern of 75% Central Share and 25% State Share. Hemorrhagic septicemia disease has been selected to be eradicated from the State during period of 10<sup>th</sup> Five Year Plan under this project.

Other diseases for which free vaccination is being provided to livestock owners under this project are FMD, BQ, Enteroloxaemia, PPR, Ranikhet disease, Marek's disease and Rabies.

#### 9. Back Yard Poultry Development Scheme:

The Animal Husbandry Department has introduced Backyard Poultry Scheme under the Centrally Sponsored Scheme "Assistance to the State Poultry Farms" which is a 80:20 scheme. The State's share is in kind i.e. land, infrastructure, staff, etc. The medium and the large poultry farms have come up of late in the State due to the efforts of the department, whereby training and other help in the form of project reports and opening of the units under subsidy have been provided to the poultry farmers. Therefore, the department tried to give more attention to the small and marginal poultry farmers who have specific requirements w.r.t. the strain of the poultry bird provided. This is important because with the limited resources such group of poultry farmers need a disease resistant strain with local availability. This was ensured under the Backyard scheme where low input technology bird of coloured strain but disease resistant type are supplied to the farmers of the State @ ` 14/-chick of 2- 3 weeks age to prevent the early mortality. This scheme has been an instant success because it not only supplements the income of the poor farmers of the State but also provides nutrition of high order to them, which is amply clear from the fact that about 2.00 lakhs chicks were distributed under the scheme last year.

Under the Backyard Poultry Scheme, various State Poultry farms are being strengthened while the Sundernagar and Nahan farms have been fully renovated. Works at Chauntra will be completed within a month's time while the works at Palampur farm are 50% complete. The Chamba and Una farms too have been provided funds and the necessary estimates are being prepared prior the start of the strengthening works.

Besides the above, a project proposal for the strengthening of the Poultry Farm, Kamlahi, Shimla has also been sent to the Government of India recently for the necessary sanction. This project is of 1,05,91,650/- while the Central share comes out to ` 84, 73, 320/-.

As per the feedback received from the field small poultry units of both broilers and eggers of 20 to 50 numbers are becoming very popular. Therefore, the department with the help of Govt. of India has started a scheme on cost basis for development of backyard poultry. This scheme is on 80:20 ratio (Central Share: State Share). Under this scheme, chicks in the multiples of 10 are provided to breeder @ ` 10/- per chick. Transportation of chicks to nearest road head to breeder is arranged by the Department.

To fully meet the demand of chicks, few poultry farms of the State are also proposed to be strengthened under this scheme. Sundernagar and Nahan Hatcheries have already been strengthened. Strengthening of Poultry Farm Chauntra is proposed next. Rupees 54.80 lakhs were sanctioned under this scheme for Himachal Pradesh and first installment of `27.40 lakhs has been received from the Government of India.

#### 10. Sheep Development

I) Integrated Wool Improvement Programme  
This Project has been sponsored by Central Wool Development Board Jodhpur for the period of 4 years on the 100% Central Assistance pattern. This project is being implemented in Chamba, Kangra & Kullu districts. Rupees 1.25 Crores as first year installment have been received by Wool Federation and are being spent on following activities:

- Breed improvement.
- Health Care.

- Training camps for sheep breeders.
- Assistance for marketing and product development of wool.
- Establishment of multipurpose extension centres.

## II) Integrated Sheep and Wool Development Projects

Integrated Sheep and Wool Development Project have been sponsored by Central Wool Development Board, Jodhpur on 100% Central Government Assistance. These projects are for duration of 3 years and are being implemented in the following districts:

Name of District Grant released during year 2003-04

- ISWDP Chamba -III 12.84 lakh (Bharmour)
- ISWDP Kangra -III 11.97 lakh (Palampur/ Dharamshala)
- ISWDP Shimla 12.88 lakh (Rohru/Chirgaon)
- ISWDP Kinnaur -I 13.00 lakh
- Total 50.69 lakh

Following activities are being covered under these projects:

50,000 sheep are being covered in each district and following facilities are provided to the registered breeders

- Breed improvement.
- Health Care.
- Product development
- Marketing Assistance.
- Training camps for sheep breeders.

## III) Continuous fiber dryer plant

Rupees 7.55 lakhs has been received by H. P. Wool Federation as 100% Central Assistance from Central Wool Development Board, Jodhpur for installation of continuous fiber

Dryer Plant as an attachment to mini wool scouring Plant Palampur.

S. No.	Name of the project	Ministry in GoI	Amount
1.	Integrated Dairy Dev. Project	Agriculture Ministry	19.97 Crores
2.	Women Dairy Project	HRD Ministry (Women & Child Deptt.)	4.93 Crores
3.	Quality Assurance	Agriculture Ministry	0.65 Crores

## 11. Projects Sanctioned under RKVY for Animal Husbandry Sector for year 2009-10

		Total Project Cost
1.	Strengthening of Disease Investigation Laboratory Mandi-	80.00 Lakh
2.	Characterization and Conservation of Hilly Cattle	162.53 Lakh
3.	Establishment of Research and Disease Investigation Laboratory at Palampur	15.00 Lakh
4.	Small Ruminant Development	61.92 Lakh
5.	Establishment of Cold Chain for Milk and Milk Products	208.38 Lakh
6.	Provision of Drenching Guns and Automatic Vaccinators in Veterinary institutions of the State	54.00 Lakh

On going projects related to the development of Livestock

1. National Project on Cattle and Buffalo Breeding (NPCBB): Primary aim of the Project is to cover 100% breed-able cows and Buffaloes through Artificial Insemination and Natural Service where all facilities cannot be provided. Cow, Bulls and Buffaloes will be provided free of cost under this project and the Bulls will be reared by the private farmers by charging the Natural Service Fee from the farmers.

- To Strengthen the Sperm Station by providing/purchasing the latest/modern equipments to process the high quality aseptic semen straws and purchase of high pedigreed bulls.
- To impart training to the in-service Veterinary Pharmacists to update their skill in artificial insemination and aseptic measures to be adopted while performing Artificial Insemination to check the repeat breeding problem.
- To strengthen the Semen Banks for storage and transportation of the Liquid Nitrogen Gas and Semen Straws.

## 2. Achievements made by Livestock Development Board (HPLDB):

- 364 Existing Artificial Insemination (AI) Centers were converted in Mobile A.I. Centers by providing One Litre Liquid Nitrogen Container and A.I. Kit for door step A.I. facility.
- A.I. facility was provided in 19 New Veterinary Institutions of the department.
- For processing quality semen straws in Semen Processing Laboratories of the State, 8 Jersey Bulls and 11 Buffalo Bulls were purchased from Pune, Jaipur and CHRS Rohtak.
- To provide breeding facilities to the livestock of far-flung areas in district Shimla, Lahaul & Spiti and Solan, 12 high pedigree Jersey Bulls have been provided at Panchayat level for natural service.
- For improving the quality of semen straws, various advanced equipments worth One Crore have been purchased.
- To improve distribution of Liquid Nitrogen Gas to various Veterinary Institutions, various transportation facilities have been provided.

- Efforts are being made to introduce quality control and certification of bulls and services as Sperm Stations and Semen Banks.
- Grant-in-aid amounting to ` 2,70,20,000/- has been received by H.P. Livestock Development Board for implementing 2nd Phase of National Project on Cattle & Buffaloes Breeding in Himachal Pradesh.

Efforts are being made to introduce quality control and certification of bulls and services at Sperm Station and Semen Banks. Besides these, the State is also taking various important steps for the proper growth and management of livestock which include:

- Strengthening of animal health care services: Improved health care facility would ensure not only quality produce but also raise the productivity. For implementing these, the State has already taken steps like set up of veterinary services, training camps etc.
- Upgradation of genetic stock of cattle and buffaloes: The State has yet very limited crossbred cattle. Steps to improve the indigenous stock by extension services from veterinary institutions are in progress.
- Quality feed and fodder: Animal food in future shall be more in demand to supplement the protein requirement of our diet. State is thus ensuring better feed and quality fodder by developing locally-grown maize crops and by following a rotational system in pasture management.
- Dairy Co-operation: Women labour force is the largest in livestock management particularly in cattle and buffaloes. State is conducting training camps for women under Panchayati Raj based on dairy co-operatives.
- Disaster management programme: The western districts (Chamba, Kangra and



Una) where buffaloes are mostly concentrated are unfortunately drought prone also. In the event of drought, State is organizing disaster management programme, which can save the poor from destitution.

3. Veterinary aid and disease control: Livestock health care and disease control are the foremost priority of the department. These services are being provided at the nearest place through a network of 1936 Institutions (7 Polyclinics, 302 Veterinary Hospitals, 25 Central Veterinary Dispensaries, 14 Mobile Veterinary Dispensaries). Through these institutions about 25 lakh cases are treated and about 4 lakhs vaccinations are carried out annually. Although there have been no major incidences of diseases in the State but sporadic outbreaks of PPR in migratory flocks of sheep and goats have been noticed.

