

Fig. 1.35.

1	2	3	4	5
2	Pear-tree (<i>Pyrus communis</i> L.)	Garm nok, Amrud, Noshpoti zimistona, Sabznok, Surkhnok, Zardnok	Bere Ligel, Bere Bosk, Bere Jiffar, Williams, Dilafruz, Josephine Mehelskaya, Kure, Lastochka, Lubimitsa klappa, Lesnaya krasavitsa, Olivie de Serre	Shakhrinau household «1100 years of Samanids», SPE «Bogparvar»
3	Quince (<i>Gudonia oblonga</i> Mill)	–	Izobilnaya, Samarkandskaya krupnoplodnaya, Turush Bukharskaya	– // –
4	Apricot (<i>Armeniaca vulgaris</i> Lam.)	Akhrori, Babai krupnoplodniy, Kandak, Mirsanjali, Subkhoni Khurmoi, Serkhosil, Kadu khurmoi	Rukhi Javononi Surkh	Sogd branch after N.V.Michurin of SPE «Bogparvar»
5	Plum (<i>Prunus</i> Mill)	–	Anna Shpet, Vengerka ajanskaya, Vengerka italianskaya, Vengerka violet, Ekaterina Persikovaya	Shakhrinau household «1100 years of Samanids», SPE «Bogparvar»
6	Peach (<i>Persiaea vulgaris</i> Mill)	Guldor, Ravgani gov, Sumubli, Ravshan, Ozoda, Safedshaftolu	Alexander, Injirniy red, Comberland, Lola, Malinovi, Obilniy, Start, Farkhad, Champion, Elberta, N-I-C-(Nic-19)	settl. Tabachniy, test station, Dushanbe, SPE «Bogparvar»
7	Cherry <i>Cerasus juss</i>)	Khovaling melkokostnaya	Anadolskaya, Griot, Ostcheimskiy, Lubskaya-15, Podbelskaya, Shpanka black	Shakhrinau household «1100 years of Samanids», SPE «Bogparvar»
8	Sweet cherry (<i>Cerasus avium</i> L.)	Local pink-yellow	Bagration, Daibera black, Drogana yellow, Negriyanka	– // –
9	Lemon (<i>Citrus limon</i> Burm)	–	Villa Franka, Meyer, Grecheskiy, Dioskuria	Vakhsh test station of sub-tropical crops. SPE «Bogparvar»
10	Orange (<i>Citrus sinensis</i> Osb.)	–	Washington Navel, Sochinskiy, Gamlin, Messinskiy	– // –
11	Pomegranate (<i>Punica granatum</i>)	Desertniy, Bashkalinskiy, turush anor	Azerbaijan, Achik Dona, Kazake anor, Kzyl anor	– // –
12	Fig (<i>Ficus carica</i> L.)	Vakhshskiy	Green-iskiya, Dalmatskiy, Kadota	– // –
13	Date (<i>Zizyphus jujuba</i> Mill.)	Vakhsh, Gissarskiy late, Finik	Tf-yan-tsar	– // –
14	Persimmon (<i>Diospyros kaki</i> L.)	–	Gosho-Gaki, Zenji-Maru, Khiakume	– // –
15	Almond (<i>Amugdalus communis</i> L.)	–	Desertniy, Drake, Langedock, Nikitskiy late flowering, Nonparel, Yaltinskiy	– // –
16	Pistachio (<i>Pistacia vera</i> L.)	Albina, Orzu, Oktyabrskiy, Mount pearl	–	– // –
17	Walnut (<i>Juglans regia</i> L.)	Tajik-17, Tajik-25, Durmen-1, Grozdovidniy, Skoroplodniy, Gissarskiy, Faizabadskiy	–	Faizabad test gardening station, SPE «Bogparvar»

Fig. 1.35.

1	2	3	4	5
18	Grape (<i>Vitis vifera</i> R.)	Anzob, Gissar early, Zaris, Black raisin, white raisin, Nimrang, chilyaki white	Jonjal kara, raisin khishrau, early VIR, Sultani, Taifi pink, Industrial varieties: Rkaciteli, Saperavi, Terbash, Risling, Aligote, Muskat pink	Sugd branch after N.V.Michurin of SPE «Bogparvar» test station "Sumbuli"
19	Wild strawberry (<i>Fragaria</i> L.)	–	Sevara, Surprise, VIRa, Festival, Zenga-Zenga, Talisman, Urozhainiia, Vola, Aza, Everest Mount., Krymskaya remontant, Jam	Faizabad test gardening station, SPE «Bogparvar»
20	Sea-buckthorn (<i>Hippophae rhamnoides</i> L.)	Zeravshan, Garm, Ishkashym	Velikan, Zolotistaya, Obilnaya, Obskaya, Prevoskhodnaya, Chuiskaya, Novost Altaya	– // –
21	Currant (<i>Ribes</i> L.)	Meyer	Kirgiz, Byelorussian sweet, Golubka, Graneniya, Zagadka, Lakston, Nadezhda, Nina	– // –
22	Mulberry (<i>Morus alba</i> , <i>Morus Niegra</i>)	Safedtut, Balkhi, Sechi, Rakhshak, Bedona, Tuti rakhshak, Ravandi, Muzafari, Kambalatut, Siyokh tut, Karategini, Mavizi, Nazari	–	– // –
23	Onion (<i>Allium cepa</i> Regel.)	Dusti, Peshpazak, Leninabad kulcha	Spanish 313, Karatavskiy	SPE «Bogparvar» test station "Sumbuli" of Gissar region
24	Carrot (<i>Daucus carota</i>)	Mshaki surkh, Mirzoi surkh, Mirzoi zard, Tillorang	Nantskaia -4, Shantane	Sogd branch after N.V.Michurin of SPE «Bogparvar»
25	Cabbage (<i>Brassica</i> L.)	Dushanbe late	Number one, Gribovskaya 147, Slava, Bagirskaya, Apsheronkaya	Sogd branch after N.V.Michurin of SPE «Bogparvar»
26	Cucumbers (<i>Cucumis sativa</i>)	Benazir, Margelansky 812	Parad, Concurrent, Dekan	– // –
27	Tomato (<i>Lucopersicon esculentum</i>)	Faizabad red	Uzbekistan, Novochok, Titan, Volgograd 5/95, Novinka Pridnestrovskaya	– // –
28	Garlic (<i>Allium sativum</i> L.)	Dushanbe-2, Dungan native		– // –
29	Paprika (<i>Capsicum annuum</i> L.)	–	Podarok Moldovi	– // –
30	Aubergine (<i>Solanum melongena</i> L.)	–	Erevan-14	– // –
31	Melon (<i>Cucumis melo</i>)	Kokcha-14, Kokcha-58, Saryk-kaun, Parceldack, Bukhara-33, Obi-navot		Vakhsh test station of sub-tropical crops, SPE «Bogparvar»
32	Water-melon (<i>Citrullus aedulis</i>)	Vakhsh, Mozaichniy, native, Khait-kara	Astrakhan, Ogonyok, Yarilo	– // –
33	Pumpkin (<i>Cucurbita</i> sp.)	Leninabad perekhvatka, Palov-kadu	Spanish	Sogd branch after N.V.Michurin
34	Potato (<i>Solanum tuberosum</i> L.)	Zarina	Lorkh, Polyot, Naryshka, Cardinal	Jirgital point of SPE «Bogparvar»