### **6.3 Technology / Schemes adopted in the livestock sector along with any changes in technology**

The use of bullocks and need for manpower have faced a sharp decline in recent years due to introduction of machinery in agriculture and small holdings. According to annual season crop report (1996-97) of Himachal Pradesh, the number of tractors and threshers increased from 936 & Nil in 1982 to 3466 & 2692 in 1992.

#### **a. Breeding of Cows**

1. Artificial insemination: Artificial insemination is an accepted method for cross breeding of cows. This is done with the help of good quality semen of excellent bulls. This technique in cows has been supported through veterinary dispensaries and hospitals. The success rate has been moderate.

2. Natural service: Natural service is traditionally practiced in local communities, which maintain bulls for this purpose. However, with the spread of artificial insemination techniques this system is now not favored.

**b. Breeding of Buffaloes:** Breeding of buffaloes is done for improvement of the quality of the livestock and also for increasing the milk yield. The methods adopted for this purpose have been outlined in brief below.

1. Artificial insemination: Artificial insemination is done with high quality semen or straw by adopting a technique similar to that for cows. However, artificial insemination is not very successful in the case of buffaloes, particularly in the remote and inaccessible areas where technical persons take time to reach.

2. Natural service: High quality buffalo bulls are maintained in the rural areas to provide natural service. This is a traditional method adopted by rural communities for buffalo breeding. It has proved to be more successful than artificial insemination. One horse breeding farm at Lari in Lahaul & Spiti district has been established with the objective to preserve Spiti breed of horses. One Yak breeding farm has been also established in the premises of horse breeding Lari. During the year 2009-10 the strength of yaks was 45 in this farm. Under feed and fodder development scheme 12 lakh fodders root, 0.45 lakh fodders plant and 1, 00,000 kgs fodder seed were distributed in 2009-10.

### **6.4 Stakeholder involvement in environment preservation and restoration**

- State and local government (Panchayati Raj Institutions) including department of Animal Husbandry, Department of Forest and Wildlife, Department of Agriculture, Department of Horticulture, Department of Fisheries,

Pollution Control Board and other line departments for future planning.

- NGOs, Civil Society Organization (CSOs) and other training institutes for awareness development.
- People of Himachal Pradesh, who are directly or indirectly, associated with Animal Husbandry and Livestock management practices.

## 6.5 Critical environment issues /hotspots associated with the livestock sector

In Himachal Pradesh, 17.6% of the geographical area is under permanent pasture or grazing lands. The livestock population of the State is three times the carrying capacity of grazing lands. Due to the excessive grazing of livestock and modification on the livestock population, this sector has various deleterious effects on the environment like degradation of vegetation resources due to overgrazing, increased soil erosion due to clearing of vegetation and trampling, increased siltation of surface water and deterioration of soil fertility and physical characteristics through removal of vegetation, increased erosion and soil compaction. Increased rapid runoff due to vegetation cleaning and soil compaction leads to decreased infiltration capacity of land. Conversions of moist tropical lowland forest to pasture and grazing land for livestock results in long-term environmental degradation leading to unsustainability.

1. Degradation of all kind of land (Alpine pastures vegetation, forest area) and Shrinkage of private grasslands and village common lands due to over grazing by livestock:

Overgrazing by domestic animals has adverse effects on the vegetation like alpine grasslands and forests. Due to this, the forests and the grasslands become bare and subsequently prone to soil erosion. Selective grazing tends to alter the composition of the forest or grassland

ecosystem, causing an increase in the population of undesired species, which are not consumed by the animals. Seedlings of various species can get crushed and trampled under the hooves of cattle. In some cases, the roots of a tree species may be exposed by trampling. This results in the death of the desired plant species. The animals graze during spring, when the seedlings of various tree species, grasses and herbs are growing. This leads to the problems of regeneration as the future crop is adversely affected.

Overgrazing also occurs when plants are exposed to intensive grazing for extended periods of time or without sufficient recovery periods. It can be caused by either livestock in poorly managed agricultural applications or by overpopulation of native or non-native wild animals. It reduces the usefulness, productivity, and biodiversity of the land and is one of the causes of desertification and erosion. Overgrazing is also seen as a cause of the spread of non-native plants and weeds.

2. Public and Animal Health Risk due to Inadequate Animal/Public health infrastructure: Inadequate capacity of health infrastructure / facilities including buildings & equipment for treatment of livestock is causing public health and animal risk. There is also a problem of inadequate mechanism for drugs' availability and distribution of veterinary drugs in Himachal Pradesh.

3. Effect of Animal Diseases on Human & Animal Health

a. Transfer of diseases from animals to human & vice versa (Zoonotic diseases): Zoonotic diseases are infectious diseases transmittable between animals and humans and outbreaks of these diseases in animals can signify that humans are also infected (or vice versa). In addition a number of well known and preventable animal diseases that can be transmitted to humans (i.e. zoonoses) such as rabies, brucellosis, leishmaniasis and

echinococcosis. They cause a serious amount of deaths and affect millions of people every year.

b. Inadequacy of awareness about animal health issues practices leads to higher public and animal health risk: In the State of Himachal Pradesh, most of the livestock owners or farmers are not properly aware about animal health issues. Due to the inadequacy of knowledge, the population of some livestock during 1972-97 has been declining. The livestock population has been increased during 1998- 2007. Cattle percentage share declined from 46.3 to 41.6, while the percentage share of sheep went down from 21.1 to 20.7. The number of horses and ponies has come down by one-fifth.

c. Public health and animal health risk due to increase in animal disease: Due to improper/inadequate sanitary and habitat conditions, the various kinds of diseases are caused to the animals, which are generally due to the parasites, protozoa, viruses etc. The most important protozoan diseases observed in common livestock (cattle, buffalo, sheep, goat, etc.) based on the studies conducted in Himachal Pradesh are Coccidiosis and Haemoprotista. In sheep and goats, which are less than 6 months of age, are the main victims of coccidiosis. Four species of *E. arloengi*, *E. intricata*, *E. parva* and *E. ninakoyakimovae* are reported to occur in goats in Himachal Pradesh out of the 11 species of *Coccidia* known to harbour in Indian goats. In poultry, Coccidiosis is a major cause of mortality and sub optimal growth and conversion efficiency in immature flocks. The diseases which are generally found in Himachal's livestock are Sarcocystosis, Toxoplasmosis, Encephalitozoonosis, Trypanosmosis, Anaplasmosis, etc.

4. Increasing pressure on forest area/other land use: The livestock population in Himachal Pradesh is 53 lakhs. About 43 lakh tonnes (green) and 40 lakh tonnes (dry) fodder are required for the survival of these livestock but the availability of fodder is only 16 lakhs tonnes

(green) and 30 lakh tonnes (dry), which is very less as per the requirement. The 0.5 ha per livestock grazing/ pasture land is required but 0.18 ha. is available to sustain one livestock unit.

5. Environmental pollution due to animal waste: Fodder production requires intensive use of water, fertilizer, pesticides and fossil fuels. These items cause water and soil pollution. Further, because only a third of the nutrients fed to animals are absorbed, the remaining nutrients go into excreta. Therefore the disposal of animal waste is a leading factor for water and land pollution.

6. Impact of migrating animals on the environment: Migratory movements reflect an animal's need to eat, breed, avoid predators and find a tolerable physiological environment over the short term. These movements are also shaped by an animal's evolutionary history, during which natural selection has resulted in behaviors that maximize fitness in complex and changing environments. Because migration behavior is labile, it contains information about the integrated organism's response to recent changes in the environment. These properties make migration behavior an ideal metric for understanding organismal responses to changing environments over large spatial extents (e.g., climate change and land use change).

7. Threat of obnoxious weeds affecting fodder availability for animals: Trees felled by right holders or removed after they dry up or fall due to vagaries of weather. This phenomenon has created gaps in the canopy, which has resulted in preponderance of invasive species *Parthenium hysterophorus*, *Ageratum conyzoides*, etc. and a change in the vegetation mix in all types of forests in the State. The resultant growth even though serves the purpose of soil and water conservation, but also effectively eliminates the emergence of tree seedlings and smothers the naturally occurring grasses and herbs in the affected areas.

8. Water, soil and air pollution due to lack of dead animal management: Inadequacy of dead animal management programmes in the State lead to release of harmful gases infected/putrefied waste leading to soil, water and air pollution.

9. Increase in environment and public health (Effect on human/animal health.) risk due to unscientific management of slaughter houses: Inadequacy of programmes and policy for slaughter houses lead to decrease in population of livestock and increase in environment and public health risk such as disposal of slaughter waste, treatment, and packaging of meat, preservation of meat, transportation of meat and other health safety & environment issues.