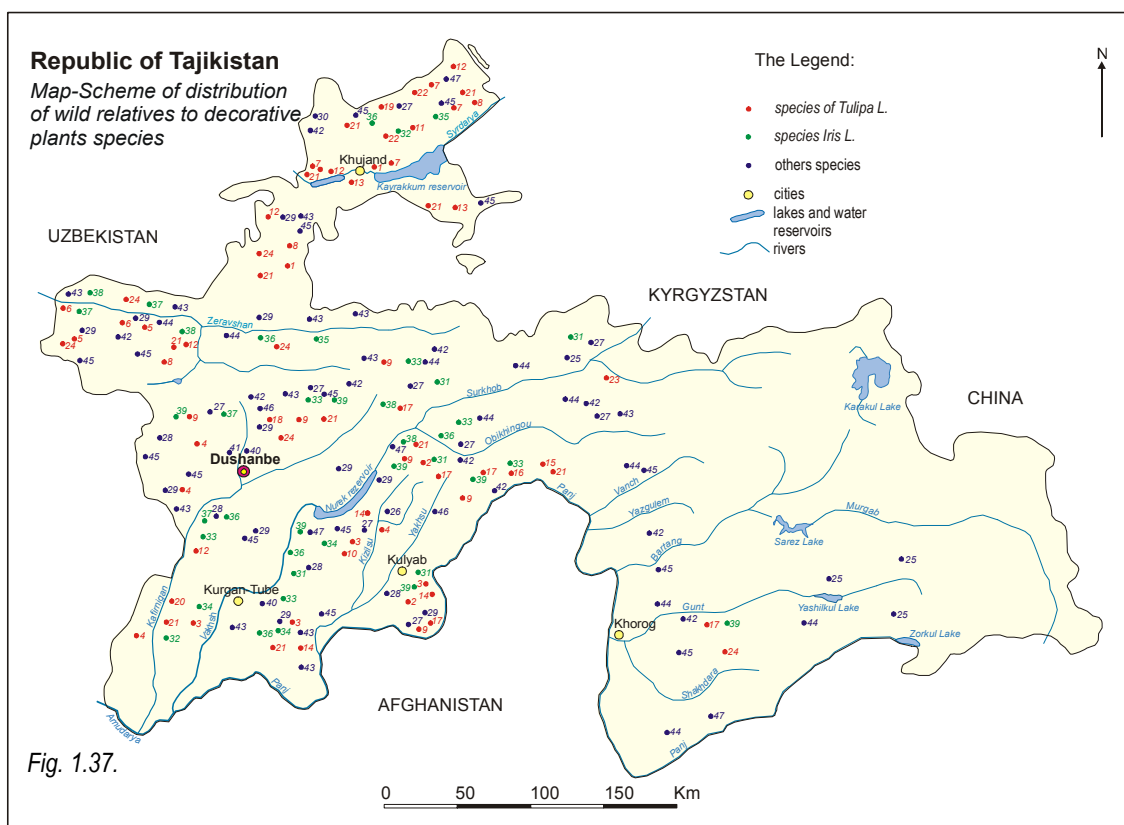
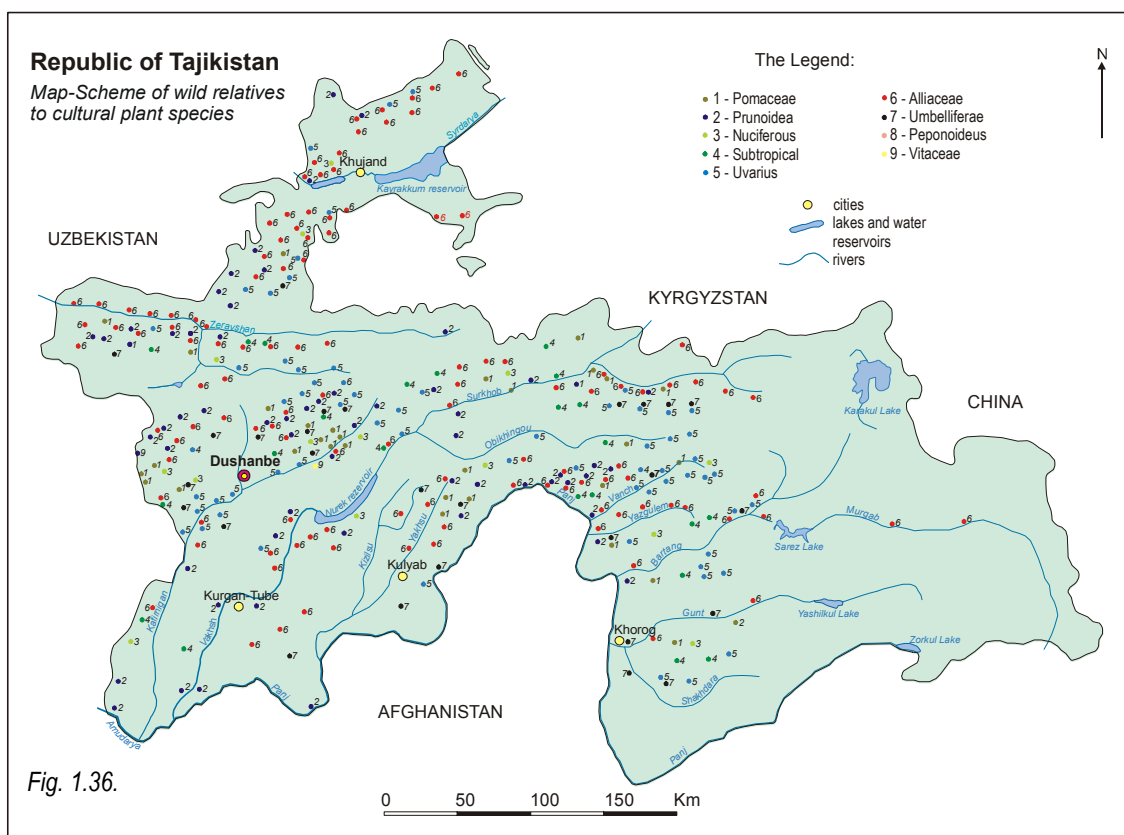


Fig. 1.37. Legend to «Map-scheme of Distribution of Wild Relatives of Decorative Plants»

No.	Latin Names
1	2
1	<i>Tulipa affinis</i> Z. Botsch.
2	<i>Tulipa subquinquefolia</i> Vved.
3	<i>Tulipa tubergeniana</i> Hoog
4	<i>Tulipa lanata</i> Regel
5	<i>Tulipa ingens</i> Hoog
6	<i>Tulipa fosteriana</i> Irving.
7	<i>Tulipa mogoltavica</i> M. Pop. et Vved.
8	<i>Tulipa micheliana</i> Hoog
9	<i>Tulipa praestans</i> Hoog
10	<i>Tulipa subpraestans</i> Vved.
11	<i>Tulipa lehmanniana</i> Merckl.
12	<i>Tulipa nitida</i> Hoog
13	<i>Tulipa rosea</i> Vved.
14	<i>Tulipa maximowiczii</i> Regel
15	<i>Tulipa linifolia</i> Regel
16	<i>Tulipa anisophylla</i> Vved.
17	<i>Tulipa korshinskyi</i> Vved.
18	<i>Tulipa hissarica</i> M.Pop. et Vved.
19	<i>Tulipa kaufmanniana</i> Regel
20	<i>Tulipa sogdiana</i> Bunge.
21	<i>Tulipa turkestanica</i> Rgl.
22	<i>Tulipa orithyioides</i> Vved.
23	<i>Tulipa bifloriformus</i> Vved.

Fig. 1.37.

1	2
24	<i>Tulipa dasystemon</i> Rgl.
25	<i>Aster serpentimontanus</i> Tamamsch.
26	<i>Narcissus tazetta</i> L.
27	<i>Paeonia intermedia</i> C.A. Mey.
28	<i>Gladiolus segetum</i> . Ker-gawl.
29	<i>Crocus korolkovii</i> Rgl.et Maw.
30	<i>Crocus alatavicus</i> Rgl.et Sem.
31	<i>Iris darvasica</i> Rgl.
32	<i>Iris falcifolia</i> Bunge
33	<i>Iris hoogiana</i> Dykes
34	<i>Iris lineata</i> Foster ex Rgl.
35	<i>Iris moorkroftiana</i> Wall. ex D.Don.
36	<i>Iris sogdiana</i> Bunge.
37	<i>Iris stolonifera</i> Maxim.
38	<i>Iris tianschanica</i> (Maxim) Vved. ex Woronow
39	<i>Iris korolkovii</i> Rgl.
40	<i>Matricaria aurea</i> (L.) Sch. Bip.
41	<i>Matricaria suaveolens</i> Buch.
42	<i>Dianthus seravschanicus</i> Schischk.
43	<i>Dianthus subscabridus</i> Lincz.
44	<i>Dianthus darvazicus</i> Lincz.
45	<i>Dianthus tetralapis</i> Nevski
46	<i>Dianthus baldshuanicus</i> Lincz.
47	<i>Dianthus pamiroalaicus</i> Lincz.

the Tajik Forestry Department, as living collections and germ plasma (collections of species, varieties, hybrids, lines, forms, breeds, types, etc.).

Many local and introductive collection forms of agricultural plants are grown mainly at test stations, temporary points, branch institutes, as well as in botanical gardens, in various nature-climatic zones of Tajikistan.

The genetic resources of domestic animals are conserved mainly at pedigree stock-breeding farms and local households. The pedigree material of germ plasma is deposited in the stations of the Tajik Ministry of Agriculture.

Medicinal plants are valuable genetic resource, 80 species being used in official medi-

cine; 150 species, used in popular medicine, are still potential for further study. Most of 13 forage species are wild relatives of cultivated plants, preserving the species genetic resources in natural conditions.

Traditionally, the private farming sector uses local varieties and forms of plants and animals. All of them, as a rule, are highly resistant to unfavourable, biotic and abiotic factors.

Use of biotechnologies and gene engineering is restricted to narrow spectrum of research carried out in recent 20 years. A number of plant varieties, highly adaptable to environment – potato, cotton, tobacco, and tomato – are bred. Some positive data are obtained as a result of work on cattle embryo transplantation.

The absence of systematic work on maintaining the quality of local breeds causes the loss of plant genetic resources. There is sharp decline of the cattle genetic resources.

There are no laws regulating the conservation of the wild plant and animal genetic resources, controlling the relationships in the field of biotechnology, genetic resource, and genetically modified organism management. No legislation has been issued on regulating the economic tools of managing plant and animal resources.

Being aware of the importance of genetic resources conservation, Tajikistan took a decision (No.19/1-4 of 1.01.2002) to join the Cartagena Protocol of the Convention on Biological Diversity. However, to provide biosafety while using GMO, and effective use of biotechnologies, the complex of urgent measures is to be taken:

- developing legislative and institutional base in this field;
- training specialists and creating a special body controlling the GMO management;
- developing special programs on informing the population of genetically modified organisms.

1.4.4. Use of Biological Resources

The natural communities of living organisms preserved in Tajikistan are the base for sustainable development of both mountainous and adjacent plain areas, where the human impact caused transformation of ecosystems, which are not able to maintain their sustainable development any more.



Tanacetum L.

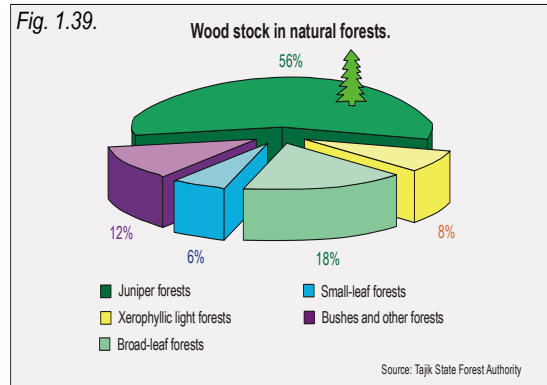
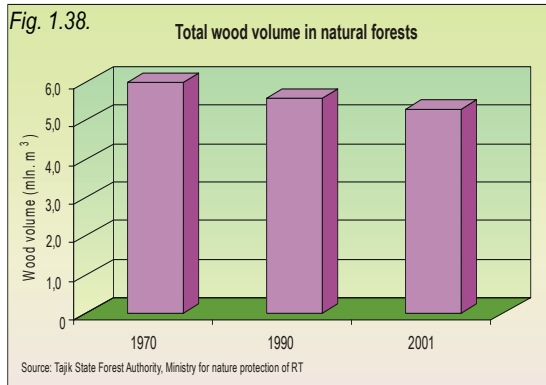
Biological resources of Tajikistan are widely used; they are the base of agricultural development, providing everyday needs of the population in the period of the socio-economic decline and the high level of poverty among the rural population, particularly in the mountain areas.