10. Menace of stray cattle / dogs and Menace of wild animals like monkeys, bears etc.: In the past, wild animals used to feed on wild fruits and other natural food resources and did not interfere with the agricultural crops. However, due to increases in their population and less of their natural food resources, wild animals have become more aggressive resulting in human animal confrontation. Monkey Sterilization has been set up in the State to check monkey menace. About 30,000 monkeys have been sterilized and released.

11. Research on effect of climate change on animal health: The threat of climate change and global warming is now recognised worldwide and some alarming manifestations of change have occurred. Animal health may be affected by climate change in four ways: heat-related diseases and stress, extreme weather events, adaptation of animal production systems to new environments, and emergence or reemergence of infectious diseases, especially vectorborne diseases critically dependent on environmental and climatic conditions. To face these new menaces, the need for strong & efficient veterinary services is irrefutable, combined with good coordination of public

health services, as many emerging human diseases are zoonoses and research.

## **6.6 Environment initiatives taken by the livestock sector to address critical environment issues**

Feed and Fodder Development: The State Department of Animal Husbandry is motivating the farmers to provide adequate nutritious fodder to harness the benefits of improved livestock. The department is distributing quality fodder grasses seeds and planting material for introduction on the field bunds and overheads. Fodder seeds and grass nurseries are being raised at Fodder Seed multiplication farms of the department. Coordinated efforts of various agencies – Forest, Agriculture, Animals Husbandry and R&D are required to undertake fodder and pasture development programmes with the involvement of farmers/villagers in their watershed development and other programmes. Veterinary aid institutions are providing following facilities to livestock owners for development of fodder:

- Department is supplying certified seed of cultivable fodder crops to farmers at full cost to all farmers and at 50% subsidy to IRDP, SC/ST and women.
- Department is supplying improved fodder grass roots and plants to the farmers.
- Two seed multiplication farms are also being run by the department at Sunni (Shimla) and Kotla Barog (Solan).
- The pasture land in the State is decreasing day by day due to rapid growth of weeds which is adversely affecting the sheep population of the State. In order to overcome this difficulty deweeding and regeneration of pasture land by seedling with

temperate grasses and fodder trees will be carried out.

- Fodder plant nurseries will be raised so that parent stock of grass roots and fodder trees are maintained and further distributed to the farmers.

#### Veterinary Services and Animal Health

To protect the livestock from epidemics and to provide timely veterinary aid, the department has a net work of veterinary institutions in the State. The number of polyclinics, veterinary hospitals, central veterinary dispensaries and veterinary dispensaries till March, 2007 has reached 2139.

Efforts to strengthen the existing veterinary institutions by providing laboratory and other diagnostic aid facilities have been made so that quality veterinary services could be provided.

- To protect animals against contagious diseases like Foot and Mouth Disease, HS, BQ and PPR diseases. The Government of India will be requested to provide sufficient grant under Centrally Sponsored Scheme “Assistance to control of animal diseases” (ASCAD) for purchase of vaccines to cover entire population of the State.
- Sero Surveillance programme for detection and monitoring of other diseases like Brucellosis, TB, JD and CRD etc. will be started in the State in addition to continuation of ongoing surveillance programme.
- To maintain cold chain for vaccines efforts to provide refrigerator up to grass root level institution (Veterinary Dispensary) are being made.

For mitigating the problem of degradation of vegetation resources due to overgrazing, the State is taking various steps which include:

- Limit the number of animals involved in overgrazing
- Control the length of grazing time on particular areas
- Restriction of livestock to certain areas reserved for food upliftment
- Mixing of livestock species to maximize use of vegetation resource
- Water and salt application should be such so as to have less of the impact on the vegetative resources

To have less impact on the soil erosion, fertility and water runoff, the State is taking the following steps:

- Restriction of livestock access to unstable areas (e.g., steep slopes).
- Soil erosion can also be controlled by various control measures like reforestation, reseeding of grasses, land preparation, terracing.
- For addressing the problem of rapid runoff of water, various water conservation measures have been adopted.

#### 6.7 Environment related studies carried out in the livestock sector

Livestock in Himachal Pradesh depends upon the natural resources (forest and pastures) for fodder. Most of the cultivable land in the State is devoted to the food production for humans and thus the area under fodder production is negligible. Therefore the size and structure of the livestock population on farms depends on crop by- products and fodder from the forest and pasture lands. The continuous growth of livestock is worsening the quality and productivity of their Common pool resources. Thus high densities of livestock are degrading the quality of resources and environment of H.P. Himalayas. Thus the State has carried out various mathematical calculations for estimating

Carrying Capacity i.e. how many resources environment can hold in a sustainable manner.

It has been found that there is an immense pressure of livestock based on resources. This has resulted in ecological problems in form of high intensity of soil erosion, gully formation and thinning of forests due to intensive lopping and grazing. Also if livestock population will increase, it will further pressurize the natural resources and thus will lead to permanent damage to fragile environment of Himalayas. The existing fodder resources can sustain 35% of total livestock population and 66% was surplus during 1992. This surplus population is a burden to resources and studies show that increase of fodder availability on private land is limited. Thus the carrying capacity is decreasing due to heavy biotic pressures as well as lack of proper management.

**Table 31: Estimated optimum and surplus livestock population in H.P., 1992**

Particulars	Population (in lakh)
Actual livestock population	42.08
Optimum livestock population	14.47
Surplus livestock population	27.61
% of surplus livestock to total livestock population	65.61

### 6.8. Environment monitoring (key parameters such as air and water pollution) carried out for activities related to the livestock sector

At present, there is no environment monitoring carried out by the Animal Husbandry Department.

### 6.9 Institutional mechanisms within the sector to address identified environment issues

In 1948 separate Animal Husbandry Department came into existence and programmes for increased milk production and breed improvement were taken up to meet the day to day requirement of increasing human population and to boost the rural economy.

#### Mandate of the Department

- Healthcare and Disease Investigation.
- To bring improvement in production of livestock products by crossbreeding and conservation of indigenous livestock under:-
  1. Cattle and Buffalo Development
  2. Sheep Development.
  3. Angora rabbit development.
  4. Poultry Development.
- Improvement of nutritional status of animals.
- Training & Demonstration in scientific livestock rearing.
- Extension and Transfer of technology.

The Department of Animal Husbandry is the nodal department for carrying out all activities connected with Animal Husbandry in the State of Himachal Pradesh. The department is headed by Director of Animal Husbandry. S/he is assisted by Joint Director (H. Q.), Joint Director (SLBP- CO North Zone), Joint Director (Palampur- CO South Zone) and Joint Director (Stat). The existing institutional framework of Department of Animal Husbandry is shown in Figure 1 and responsibilities of the officers are described below.

Director:- Director of Animal Husbandry, being the administrative and professional head

of the Animal Husbandry Department in the State is responsible for the efficient working of the Department and shall exercise all administrative financial and technical powers as exercised by the Heads of the Department in Himachal Government. S/he also acts as Advisor to the State Government on all technical matters relating to Animal Husbandry and allied subjects.

Joint Director (H.Q.): - The Joint Director assists the Director Animal Husbandry in the performance of his/her duties and responsibilities as Stated above. S/he shall be required to inspect the institutions under his/her control and shall exercise all the administrative and financial powers of the controlling officer within his/her jurisdiction.

Joint Director (SLBP): - The Joint Director (SLBP) assists the Director, Animal Husbandry in the performance of duties and responsibilities. S/ he is also the controlling Officer of North Zone comprising Distt Kinnaur, Shimla, Solan, Sirmaur, Bilaspur, Una and the area under the jurisdictions of Assistant Director (AH/B) Kaza in addition to his/her duties. S/he will also exercise all the administrative and financial powers attached to his/her post in the capacity of being controlling officer.

Joint Director (Animal Husbandry) Palampur: - The Joint Director, Animal Husbandry shall assist the Director, Animal Husbandry in the performance of his/her duties and responsibilities. S/he has been delegated with the powers of Head of office and DDO in respect of his/her own office as well as Poultry Farm Palampur, Cattle Farm Palampur, Assistant Director (AP) (Palampur). S/he is also Controlling Officer of South Zone consisting of District Kangra, Kullu, Lahaul &Spiti (except Spiti Valley), Hamirpur and Chamba. S/he will also excise all the administrative and financial power attached to his post in the capacity of being controlling officer.

Joint Director (Stat):- The Joint Director (Stat) is assisted by Statistical officer to perform his/her duty.

Deputy Director-Animal Production (H.Q.): - S/he is responsible to act as nodal officer for implementation of frozen semen technology in the State and work as liaison officer between Govt. of India and State department of Animal Husbandry for the same and any other duty pertaining to Animal Husbandry activities as may be assigned by Director.

Deputy Director (Epidemiology)-H.Q.:- S/he is responsible for the study of geographical, seasonal & regional distribution of different strains of Foot and Mouth Disease. S/he is also responsible to carry out systematic epidemiological studies of F.M.D. outbreaks, and serotyping of outbreak.