Over 100 species of food and vitamin-bearing plants, and about 60 essential species grow in Tajikistan. The group of tanniferous plants includes about 100 species, dye plants – over 80, melliferous – over 100. Oil-bearing, fibrous, and cellulose plants are represented by great specific diversity. About 30% of natural floras consist of forage plants.

The forest resources are used most actively. The forests of Tajikistan, as a whole, are marked with low productivity; the higher growth classes are only 10%. The State Forest Resources (SFR) of Tajikistan (according to the data available by 01.01.2001) are 1,941 thousand hectares. Total forested area is 3%, or 0.1 ha of the forest area per person. Over 120 th.

Table 1.32. Dynamics of Forest Resource Indications for the Period from 1970 to 2001

No.	Indications	Including (by years)			
		1970	1980	1990	2001
1.	Total SFR area (m. ha)	1.941	1.941	1.941	1.941
2.	Including area, managed by forestry institutions (FIC, RT) (m. ha)	1.820	1.820	1.820	1.820
3.	SFR lands, managed by FD, RT, assigned to collective and state farms for long-term use, as pastures (m. ha)	1.2	1.2	1.2	1.2
4.	Free SFR, managed by FD, RT (m. ha)	0.62	0.62	0.62	0.62
5.	Forested area in SFR lands (FD, RT) (ths ha), according to:				
	a. Aerocosmogeodesy	830	800	730	694
	b. State Statistic Agency and FD, RT	378	383	392.2	401



young plants were planted; forests were re-restored in the area of 4,660 ha. 72.6% of one-year-old forest plants take root (table 1.32, fig. 1.38-1.41). Nearly 6 th. ha of forested area are annually illegally cut over, with the total volume of timber 10-15 th. cub. m. Illegal forest cutting is observed almost everywhere.

The Tajik forests contain over 60 species of wild medicinal plants, included in major formations, used in pharmacology. Of these, 22 species are gathered by forestry companies. About 400 species of medicinal plants are widely used by the population.

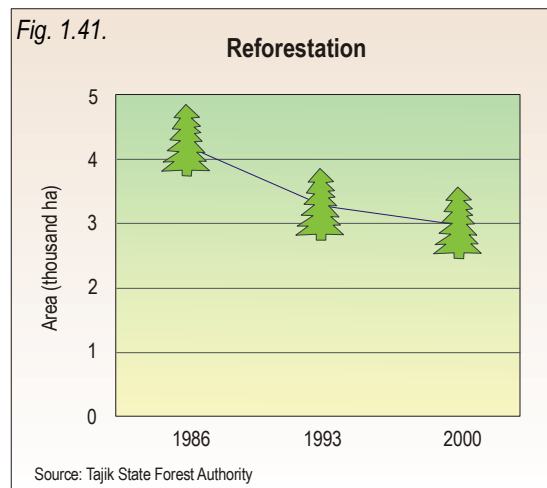
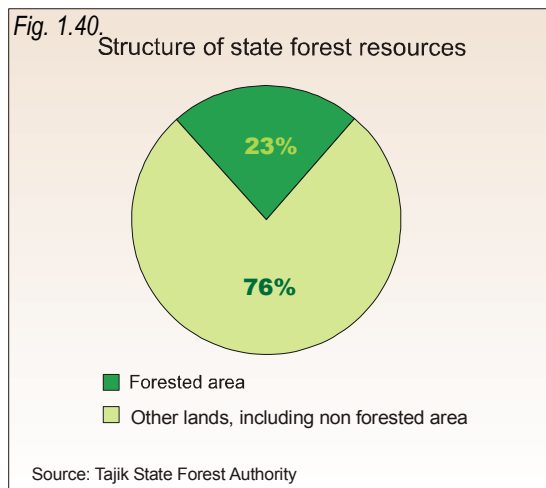
The annual resources of medicinal plants in the country are over 100 tonnes, 40 th. tonnes of them are accessible, and only 5 th. tonnes are gathered. The resources of gathered wild medicinal plants are not determined by species, which makes their planning and restoring for biodiversity conservation difficult. The uncontrolled gathering causes the reduction of medicinal and food plant diversity and range.

Plants are gathered mainly in forest, steppe, semisavanna, rarely in desert communities. The main medicinal plants are: nettle

(*Urtica*), coltsfoot (*Tussilago*), common horsetail (*Equisetum arvensis*), caraway (*Thymus seravshanicus*), *Ziziphora*, *Bunium*, St.-John's-wort (*Hypericum*), melissa (*Melissa*), wormwood (*Artemisia*), yarrow (*Achillea*), licorice (*Glycyrrhiza glabra*), inula (*Inula*), rhubarb (*Rheum*), sage (*Salvia*), plantain (*Plantago*), harmel (*Peganum harmala*), tansy (*Tanacetum pseudoachillea*), *Rhodiola*, ferule (*Ferula*), *Lagochilus*, and others.

The most valuable communities of the group are the formations of licorice (*Glycyrrhiza*), origanum (*Origanum*), sage (*Salvia*), *Lagochilus*, *Ziziphora*, *Bunium*, rhubarb (*Rheum*), inula (*Inula*), coltsfoot (*Tussilago*), *Ungernia*, *Rhodiola*, ferule (*Ferula*) – 5 species, onion (*Allium seravschanicum*, *Allium stipitatum*) – 3 species, angelica (*Angelica sp.div*).

A considerable number of the following wild food plants is used: *Allium Roseenbachianum*, *Allium stipitatum*, *Allium Suworowii*, *Rheum Maximovichii*, *Berberis heterobotrys*, *Berberis heteropoda*, *Berberis integerrima*, *Bunium persicum*, *Carum carvi*.



Wild nuts and other forest varieties are used as food species. Also seed, stone, and subtropical fruits, as well as dried fruits, are stored (table 1.33).

Wild relatives of fruits are used by the local population for breeding new fruit varieties (apple, pear, apricot, plum, etc.), nuts (walnut, almond), grape, berries (currants, sea buckthorn).

Main Species of Medicinal Plants Used in Popular and Official Medicine

No.	Latin Names
1.	<i>Hippophae rhamnoides</i>
2.	<i>Ephedra equistena</i> ,
3.	<i>Rosa nanothamnus</i> , <i>R.beggeriana</i> , <i>R.maracandica</i> , <i>R.huntica</i> , <i>R.fedschenkoana</i> , <i>R.achburensis</i> , <i>R.korshinskyana</i> , <i>R.canina</i> , <i>R.corymbifera</i>
4.	<i>Ungernia victoris</i>
5.	<i>Rhus coriaria</i>
6.	<i>Crataegus altaica</i> , <i>C.songorica</i>
7.	<i>Ribes meyeri</i> , <i>R.janczewskii</i>
8.	<i>Rhodiola gelida</i>
9.	<i>Plantago major</i> , <i>P.lanceolata</i>
10.	<i>Hypericum perforatum</i> , <i>H.elongatum</i> , <i>H.scabrum</i>
11.	<i>Tussilago farfara</i>
12.	<i>Melissa officinalis</i>
13.	<i>Ziziphora brevicalyx</i>
14.	<i>Inula helenium</i> , <i>I.britanica</i> , <i>I.macrophylla</i>
15.	<i>Glycyrrhiza glabra</i>
16.	<i>Origanum tyttanthum</i>
17.	<i>Salvia sclarea</i>
18.	<i>Peganum harmala</i>
19.	<i>Thermopsis dolichocarpa</i>
20.	<i>Polygonum aviculare</i>
21.	<i>Urtica diodica</i>
22.	<i>Achillea millefolium</i>
23.	<i>Artemisia vulgaris</i> , <i>A.mogoltavica</i>
24.	<i>Mentha asiatica</i>
25.	<i>Thymus serpyllum</i>
26.	<i>Ferula kuchistanica</i> , <i>F.sumbul</i> , <i>F.kirialovii</i> , <i>F.grigoriewii</i>
27.	<i>Capsella bursa-pastoris</i>
28.	<i>Equisetum arvensis</i>
29.	<i>Apium graveolens</i>



Cereals fields

Natural pastures, covering 3689.5 th. ha, are widely used. However, the uncontrolled overgrazing of domestic animals worsened their state greatly. Especially actively utilizing are the fall-winter-spring ephemeral-ephemeroid and wormwood pastures of southern and northern Tajikistan and summer steppe pastures of the Kuramin Range (table 1.34).

The most valuable forage and ecologically important grass and dwarf sub-shrub communities make 70% of the arable lands of the country. In plains and intermountainous valleys, desert and semidesert communities prevail. Foothills are occupied by low grass ephemeroid semisavannas. In mid and high mountains, high-grass subalpine and alpine low-grass meadows with steppes are located (fig. 1.42).

Table 1.33. Dynamics of Gathering Forest Products, 1991-2201 (tonnes)

Species	Year	
	1991	2001
Nuts, including:	112.4	45.7
Walnut (<i>Juglans regia</i>)	41	36
Pistachio (<i>Pistacia verae</i>)	63	0
Sweet almond (<i>Amygdalus bucharica</i>)	1.5	1.7
Bitter almond (<i>Amygdalus vavilovii</i>)	3.9	5
Anzur onion (<i>Allium rosenbachinum</i>)	28	20
Rhubarb (<i>Rheum maximovichii</i>)	322	60
Medicinal plants	470	6
Bunium persicum	0.2	0.1
Wild rose (<i>Rosa sp.div</i>)	18.4	15
Barberry (<i>Berberis sp.div</i>)	0.74	0.6
Sea buckthorn (<i>Hippophae rhamnoides</i>)	55.8	3
Honey	6.63	3.8

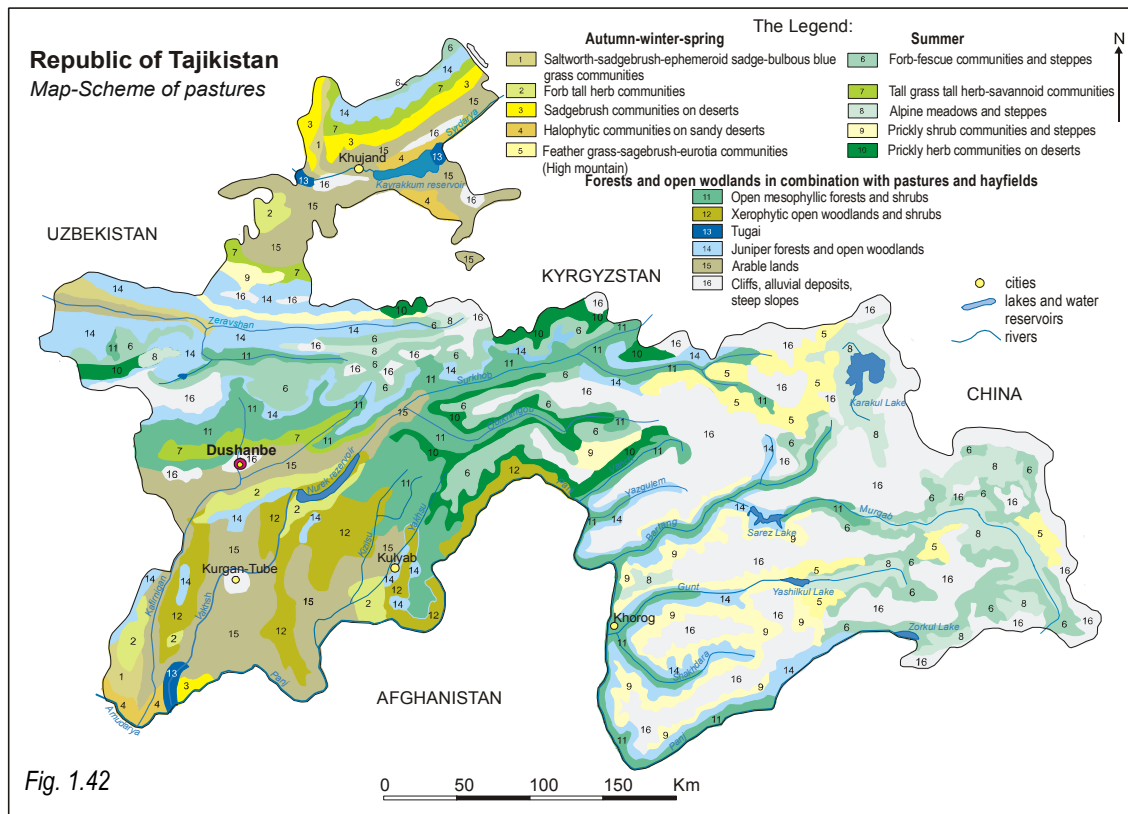


Fig. 1.42

The perennial grass formations of steppes with sub-shrub vegetation are common at 2800-3000 masl on the Turkestan, Zeravshan, Hissar, Darvaz, and Peter-the-Great ranges. The major species of steppe vegetation are: meadow grass (*Poa*), feather grass (*Stipa*), fescue grass (*Festuca*), steppe timothy grass (*Phleum phleoides*), and others. The steppe forage yield (depending on grass composition) varies from 3.5 to 17.0 centners/ha of dry mass. The uncontrolled and unseasonable cattle grazing of domestic animals in recent years and numerous

erosion processes made the steppes low-productive wormwood lands of steppe type. The productive forbs-fescue steppes of the northern sides of the Zeravshan and Hissar ranges are replaced with tarragons. A premature cattle grazing promotes selection and conservation of weed, uneatable plants: *Cousinia sp. div.*, *Adonis turkestanicus*, *Rumex sp.*, *Acantholimon sp. div.*, and others.