Deputy Director (Poultry)-H.Q.:- S/he acts as a nodal officer for all the poultry development project, draw annual action plan for the development of Poultry activities in the State of Himachal Pradesh, ensure efficient running of various poultry schemes operational in the State from time to time by monitoring them through inspections and progressing returns, inspect all poultry farms, hatcheries and extension centres twice in a year to ensure their efficient functioning and inspect the units of poultry birds given in each district once in a year.

Deputy Director(s) (Animal Health/Breeding):- The Deputy Directors(s) of the respective Districts act as the nodal officers who will be accountable for the entire departmental activities in their jurisdiction. S/he is responsible for monitoring the achievements made and physical & financial targets of the schemes for which they have been declared as controlling officers by the competent authority and make appropriate evaluation and recommend remedial measures for any shortcomings.

Deputy Director (Dairy):- S/he responsible for to assist the Director, Animal Husbandry in assessing the requirement of financial assistance to Himachal Pradesh Milk Fed and to get the areas surveyed for potentiality of establishing milk schemes in the Pradesh.

Agrostologist, Directorate of Animal Husbandry: - Agrostologist responsible for implementation of feed and fodder development programme of the Department through the District Animal Husbandry Officer/Farm Managers.

Assistant Director(s) (Cattle Production):- S/he is responsible for supervising the Cattle Development Schemes at the State Head Quarters, responsible for monitoring the requirement and supply of the Sperm Station/Semen Banks in Himachal Pradesh and responsible for coordinating the Projects / Livestock Development Board /Budget and Planning at the State Headquarters.

Assistant Director(s) (Extension) H.Q.:- The Assistant Director(s) (Extension) assist the Director or Deputy Director of Animal Husbandry in the performance of duties and responsibilities in respect to extension activities of the Department. S/he is the Nodal Officer of NABARD Projects.

Assistant Director(s) (Sheep & Wool):- S/he is responsible for assisting the Director (AH) or Deputy Director to administer working of Rabbit Breeding Farms, Sheep Breeding Farms, Horse Breeding Farm and Yak Breeding Farm. S/he is also responsible for assisting the Director (AH) in maintaining liaison between department and Himachal Pradesh Wool Federation to monitor implementation of Sheep and Wool development projects.

Assistant Director (Rinderpest.) H.Q.:- S/he is responsible to act as nodal officer for monitoring & containment of Bovine Spongiform Encephalopathy (B.S.E.) in the State, to monitor National Programme on

Rinder Pest Eradication (NPPE) in the State and as the Rinderpest Officer formulates suitable control measures so that the disease can be controlled in minimum possible time.

Assistant Director (Disease Investigation Laboratory):- On receipt of any information of any disease prevailing in his/her jurisdiction for which proper diagnosis cannot be made by the field staff for farm, S/he immediately proceeds on a tour using quickest means of communication and get the approval subsequently from the competent authority for such tour.

Assistant Director (Sheep Development) Bharmour: - S/he performs all the duties of Deputy Director (Animal Health/Breeding) in Bharmour Division of Chamba in addition to implementing Sheep Development activities in that area.

Assistant Director(s) (Animal Production):- S/he supervise processing/procurement of quality semen straws in the Sperm Stations/Semen Banks, responsible for smooth & efficient functioning of Liquid Nitrogen Plants and any other duty assigned by higher authorities.

Assistant Director(s) (Cattle Farms):- S/he is responsible for general management & to see that records are properly maintained at the farm and draw up the breeding plan in accordance with the breeding policy laid down by the Director, Animal Husbandry.

Assistant Director(s) (Sheep Farms):- S/he is the technical & administrative head of the farm. S/he draw up list of animals to be culled, and the Joint Director of the Zone/ representative of the Director Animal Husbandry being head of the culling Committee, shall examine the animals as early as possible, along with two other members of the culling Committee i.e. D.D (AH/B) and A.D Farm.



Senior Veterinary Officer(s):- Being In-charge of the Sub Divisional Hospital, S/he discharges the same duties as Veterinary Officer discharges in the Hospital. In addition s/he co-ordinates the work of all the Institutions falling in the Sub Division, all the reports of all the Veterinary Hospitals are routed through him/her and any other duty assigned by the Deputy Director (AH/B).

Veterinary Officer(s):- S/he assists the farm manager in the proper maintenance and management of livestock allotted to him/her, responsible for proper implementation of breeding programme at the farm. H.P.State Wool Procurement and Marketing Federation Ltd

The H.P.State Wool Procurement and Marketing Federation Ltd. commonly known as “Woolfed” was established on 7<sup>th</sup> November 1988 and registered with Registrar Cooperative Societies, Government of Himachal Pradesh for the upliftment of sheep breeders of the State. The organization structure of H.P. State Wool Procurement and Marketing Federation Ltd. is given in Figure 2.

H.P.State Cooperative Wool Procurement and Marketing Federation Ltd

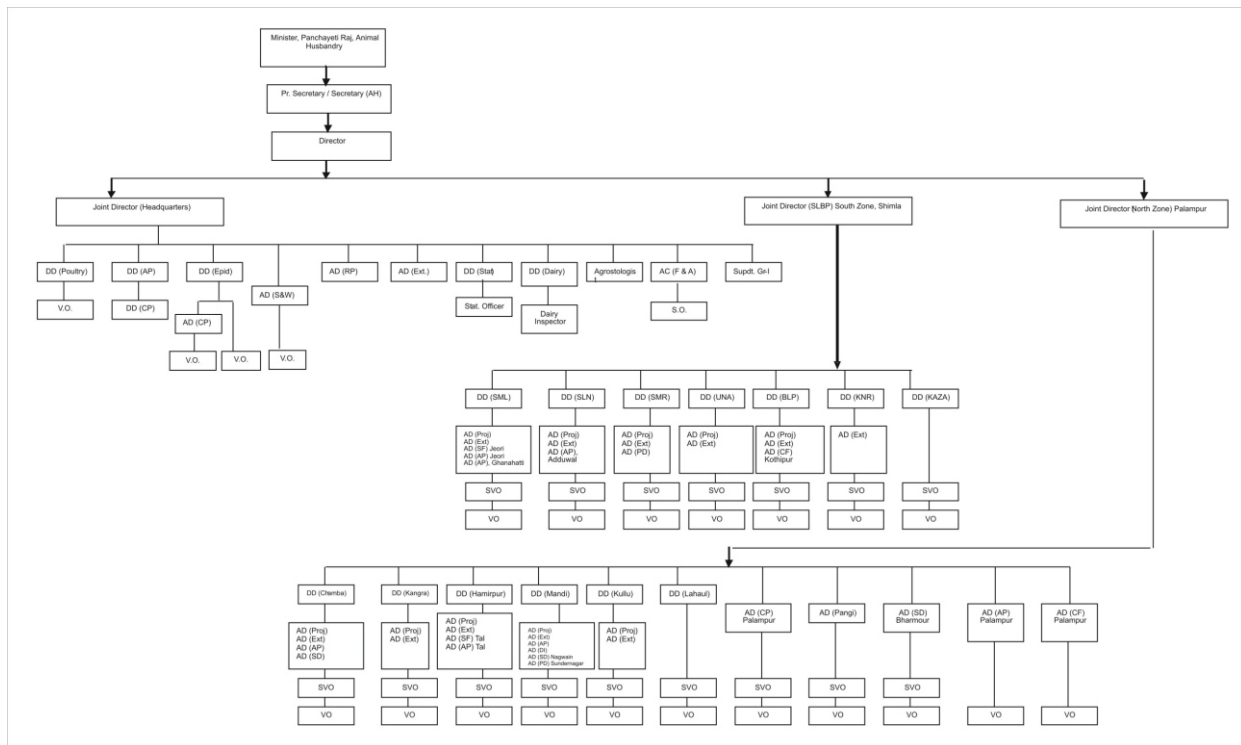
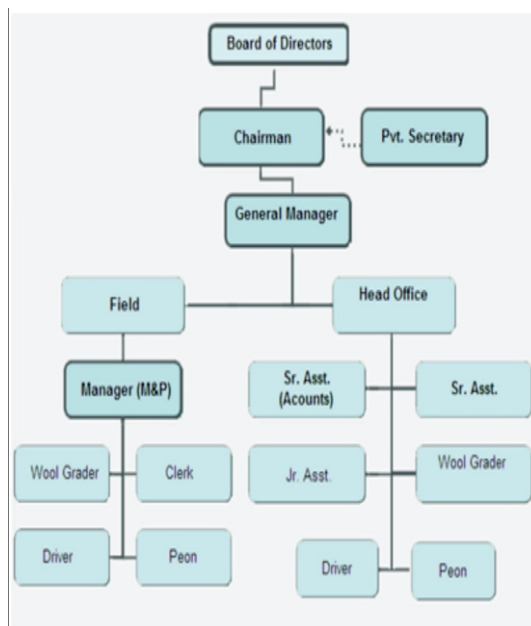


Figure 1: Organisational Chart of Animal Husbandry Department



**Figure 2: Organisational Chart of H.P.State Wool Procurement and Marketing Federation Ltd**

Based on the above institutional structure, gaps have been identified within the existing institutional framework which is described in Institutional Mechanism report. Further, institutional responsibilities to implement actions identified and approved by the nodal department and line departments have also been described in Institutional Mechanism report. In order to address environmental issues identified in concerned sectoral guidelines, a number of interventions are required from the nodal department with identified line departments.