The high-grass semisavannas are represented mainly by high ephemeroïd and umbelliferous plants – ferule and hay plant, compositae -

Table 1.34. Pasture area and forage resources

Name	Summer		Spring-fall		Winter		All-the-year-round		Total	
	Area, ths ha	Forage resources ths tonnes	Area, ths ha	Forage resources ths tonnes	Area, ths ha	Forage resources ths tonnes	Area, ths ha	Forage resources ths tonnes	Area, ths ha	Forage resources ths tonnes
Districts of Republican subordination	729.1	539	194.7	41	41.1	17	-	-	964.9	597
Sogd Region	415.6	212	162.2	58	146	26	-	-	723.8	296
Khatlon Region	255.3	146	68.1	29	851.6	297	104.04	35	1279.1	507
Gorno-Badakhshan Autonomous Region	443.6	189	-	-	278.1	33	-	-	721.7	222
Total in the Republic	1843.6	1086	425.0	128	1316.8	373	104.04	35	3689.5	1622

Table 1.35. State Forestry-hunting Enterprises of the Forestry Department, Republic of Tajikistan

Name	Area, ths ha	Main species of game animals and birds
"Karatag"	24.0	Wild boar (<i>Sus scrofa</i>), partridge (<i>Alectorius keklik</i>), badger (<i>Meles meles</i>), Siberian ibex (<i>Capra sibirica</i>), hare-tolai (<i>Lepus tolai</i>), Red marmot (<i>Marmota caudata</i>), etc.
"Kofarnihon"	25.5	
"Tavil-Dara"	96.0	
"Rasht"	18.0	
"Jirgatal"	97.0	
"Shakhristan"	57.0	

inula, which are common in the Hissar, Darvaz, western Peter the Great ranges, and the Vakhsh Valley. The productivity of green mass is high, dried and standing plants are used even in the winter period. Overgrazing influences the plant composition of the pastures, increasing the role of umbelliferous plants.

The waste lands are represented by perennial low grasses and dwarf sub-shrubs, resistant to low temperatures. They are located in high-mountain areas of Tajikistan, many of them are in the Western and Eastern Pamirs. These lands are used as short-term summer pastures. The dominating species of the waste lands are:

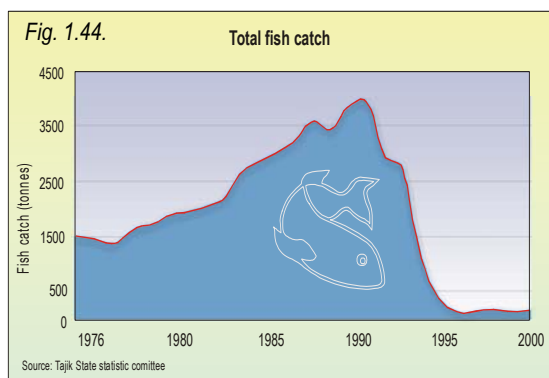
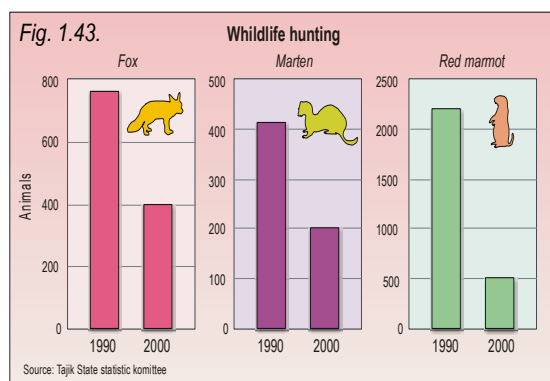


Table 1.36. Limit of Game Shooting Wild Animals and Birds for the Period of 1990-2001 (individuals)

Name	1991	2001
Wild boar (<i>Sus scrofa</i>)	265	257
Badger (<i>Meles meles</i>)	27	259
Hare-tolai (<i>Lepus tolai</i>)	345	977
Partridge (<i>Alectoris graeca</i>)	3490	14546
Pigeon (<i>Columbia columbia</i>)	5000	2895
Water fowls	1350	1492
Ibex (<i>Capra sibirica</i>)	18	48

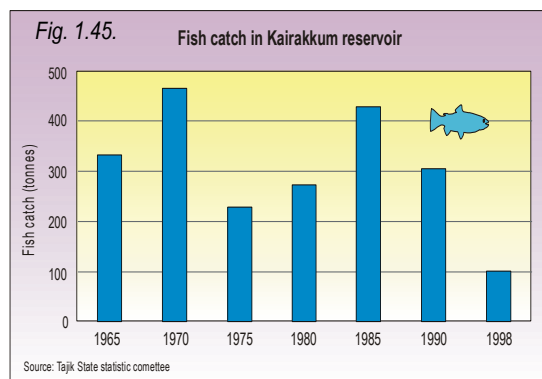
alkali grass (*Agrostis*), *Oxitropis*, Hissar pepper plant (*Polygonum hissaricum*), fescue grass (*Festuca*), *Cobresia*, and others. The yield of dried eatable mass of various formations varies from 2 to 12 centners/ha.

Great negative impact on the animal world has been caused by trade and individual international hunting. It is carried out at 6 state forestry-hunting enterprises (table 1.35, fig. 1.43).

Annually, game shooting limit (from 5 to 20% of total number of animals) is allowed in the areas of hunting enterprises, after the data on animal numbers are summarized. The game shooting is limited for species declining in numbers (table 1.36).

In recent 10 years, due to insufficient hunting equipment and lack of technical means, only half of the limits, established for game shooting wild animals and birds, have been used. The poaching has been increased considerably.

The unrestrained fishing and the destruction of fish habitats promote the decline of fish specific diversity. A drop of fishing productivity (poaching being the reason, among others) is also observed. Fish breeding in pond farms is considerably reduced (fig. 1.44, 1.45).



1.5. Prerequisites for Biodiversity Conservation

Flora, rich in specific diversity, composes the pastures and forest resources of the country. Fruits (nut, seed, stone), and berries are gathered in the forests of Tajikistan. In recent decades, the volume of forest food products has been reduced, due to the transformed land use structure.

The genetic resources, selection and practical management of agriculture, are based on the wild fruit plants of Tajikistan, particularly in mountain areas. The fruit resources include 1457 variety of specimens: apple (*Malus*), pear (*Pyrus*), cherry (*Cerasus*), plum (*Prunus*), etc. Since the ancient times, the local population selected and used wild fruits to cultivate varieties, using the broad polymorph properties. In this connection, the biodiversity management should be developed in combination with its conservation and sustainable development.

1.5.1. Legislative and Institutional Base

The biodiversity conservation and sustainable management in Tajikistan are included in the Constitution and secured by the legislation. The Law on Nature Protection of Tajikistan promotes the formation and improvement of environmental legislation, as well as the biodiversity conservation, for the sake of the present and future generations.