### 6.10 Data / documentation pertaining to addressing demographic issues in the

**context of the sectors, such as population changes; requirements of population and changing lifestyles; migratory population including tourists; transhumants; transit labour population; pressures felt by communities due to degraded environment conditions.**

Livestock population: - The Tehsil wise information of the population of livestock for the year 2003 is given in Table 32.

Veterinary Institutions: - District wise veterinary health services for the year 2010 is given in Table 33a and Table 33b.

**Table 32: Tehsil wise information of the population of livestock for the year 2003**

Tehsil	Cattle	Buffaloes	Yaks	Mithuns	Sheep	Goats	Horse and ponies	Donkeys	Camel	Pigs	Total livestock
<b>District: Bilaspur</b>											
Bilaspur	21884	16969	0	0	1149	16618	44	101	0	18	56783
Ghumarwin	12824	36487	0	0	1088	14623	39	79	0	12	65152
Jhadunta	12544	27832	0	0	714	13519	4	59	0	41	54713
Naina Devi	6694	16380	0	0	43	8059	10	166	1	12	31365
District total	53946	97668	0	0	2994	52819	97	405	1	83	208013
<b>District: Chamba</b>											
Bhalai	16545	2932	0	0	8081	7282	147	6	0	0	34993
Bharmaur	12581	191	0	30	25548	16827	102	2	0	0	55281
Bhatiyat	20689	4387	0	0	9410	14964	42	26	0	0	49518
Chamba	95569	13367	2	0	63248	36942	545	407	1	0	210081

Tehsil	Cattle	Buffaloes	Yaks	Mithuns	Sheep	Goats	Horse and ponies	Donkeys	Camel	Pigs	Total livestock
Churah	55100	9521	0	0	70586	23714	338	41	0	0	159300
Dalhausic	15967	2297	0	2	5698	4548	41	3	0	0	28556
Holi	8876	0	0	0	40013	41616	276	8	0	0	90789
Pangi	10232	0	167	0	26003	11831	47	6	0	0	48286
Salooni	31400	4347	0	0	21189	8896	47	57	0	23	65959
Sihunta	23893	4393	0	0	11592	18210	238	13	0	0	58339
District Total	290852	41435	169	32	281368	184830	1823	569	1	23	804942
District: Hamirpur											
Barsar	4155	14779	0	0	339	2427	42	24	0	0	21766
Bhoranj	5566	18877	0	0	4509	6222	24	111	0	0	35309
Datwal	2580	9209	0	0	140	1713	6	3	0	11	13662
Hamirpur	9728	25874	0	0	6786	6866	27	33	0	12	49326
Nadaun	9876	26839	0	0	1590	4591	38	29	0	6	42969
Tihra Sujanpur	7135	8934	0	0	4547	7822	1	52	0	25	28516
District total	39040	104512	0	0	17911	29641	138	252	0	54	192720
District: Kangra											
Bajnath	25136	2070	0	0	14799	13839	435	13	0	0	56292
Baroh	7062	5945	0	0	509	9832	13	3	0	16	23380
Dehra Gopipur	36774	32213	0	0	1905	13471	200	33	0	70	84666
Dharamshala	28059	4446	0	68	12385	16595	369	8	0	23	61953
Dhira	5556	3056	0	0	772	4518	53	56	0	12	14023
Fatehpur	20810	10993	0	0	1265	7457	272	9	2	8	40816
Harchakkian	5990	1814	0	0	480	4211	47	1	0	0	12543
Indora	23248	13744	0	0	1470	6187	433	15	14	0	45111
Jai Singh Pur	11491	7539	0	0	4586	7462	7	59	0	0	31144
Jaswan	10165	6982	0	0	977	1479	41	3	0	0	19647
Jawali	34243	15128	0	0	7100	20129	196	44	1	45	76886
Kangra	36514	13029	0	0	5476	22038	332	49	0	0	77438
Khundian	9793	9212	0	0	1079	7926	4	12	0	7	28033
Multhan	5297	0	0	0	19279	13202	369	1	0	0	38148
Nurpur	52550	14572	0	0	8422	23059	534	45	11	0	99193
Palampur	46570	6418	0	0	20099	19411	564	55	0	39	93156
Rakkar	7546	8450	0	0	410	1250	16	2	0	0	17674
Shahpur	26163	4354	0	0	5715	14315	349	13	0	26	50935
Thural	3590	2730	0	0	899	2705	8	25	0	34	9991
District total	396557	162695	0	68	107627	209086	4242	446	28	280	885455
District: Kinnaur											
Hangrang	1145	0	2	0	5935	2767	75	777	0	0	10701
Kalpa	3214	9	194	11	7473	2171	99	206	0	19	13396
Moorang	2381	0	5	47	10556	4351	78	367	0	0	17785
Nichar	10265	0	13	11	28411	14016	197	526	0	0	53439
Pooh	1517	0	7	19	9064	4060	146	452	0	0	15265
Sangla	4611	0	118	7	12947	7270	60	220	0	0	25233
District total	23133	9	339	95	74386	34635	655	2548	0	19	136189
District: Kullu											
Anni	2917	0	0	0	1112	556	1	0	0	0	4586
Banjar	30050	0	0	0	19841	10283	44	0	0	0	60218
Kullu	84397	184	0	0	77298	44818	1702	5	0	0	208404
Manali	10349	47	5	2	9461	1472	672	76	0	0	22084
Nirmand	30752	62	0	0	13576	13037	125	74	0	0	57626
Sainj	16463	20	0	0	8554	7930	89	5	0	0	33061
District total	174928	313	5	2	129842	78096	2633	160	0	0	386456
District: Lahaul & Spiti											
Lahaul	5258	0	21	0	18950	668	385	107	0	0	25389
Spiti	4846	0	942	0	7584	6933	644	2169	0	0	23118
Udaipur	3197	0	105	0	14915	2967	146	14	0	0	21344
District: Mandi											
Aut	14859	598	0	0	5416	6746	8	7	0	0	27634
Baldwara	7052	10141	0	0	2343	5976	19	5	0	1	25537
Bali Chowki	24852	4	0	0	16845	11544	2	9	0	0	53256
Chachiot	30935	1217	0	0	10092	7906	220	4	0	0	50374
Dharampur	10789	5839	0	0	3149	7508	21	11	0	0	27317
Jogender Nagar	34640	2782	0	0	4182	11004	190	52	0	0	52850
Karsog	69276	1822	0	0	13277	23770	331	39	0	3	108518
Kotli	15831	2197	0	0	4041	3622	132	8	0	0	25831
Lad Bharol	11391	2874	0	0	1478	7135	58	33	0	6	22975
Mandi Sadar	80446	14552	0	0	16405	20230	633	65	0	88	132419
Nihri	28886	2767	0	0	11631	19034	97	15	0	0	62430
Padhhar	32810	5655	0	0	12096	18854	255	15	0	0	69685
Sandhol	3230	2817	0	0	1686	5612	0	3	0	3	13351
Sarkaghat	20695	18040	0	0	3416	13147	201	67	0	204	55770
Sundernagar	22899	12991	0	0	3557	12431	75	10	0	204	52167
Thunag	28945	5	0	0	20230	15226	132	0	0	1	64539
District total	437536	84301	0	0	129844	189745	2374	343	0	510	849461
District: Shimla											
Chargaon	19573	132	0	0	28132	13229	169	163	0	13	61411
Cheta	12736	330	0	0	3738	7304	15	14	0	206	24343
Chopal	19383	543	0	0	2612	4411	60	41	0	30	27080
Dodra Kwar	3495	16	0	3	13879	6990	2	0	0	0	24385

Tehsil	Cattle	Buffaloes	Yaks	Mithuns	Sheep	Goats	Horse and ponies	Donkeys	Camel	Pigs	Total livestock
Jubbal	14314	41	0	0	3230	3469	30	48	0	51	21183
Junga	9372	1239	0	0	204	1513	93	8	0	0	12429
Kotkhai	13780	112	0	0	740	782	30	12	0	1	15457
Kumarsain	16304	231	0	0	2234	4529	84	11	0	0	23393
Nankhari	10325	22	0	0	3417	2655	60	24	0	0	16503
Nerwa	25076	889	0	0	4110	19688	214	273	0	123	50373
Rampur	29604	704	0	0	24773	16944	121	156	0	47	72349
Rohru	16508	65	0	0	3058	681	43	62	0	0	20417
Shimla	36408	6763	0	0	2950	2781	271	6	0	69	49248
Sunni	26110	2783	0	0	1519	6914	77	61	0	2	37466
Theog	48182	2415	9	0	3032	6032	763	23	0	2	60458
Tikker	6017	7	0	0	748	301	45	2	0	0	7120
District total	307187	16292	9	3	98376	98223	2077	904	0	544	527551
District: Sirmaur											
Dabahu	12484	1470	0	0	382	10067	14	21	0	49	24487
Kamrau	15934	2619	0	0	1172	11721	29	3	0	39	31517
Nahan	30188	7387	0	0	347	14205	27	214	45	263	52676
Nohra	16836	1836	0	0	2477	11486	91	0	0	34	32760
Pachhad	36682	6123	0	0	2378	20025	251	120	0	1	65580
Paonta Sahib	40331	22439	0	0	526	10600	76	23	12	139	74146
Rajgarh	34254	4528	0	0	2460	12126	418	20	0	16	53822
Renuka	30625	1813	0	0	2451	24019	28	2	0	46	58984
Ronhat	13432	458	0	0	1950	7097	8	0	0	21	22966
Shalai	17279	2002	0	0	3615	17473	160	0	0	221	40750
District total	248045	50675	0	0	17758	138819	1102	403	57	829	460009
District: Solan											
Arki	45020	9895	0	0	1622	9722	79	120	0	8	66466
Kandaghat	22118	3897	0	0	906	1989	126	19	0	54	29109
Kasauli	15372	6974	0	0	482	5710	35	122	1	153	28849
Krishangarh	12412	4173	0	0	408	9654	21	27	0	25	26720
Nalagarh	18577	50801	0	0	61	20575	83	58	10	27	90192
Ramshehar	12972	9519	0	0	127	13280	4	64	0	3	35969
Solan	28099	5528	0	0	707	6558	163	38	0	44	41137
District total	154570	90787	0	0	4313	67488	511	448	11	314	319881
District: Una											
Amb	25208	38479	0	0	17	4827	139	18	4	15	68707
Bangana	10174	26163	0	0	103	7276	33	25	0	19	43793
Bharwain	3170	3328	0	0	30	607	28	2	0	10	7175
Haroli	5726	15777	0	0	0	4131	22	7	15	0	25678
Una	13165	40798	0	0	9	4789	122	39	11	95	59028
District total	57443	124545	0	0	159	21630	344	91	30	139	204542

**Table 33a: District-Wise Number of Various Veterinary Institutions under Animal Husbandry Department in H.P. (as on 01.06.2010)**

S. No.	Name of Institution	Name of District									
		Bilaspur	D.D. Chamba	A.D. S.D. Bharmour	A.D. Pangi	Total Chamba	Hamirpur	J.D. Palampur	D.D. Dharamsala	A.D.C.P. Palampur	Total Kangra
1	State Vety. Hospital	0	0	0	0	0	0	0	0	0	0
2	Vety. Polyclinic	0	1	0	0	1	0	0	1	0	1
3	Sub. Div. Vety. Hospital	2	3	1	1	5	4	0	5	2	7
4	Vety. Hospital	17	19	7	4	30	14	0	30	19	49
5	Central Vety. Dispensary	3	1	0	0	1	1	0	3	5	8
6	Vety. Dispensary	98	129	19	15	163	116	0	225	112	337
7	Vety. Check Post	1	0	0	0	0	0	0	1	0	1
8	Pool Store	1	1	0	0	1	1	0	1	1	2
9	Semen Bank	0	1	0	0	1	1	1	0	0	1
10	Sperm Station	0	0	0	0	0	0	1	0	0	1
11	Clinical Lab.	0	1	0	0	1	1	0	1	0	1
12	Wool Analysis Lab.	0	1	0	0	1	1	0	0	0	0
13	Epid. Lab	0	0	0	0	0	0	0	0	0	0
14	Disease Investigation Lab.	0	0	0	0	0	0	0	0	0	0
15	Cattle Farm	1	0	0	0	0	0	1	0	0	1

S. No.	Name of Institution	Name of District									
		Bilaspur	D.D. Chamba	A.D. S.D Bharmour	A.D. Pangi	Total Chamba	Hamirpur	J.D. Palampur	D.D. Dharamsala	A.D.C.P Palampur	Total Kangra
16	Sheep Farm	0	1	0	0	1	1	0	0	0	0
17	Sheep & Wool Extn. Centre	0	0	2	0	2	0	0	0	1	1
18	Rabbit Farm	0	0	0	0	0	0	1	0	0	1
19	Horse Breeding Farm	0	0	0	0	0	0	0	0	0	0
20	Poultry Farm	0	0	0	0	0	0	0	0	0	0
21	Poultry Extn. Centre	0	1	0	0	1	0	2	0	0	2
22	Quality Control Lab	0	0	0	0	0	0	1	0	0	1
23	Training Centre	1	1	0	0	1	0	0	0	0	0
	<b>TOTAL</b>	<b>124</b>	<b>160</b>	<b>29</b>	<b>20</b>	<b>209</b>	<b>140</b>	<b>7</b>	<b>267</b>	<b>140</b>	<b>414</b>

Source: Department of Animal Husbandry, Himachal Pradesh

**Table 33b: District-Wise Number of Various Veterinary Institutions under Animal Husbandry Department in H.P. as on 01.06.2010**

S. No.	Name of Institution	Name of District										STATE TOTAL
		Kinnaur	Kullu	D.D. Keylong	A.D. Kaza	Total Lahaul & Spiti	Mandi	Shimla	Sirmaur	Solan	Una	
1	State Vety. Hospital	0	0	0	0	0	0	1	0	0	0	1
2	Vety. Polyclinic	0	1	0	0	0	1	1	1	1	0	7
3	Sub. Div. Vety. Hospital	3	3	2	1	3	6	4	3	3	2	45
4	Vety. Hospital	17	14	7	4	11	32	41	23	20	16	284
5	Central Vety. Dispensary	1	1	0	0	0	3	6	4	1	1	30
6	Vety. Dispensary	39	89	25	18	43	267	250	126	129	104	1761
7	Vety. Check Post	0	0	0	0	0	0	0	0	0	4	6
8	Pool Store	0	1	0	0	0	1	1	1	1	1	11
9	Semen Bank	0	0	0	0	0	1	2	0	1	0	7
10	Sperm Station	0	0	0	0	0	0	0	0	1	0	2
11	Clinical Lab.	0	0	0	0	0	0	0	0	1	0	4
12	Wool Analysis Lab.	0	0	0	0	0	0	1	0	0	0	3
13	Epid. Lab	0	0	0	0	0	0	1	0	0	0	1
14	Disease Investigation Lab.	0	0	0	0	0	1	1	0	0	0	2
15	Cattle Farm	0	0	0	0	0	0	0	1	0	0	3
16	Sheep Farm	1	0	0	0	0	1	1	0	0	0	5
17	Sheep & Wool Extn. Centre	1	1	1	1	2	1	1	0	0	0	9
18	Rabbit Farm	0	0	0	0	0	1	0	0	0	0	2
19	Horse Breeding Farm	0	0	0	1	1	0	0	0	0	0	1
20	Poultry Farm	0	0	0	0	0	1	0	1	0	0	2
21	Poultry Extn. Centre	2	0	0	0	0	2	1	1	1	1	11
22	Quality Control Lab	0	0	0	0	0	0	0	0	0	0	1
23	Training Centre	0	0	0	0	0	0	0	0	0	0	2
	<b>TOTAL</b>	<b>64</b>	<b>110</b>	<b>35</b>	<b>25</b>	<b>60</b>	<b>318</b>	<b>312</b>	<b>161</b>	<b>159</b>	<b>129</b>	<b>2200</b>

Source: Department of Animal Husbandry, Himachal Pradesh

**Milk production:** Milk is the most important produce of Cow, Buffalo and Goat. The following tables and figures show the trends in the Milk production from the years 1987 to 2009 in the State and district wise production of the milk from year 2000 to 2008.