The system of environmental legislation of Tajikistan, directly related to biodiversity, includes a number of laws and regulations, issued by executive bodies. They regulate the relationships within biodiversity management:

- establishing procedure of managing natural resources, including the vegetation and animal worlds;
- identifying rare and endangered animals and plants, which are forbidden to prey on;
- setting rules for non-commercial and commercial hunting and fishing;
- developing activities (hunting, fishing, gathering medicinal grass, etc.), required special permission (license);
- establishing protected areas with various conservation regimes;

- working out requirements concerning nature protection, which need to be observed while realizing economic and other activities;
- determining types of environmental law violation and crime, responsibility for crime commitment, and procedure of punishment.
- developing procedure of compensating damages caused by illegal use of nature, including the vegetation and animal world;

The environmental legislation is currently being transformed, restructured, and adapted to new economic relations and the country commitments to Conventions. But the adopted laws and regulations become outdated. Nowadays the laws on biodiversity conservation are active, but they need transformation.

Despite the approved Law on Nature Protected Areas, the legislative base ensuring the protected area status remains imperfect. With the biodiversity state worsening, new regulations on area protection and management, conservation and reproduction of rare and endangered species, need to be developed. A fundamental reconstruction of the environment protection system, adapted to everyday needs of the local population, is required.

In addition to the environmental legislation of Tajikistan, there are regulations (concerning agriculture, forestry, fishery and wa-

Main Environmental Laws:

- Administrative Code (1986);
- Law on Nature Protection (1994);
- Law on Animal World Conservation and Management (1994);
- Law on Mineral Resources (1994);
- Law on Air Protection (1996);
- Law on Protected Areas (1996);
- Land Code (1996);
- Forest Code (1996);
- Law on Public Health Protection (1997);
- Criminal Code (1998)
- Water Code (2000);
- Law on Plant Quarantine (2001);
- Law on Production and Consumption Waste (2002).

ter resources use, etc.), which influence the biological resources, e.g.:

- The forest laws regulate forest protection and prohibit commercial forest cutting, aimed at timbering. This promotes conservation of flora and fauna habitats, particularly in mountain forests;
- The land laws regulate land management and provides conservation and sustainable use of land, soil fertility reproduction, environment protection and improvement;
- The water laws commit water-consumers to sustainable management of water resources and avoidance of watercourse contamination;
- The laws on local authorities empower the local administration to control compliance of the Law on Nature Protection and Natural Resource Management, commit it to develop and implement programs on improving environment.

Main Regulations:

- The Red Data Book of Tajikistan (1988);
- Regulation on the State Environmental Expertise (1994);
- Taxing Illegal Fishing or Killing Valuable Fish Species (1995);
- Taxing Violation of the Republican Law on Biodiversity Conservation (1996, 1997);
- Regulation on Hunting and Hunting Enterprises (1997);
- Regulation on the State Service of Plant Quarantine in Tajikistan (2002).

In recent years, Tajikistan has ratified a number of International Conventions on environmental issues, including biodiversity.

The legislative base, available in the country, includes the main laws of environment protection; however, the tools of their realization are not developed. That is why, many law articles are ignored. The existing legislation is aimed mainly at environment protection and control of environment pollution. The destruction of species and ecosystems, having caused serious and irreversible results, has not got any appropriate legal assessment. There is no common law limiting further "development" of natural ecosystems, which are considered potential testing areas for economic activities (Romit Reserve).

The following reasons and difficulties are hampering an observation of the existing legislation:

- confusing content of some law articles;
- lack of proper coordination between existing laws;
- low effectiveness of economic regulating and controlling tools, due to the lack of laws for legislation observation;
- some regulations become outdated, not confirming with the socio-economic and political situation in the country.

The Institutional Base of biodiversity conservation consists of institutions and organizations working on studying and conserving biodiversity and its components. These are state bodies: Ministry for Nature Protection (MNP), National Biodiversity and Biosafety Center (NBBC), Forestry Productive Enterprise of the Republic of Tajikistan (FPE, RT), and institutes of the Academy of Science specialized in biology, botany, and zoology.

- Ministry for Nature Protection provides coordination and control of realizing the requirements of the Convention on Biological Diversity; develops and implements the state policy in nature conservation and natural resource management. The main units of the MNP are: specialized inspectorates of state control and research institutions.
- NBBC is in charge of coordination of activities on biodiversity conservation, realization of the Convention through National Biodiversity Strategy and Action Plan on Conservation and Sustainable Use.
- The Forestry Department is committed to conservation and sustainable management of forest resources, providing control of zapovedniks and zakazniks. The main units are: state-operated forestry enterprises, zapovednik and zakaznik administration.
- The Academy of Science, with relevant institutions (Institute of Botany, Botanical Garden, Pamir Botanical Institute, Institute of Zoology and Parasitology) carries out researches in botany, zoology, genetics, microbiology, etc.
- The Tajik Academy of Agricultural Sciences and the Ministry of Agriculture work on con-

servation and sustainable management of agricultural biodiversity; genetic resource preservation; breeding of new and improvement of existing varieties of agricultural plants.

- Local Khukumats provide executive tools of implementing the Convention in local communities; organize the process of environmental education.

In addition, a number of interested organizations are committed to biodiversity conservation.

Biodiversity conservation depends on the living conditions, well-being and educational level of the population. The current poverty level in Tajikistan is over 80% of the population. The unemployment, lack of means of subsistence, economic difficulties, and decline in the educational level in rural areas causes unrestrained use of natural resources. Particularly critical situation results from forest cuttings, primarily junipers, pistachios, etc. The local population uses considerable volume of timber as fuel and constructing material.

To successfully conserve biodiversity, an effective institutional base, monitoring system, and legislative base should be developed.

In addition to governmental and administrative bodies, there are over 40 various environmental non-governmental organizations (NGOs), working on environmental and public health issues in Tajikistan. Worsening of the environmental situation in the republic and the impact of negative factors on human health promoted active participation of NGOs in solving such problems as environmental education and propaganda, biodiversity conservation, ecological information, etc. However, all environmental NGOs are separate, their work being insufficiently active. Combining efforts of existing NGOs and founding new groups at the local level will produce positive effect on biodiversity conservation and environmental education of the population. This will involve the general public, primarily young people, in realization of tasks set.

Since 1995 in Tajikistan some international facilities implement their activity, the priority of which is supporting NGOs', as well as dealing with environment. Some NGO projects on biodiversity conservation have been funded.

International Relations. The policy of the Republic of Tajikistan in biodiversity conservation and sustainable management is aimed at providing priorities for ecological interests of the country, with scientifically grounded combined development of economic and environmental activities.

The main trends of environmental policy are the solving the following issues:

- Restructuring the legislative and institutional base;
- creating a base for providing environmental safety and poverty alleviation;
- organizing environmental monitoring;
- involving internal and external resources to solve primary environmental issues.