(i) Integrated Sample Survey for Estimation of Animal Products, Milk, Eggs, Wool and Meat, 2001-2002, Directorate of Animal Husbandry, Himachal Pradesh, Pasudhan Bhawan, Shimla. (iii) Census of Himachal Pradesh, 1987-2007

**Table 34: Trends in Milk Production, 1987-2009, Himachal Pradesh**

Year	Milk ('000 tonnes)				Total
	Cow	Buffalo	Goat		
1987-88	166.58	227.63	9.62		404.13
1988-89	218.13	265.88	15.74		499.75
1989-90	242.18	278.82	8.19		529.19
1990-91	257.56	300.84	14.20		572.60
1991-92	264.75	311.67	20.44		596.86
1992-93	260.66	319.95	29.47		610.08
1993-94	292.27	355.39	26.19		653.85
1994-95	303.55	331.35	28.00		662.90
2001-02	350.55	380.29	32.02		762.86
2003-04	375.92	378.37	30.94		786.22
2004-05	449.99	339.46	30.06		869.51
2005-06	505.59	335.07	28.36		869.01
2007-08	507.33	337.38	28.76		873.47
2008-09	528.36	327.51	28.13		884.00

Source: (i) Statistical Outline of different years, Himachal Pradesh. (ii) Integrated Sample Survey for Estimation of Animal Products, Milk, Eggs, Wool and Meat, 2001-2002, Directorate of Animal Husbandry, Himachal Pradesh, Pasudhan Bhawan, Shimla. (iii) Census of Himachal Pradesh, 1987-2007

**Table 35: District-wise Annual Milk Production (2000 to 2008)**

District	2000-01 ('000	2001-02 ('000	2006-07 ('000	2006-07 ('000	2007-08 ('000	Total
	Tonnes)	Tonnes)	Tonnes)	Tonnes)	Tonnes)	
Bilaspur	37.35	35.11	47.107	47.217	53.867	220.651
Chamba	55.67	61.57	70.213	69.171	63.681	320.305
Hamirpur	74.69	60.33	57.307	71.242	64.813	328.382
Kangra	145.35	143.94	178.710	163.329	187.321	818.65
Kinnaur	5.59	6.38	10.652	10.409	8.333	41.364
Kullu	35.40	30.41	51.268	48.860	49.367	215.305
Lahaul & Spiti	6.55	6.91	7.168	6.848	6.546	34.022
Mandi	124.06	120.63	127.931	137.03	136.514	646.165
Shimla	71.69	79.25	94.578	97.058	98.640	441.216
Sirmaur	63.41	71.82	69.812	72.900	60.833	338.775
Solan	68.82	73.78	89.695	84.8	77.907	395.002
Una	71.78	72.68	64.573	63.531	65.644	338.208
Total	760.41	762.86	869.014	872.395	873.466	4138.045

Source: Integrated Sample Survey for Estimation of Animal Products, Milk, Eggs, Wool and Meat, 2001-2002, Directorate of Animal Husbandry, Himachal Pradesh, Pasudhan Bhawan, Shimla, Census of Himachal Pradesh, 2000-2007

Wool: Wool is another major resource produced in the State. The following Tables 36 & 37 show the trends in Wool production from the years 1987 to 2009 in the State and district wise production of milk from year 2000 to 2008.

(ii) Integrated Sample Survey for Estimation of Animal Products, Milk, Eggs, Wool and Meat, 2001-2002, Directorate of Animal Husbandry, Himachal Pradesh, Pasudhan Bhawan, Shimla. (iii) Census of Himachal Pradesh, 1987-2007

**Table 36: Wool Production (1987-2009), Himachal Pradesh**

Sl. No.	Year	Wool (in tonnes)	Sl. No.	Year	Wool (in tonnes)
1	1987-88	1270	8	1994-95	1533
2	1988-89	1351	9	2001-02	1586
3	1989-90	1405	10	2003-04	1,598
4	1990-91	1452	11	2004-05	1,599
5	1991-92	1567	12	2005-06	1,603
6	1992-93	1510	13	2007-08	1,607
7	1993-94	1532	14	2008-09	1,617

Source: (i) Statistical Outline of different years, Himachal Pradesh.

**Table 37: District-wise Annual Wool Production (2000-2001 and 2001-02)**

District	2000-01 ('000 Kg)	2001-02 ('000 Kg)	2005-06 ('000 Kg)	2006-07 ('000 Kg)	2007-08 ('000 Kg)
Bilaspur	37.34	29.52	7.851	9.303	7.656
Chamba	343.15	381.79	467.544	448.714	466.764
Hamirpur	78.55	65.87	48.645	40.252	47.222
Kangra	224.35	201.63	215.104	202.695	204.276
Kinnaur	93.11	80.58	125.616	175.420	143.385
Kullu	200.23	218.72	230.04	224.078	242.725
Lahaul & Spiti	71.73	60.74	65.486	82.108	63.996
Mandi	261.71	266.92	237.555	220.466	216.5
Shimla	200.38	175.91	162.957	151.986	177.621
Sirmaur	34.78	61.80	32.673	35.853	27.287
Solan	25.98	28.98	7.163	11.321	6.799
Una	7.24	9.96	0.410	0.447	0.359
Total	1578.56	1582.45	1601.044	1602.643	1604.566

Source: Integrated Sample Survey for Estimation of Animal Products, Milk, Eggs, Wool and Meat, 2001-2002, Directorate of Animal Husbandry, Himachal Pradesh, Pasudhan Bhawan, Shimla. Census of Himachal Pradesh, 2000-2007

Meat: Meat is a major animal product which is found in the State and is extracted from Goat, Sheep and Pig. The following Tables 38 & 39 show the trends in the Meat production from the years 1987 to 2009 in the State and district wise production of meat for years 2001 to 2008.

(ii) Integrated Sample Survey for Estimation of Animal Products, Milk, Eggs, Wool and Meat, 2001-2002, Directorate of Animal Husbandry, Himachal Pradesh, Pasudhan Bhawan, Shimla.

(iii) Census of Himachal Pradesh (2003-2009)

**Table 38: Meat Production, (1987-2009) Himachal Pradesh**

Sl. No.	Year	Meat ('000 kgs.)	Sl. No.	Year	Meat ('000 kgs.)
1	1987-88	3392	8	1994-95	3646
2	1988-89	3670	9	2001-02	3548
3	1989-90	4026	10	2003-04	3,213
4	1990-91	4049	11	2004-05	2,915
5	1991-92	4406	12	2005-06	2,934
6	1992-93	4163	13	2007-08	3,217
7	1993-94	4664	14	2008-09	3,309

Source: (i) Statistical Outline of different years, Himachal Pradesh.

**Table 39: Himachal Pradesh: District-wise Annual Meat Production 2001-02 (in tonnes)**

District	Goat			Sheep			Pig		
	2001-02	2006-07	2007-08	2001-02	2006-07	2007-08	2001-02	2006-07	2007-08
Bilaspur	46.95	76.341	52.084	10.78	40.256	13.805	1.84	5.679	4.802
Chamba	107.72	145.486	75.702	76.02	99.667	56.317	-	9.471	6.305
Hamirpur	82.41	80.949	486.14	36.92	48.285	16.862	-	1.341	1.086
Kangra	415.68	273.395	272.733	260.51	140.229	123.969	15.41	38.611	8.099
Kinnaur	52.43	143.670	74.36	40.32	69.384	44.441	-	0	0
Kullu	179.93	165.972	347.443	122.85	76.566	301.642	-	14.809	0
Lahaul & Spiti	102	123.863	76.807	155.66	76.829	69.239	-	30.323	0
Mandi	262.36	249.255	132.735	122.06	139.892	33.078	14	16.834	3.775
Shimla	911.55	519.721	1046.673	113.99	155.715	69.627	88.86	9.970	48.938
Sirmaur	82.78	107.814	62	19.5	65.648	11.167	35.80	0.562	21.307
Solan	25.03	84.099	84.197	4.57	40.402	19.66	115.29	40.402	17.369
Una	42.13	44.47	58.640	2.75	13.638	11.557	-	38.718	1.925
Total	2311.11	2015.035	2769.514	965.98	966.511	771.364	271.20	206.72	113.606

Source: Integrated Sample Survey for Estimation of Animal Products, Milk, Eggs, Wool and Meat, 2001-2002, Directorate of Animal Husbandry, Himachal Pradesh, Pasudhan Bhawan, Shimla. Livestock Census of Himachal Pradesh (2003 & 2007)

Eggs: Eggs are another major resource produced from various animals in the State. The following Tables 40 & 41 show the trends in Meat production from the years 1987 to 2009 in the State and district wise production of meat for year 2001 to 2008.

(ii) Integrated Sample Survey for Estimation of Animal Products, Milk, Eggs, Wool and Meat, 2001-2002, Directorate of Animal Husbandry, Himachal Pradesh, Pasudhan Bhawan, Shimla.  
(iii) Livestock Census of Himachal Pradesh (2003 & 2007)

**Table 40: Egg Production (1987-2009), Himachal Pradesh**

Sr No.	Year	Egg (Lakh)	Sl. No.	Year	Egg (Lakh)
1	1987-88	338	8	1994-95	669
2	1988-89	485	9	2001-02	822
3	1989-90	491	10	2003-04	839
4	1990-91	532	11	2004-05	811
5	1991-92	580	12	2005-06	752
6	1992-93	697	13	2007-08	842
7	1993-94	714	14	2008-09	977

Source: Statistical Outline of different years, Himachal Pradesh

**Table 41: Himachal Pradesh Districtwise Annual Egg Production 2000-08**

District	2000-01 (million)	2001-02 (million)	2005-06 (million)	2006-07 (million)	2007-08 (million)
Bilaspur	6.8	7.5	11.6	13.5	14.4
Chamba	9.1	10.4	6.7	6.8	7.5
Hamirpur	3.7	2.9	1.2	1.7	1.6
Kangra	33.8	34.5	17.2	15.8	18.2
Kinnaur	0.6	0.5	0.6	0.8	0.9
Kullu	3.0	2.0	2.02	2.2	2.6
Lahaul & Spiti	0.6	1.8	0.15	0.2	0.17
Mandi	12.4	10.3	5.5	4.6	6.3
Shimla	4.7	4.8	6.1	4.1	6.6
Sirmaur	2.3	2.1	2.4	2.6	2.8
Solan	1.6	2.3	9.1	10.8	9.8
Una	2.9	3.1	12.2	13.6	13.3
Total	81.6	82.2	75.2	77.2	84.2

Source: Integrated Sample Survey for Estimation of Animal Products, Milk, Eggs, Wool and Meat, 2001-2002, Directorate of Animal Husbandry, Himachal Pradesh, Pasudhan Bhawan, Shimla. Livestock Census of Himachal Pradesh (2003 & 2007).

### 6.10.1 Milk Based Industries in Himachal Pradesh

H.P. MILKFED is implementing dairy development activities in the State. H.P. Milkfed has installed 52 Bulk Milk Coolers at village level in various parts of the state. To bring transparency and automation in the testing of milk at village level, H.P. Milkfed has installed 6

Automatic Milk Collection Units in different Village Dairy Co-operative societies and plans to install 19 new AMCUs during the end of this year. The Milkfeds Societies and production of various milk products in the organized sector is shown in Table 42.

**Table 42: Production of Milk Based Industry**

Sr No.	Particulars	Units	2005-06	2006-07	2007-08	2008-09	2009-10 upto 31.12.09
1	Organized Societies	No.	404	525	594	639	668
2	Membership	No.	22044	25325	26956	28704	34587



Sr No.	Particulars	Units	2005-06	2006-07	2007-08	2008-09	2009-10 upto 31.12.09
3	Milk procured	Lakh ltrs.	91.70	89.11	139.51	167.15	153.33
4	Milk Marketing	Lakh ltrs.	49.72	58.15	60.52	65.86	52.96
5	Ghee sold	MT	37.90	43.74	70.56	116.19	130.12
6	Paneer sold	MT	49.79	59.25	66.4	52.38	36.11
7	Butter Sold	MT	8.41	8.14	11.45	13.28	11.59
8	SFM	Lakh bottles	0.19	0.11	0.00	0.02	0.02
9	Dahi Sold	MT	103.18	179.14	216.33	174.46	126.55
10	Cattle Feed	Qtls	19344	17941	23856	30078	28207

Source: Economic Survey Report, 2009-10

### 6.11 Information on human resource management issues (which may have relevance to environment management) in the livestock sector such as: manpower, vocational training, awareness levels etc.

Director, Animal Husbandry, being administrative and professional head of the Animal Husbandry Department in the State is responsible for the efficient working of the department and shall exercise all administrative and financial powers as adjoined upon the heads of the department in the Himachal Pradesh Government.

Table 43: Detail of sanctioned posts of various categories in the Animal Husbandry Department

Sr. No.	Category	Number of Total Posts	Filled Up	Vacant
1.	Director, Animal Husbandry. H.P.	1	1	0
2.	Joint Director (AH) / SLBP	3	3	0
3.	Deputy Director (Stat)	1	0	1
4.	Deputy Director (AH/B) & other similar posts	15	14	1
5.	Agrostologist	1	0	1
6.	Deputy Director (Dairy)	1	1	0
7.	Assistant Director level posts	46	46	0
8.	Superintendent Grade – I	7	6	1
9.	Assistant Controller (Finance & Accounts)	1	1	0
10.	Stat. Officer	1	1	0
11.	Assistant Agrostologist	1	0	1
12.	Statistician	1	0	1
13.	Veterinary Officer / Senior Veterinary Officer	416	306	113
14.	Veterinary Pharmacist	2280	2066	214
15.	Animal Husbandry Assistant	259	242	17
16.	Chief Veterinary Pharmacists	43	31	12
17.	Enumerator	24	17	7
18.	Section Officer SAS	2	1	1
19.	Superintendent Grade – II	32	25	7
20.	Senior Assistant	81	73	8
21.	Senior Scale Stenographer	4	4	0
22.	Personal Assistant	1	1	0
23.	Junior Scale Stenographer	4	2	2
24.	Steno Typist	7	2	5
25.	Junior Assistant / Clerk	107	88	19
26.	Computer	4	3	1
27.	Technical Assistant (Statistical)	2	2	0
28.	Statistical Assistant	7	6	1
29.	Law Officer	1	1	0
30.	Additional Assistant Engineer	1	1	0
31.	Carpenter	1	1	0
32.	Mechanic	7	6	1
33.	Senior Scale Mechanic	1	1	0
34.	Plant Operator	1	1	0
35.	Electrician	7	6	1
36.	Driver (Regular / Contract)	49	47	2
37.	Driver (Daily Paid)	1	1	0
38.	Gestetnor Operator	1	1	0
39.	Dairy Inspector	2	0	2
40.	Co-operative Inspector	1	0	1
41.	Agriculture Dev. Officer	2	1	1
42.	Agriculture Extension Officer	10	0	10
43.	Private Secretary	1	1	0
44.	Class – IV	2922	2480	442
	<b>Total</b>	<b>6363</b>	<b>5490</b>	<b>873</b>

## 6.12 Regulatory analysis to identify any regulations that have environment implications (negative or positive), and compliance with the same

Animal Husbandry & Livestock sector and cross sector policy and regulatory framework at State level shows the intent of the State government to address inadequate service delivery in order to reduce the population, grazing and disease burden in the State. A list of policy, programme and regulations is described below.

### Policy/Plan/Programme

- Grassland Ecosystem and Grazing policy
- Grazing Policy
- Feed, Fodder, Animal Nutrition and Grazing Policy
- Forest (Conservation) Act, 1980
- The Wildlife (Protection) Act, 1972
- Himachal Pradesh Non-Biodegradable Garbage (Control) Act, 1995
- Guidelines for Implementation of Livestock Insurance Scheme
- Centrally Sponsored Schemes under District Rural Development Agency (DRDA)
- Centrally Sponsored Schemes in Sheep Development
- Centrally Sponsored Schemes in Poultry Sector
- Prevention and Control of Infectious and Contagious Diseases In Animals Act, 2009
- The Himachal Pradesh Livestock Improvement Act, 1968
- Assistance to State for Control of Animal Diseases (ASCAD)
- Transport of Animals Rules, 1978
- Livestock Importation Act, 1898
- Livestock Importation Act, 2001

- Prevention and Control of Infectious and Contagious Diseases In Animals Act, 2009
- The Himachal Pradesh Livestock Improvement Act, 1968
- Assistance to State for Control of Animal Diseases (ASCAD)
- Transport of Animals Rules, 1978
- State level animal awareness programmes.
- Mukhyamantri Arogya Pashudhan Yojana
- Programmes for Fodder development through People's Participation in grazing land and livestock management
- Pet food Order 2008
- Municipal Solid Wastes (Management and Handling) Rules, 2000
- Renewable Energy (RE) programmes
- National Biogas and Manure Management Programme (NBMMP)
- The Prevention of Cruelty to Animals Act, 1960
- Livestock Importation Act, 2001
- Animals (Registration) Rules, 2000
- Meat production (chicken)
- Municipal Act

### References

- State of Environment Report, 2006, H.P.
- State Development Report, H.P.
- State Five Year Plan, 2007-12, H.P.
- Mid Term Review, H.P.
- Statistical Outline, 2005-06, H.P.
- Environment Assessment Sourcebook, 1996
- State Water Policy, 2005
- State of Environment Report, released in October 2009
- Annual Plan 2009-10, H.P.
- Census data book for the year 1992, 1998 and 2003, H.P.





**PREPARED BY**

**IRG SYSTEMS SOUTH ASIA PVT. LTD.**

**FOR**

**DEPARTMENT OF ENVIRONMENT, SCIENCE & TECHNOLOGY (DEST)**

**NARAYAN VILLA, SHIMLA, HIMACHAL PRADESH, INDIA - 171002**

**WEB SITE: [WWW.HIMACHAL.GOV.IN/ENVIRONMENT](http://WWW.HIMACHAL.GOV.IN/ENVIRONMENT) E-MAIL: [DBT-HP@NIC.IN](mailto:DBT-HP@NIC.IN)**

**TEL. : +91-177-2620559, +91-177-2627608 FAX.: +91-177-2627609**