The main activity on maintaining biodiversity conservation and sustainable economic development is based on:

- joining the international agreements in biodiversity conservation;
- signing bilateral and multilateral agreements in biodiversity conservation at the regional and international levels;
- establishing long-term relations with regional and international environmental structures;
- developing and implementing regional and international projects and programs.

Conventions Ratified by Tajikistan:

- Vienna Convention for the Protection of Ozone Layer (1996);
- Montreal Protocol on Ozone layer depletion and the London Amendment (1997);
- Convention on Biological Diversity (1997);
- Convention to Combat Desertification (1997);
- UN Framework Convention on Climate Change (1998);
- Ramsar Convention on Wetlands (2000);
- Convention on Conservation of Migratory Species of Wild Animals (2000);
- Aarhus Convention on Access to Information, Public Participation in Decision-Making Processes, and Justice in Environmental Matters (2001);
- Stockholm Convention on Persistent Organic Pollutants (2002).

Tajikistan ratified the main international agreements and met its commitments on them. The international documents considerably supplement the national environmental legislation.

The regional cooperation is based on bilateral and multilateral agreements with neighboring Central Asian states. According to these agreements, boards, foundations, and working groups are established to coordinate work on implementing agreements on environment protection, including biodiversity conservation.

1.5.2. Requirements of Biodiversity Conservation Included in Industrial Policy

The main factor affecting the biodiversity of Tajikistan is the agriculture, forestry, energy, and transport development. The principle of favorable environment, nature components (ecosystems), fauna, and flora conservation is poorly considered by industrial norms, standards, and strategies for branch development.

Studying fauna and flora should be included in the development stages of projects concerning land allotment for any purpose.

Much attention should be paid to determining and analyzing damages, caused to biodiversity, and methods of their prevention and compensation.

The implementation of the Strategy and the Action Plan will promote the process of law development.

1.5.3. Biodiversity Research and Monitoring

The problems of research and biological monitoring have been repeatedly discussed at departmental, state, and other seminars, and included in many scientific and technical programs. However, lack of funds and a number of other factors prevent their implementation. There is no summary database on biodiversity, without which the results of research carried out cannot be controlled and analyzed.

Most of researches on biodiversity *in-situ* and *ex-situ* have been carried out within scientific and technical programs of different industries. Many of these researches are carried out by scientists of the Academy of Science, RT, and Tajik Academy of Agricultural Sciences.

The country fauna and flora has been investigated for one and a half century. The scientific expeditions of A.E.Regel (1877-1884), A.G.Grumb-Grzhimailo (1884-1889), A.N.Krasnov (1886), and V.I.Lipsky (1903-1909) were the base of the mountain vegetation investigation. The research on zoology were carried out by: B.S.Vinogradov, E.N.Pavlovsky, K.K.Flerov (1935), V.A.Nikolsky (1938), E.N.Pavlovsky (1946), V.I.Chernyshov (1958), S.I.Chernov (1959), M.N.Narzikulov (1962), G.N.Sapozhnikov (1967), V.A.Maksupov (1968), A.I.Ivanov (1949, 1969), G.S.Davydov (1964, 1974, 1988), I.A.Abdusalyamov (1971, 1973, 1977), V.A.Stalmakova (1975), S.A.Saidaliev (1979), Sh.A.Umarov, N.I.Muminov (1983), T.K.Khabipov (1992), A.I.Sokov (1993), and A.Gafurov (1997, 2002).

Main Publications on Biodiversity

- Flora of the Tajik SSR, 1-10 volumes, 1957-1991;
- Insect Fauna and Zoogeography of Central Asia, 1966;
- Atlas of the Tajik SSR, 1968;
- The Florogenetic analysis of Natural Flora from Mountainous Central Asia, 1973;
- Forest Resources of Pamiro-Alai, 1976;
- Pastures and Grasslands of Tajikistan, 1977;
- Fauna of Tajikistan. 12 volumes, 1980-1990;
- Entomological Review of Tajikistan, 1981;
- Nature and Natural Resources of Tajikistan, 1983;
- Zoological Science of Tajikistan for 60 years, 1985;
- Cartographic Materials, 1985-1995;
- Plants for Decorative Gardening in Tajikistan, 1986;
- The Red Data Book of the Tajik SSR, 1988;
- The National Report of the Ministry of Environment Protection, 1993;
- Flora of Tajikistan, 2001.

The issues of botanical and geographical investigations of Tajikistan were discussed by: Korzhinsky (1896), V.L.Komarov (1896), B.A. Fedchenko (1925, 1936), M.G.Popov (1927, 1958), R.I.Abolin (1929), A.Yudin (1932), E.P. Korovin (1934), P.N.Ovchinnikov, P.F. Goncharov, K.S.Afanasiev (1934), N.F. Goncharov, P.N.Ovchinnikov (1935), N.F. Goncharov (1936, 1937), I.S.Shchukin (1936, 1956), S.A.Nevsky (1937), E.P.Korovin and A.N. Rozanov (1938), A.I.Tolmachev (1944), K.V. Stanyukovich (1949, 1955, 1973), G.T. Sidorenko (1953, 1961), P.N.Ovchinnikov (1957, 1970, 1971), V.M.Chetirkin (1960), O.E. Agakhanyants (1965, 1966), A.N.Babushkin and N.I.Kogai (1967), M.I.Ismailov (1971, 1974), P. N.Ovchinnikov, G.T.Sidorenko, N.G.Kaletkin (1973), M.N. Nazarov (1974), R.V.Kamelin (1973, 1979), S.S.Ikonnikov (1963, 1979), V.I. Zapregaeva (1976), N.M.Safarov (1979, 1985, 1997, 2001, 2002), A.A.Madaminov, R.B.Kigo (1989), Kh. Khisoriev (1999, 2002), etc.

Comprehensive knowledge of animal and plant species is based on the results of expeditions and analysis of collections. A rich herbarium is collected; maps are drawn up. Scientific publications appeared. The main results of the country biota investigation are published.

The institutions of the Academy of Science are the major flora, fauna, and microorganism research centers of the country, as well as centers of scientific societies of botany, zoology, ecology, microbiology, genetics, hydrology, etc. The general results of the research are published in the Academy periodicals or as separate books. The Forest Research Institute (FD, RT) studies forest issues. The forest investigations improve methods of determining and evaluating forest types; technologies for treating all forest types are developed.

The flora and fauna research is carried out at species, community and ecosystem levels. The inter-institutional scientific and technical programs focus mainly on:

- Inventorying and evaluating flora and fauna and their communities;
- Developing scientific base and recommendations for conserving flora and fauna genetic resources;
- Regulating man-caused load on environment;

- Evaluating some natural resources from economic point of view and developing recommendations on their management.

Under the new socioeconomic conditions, insufficient funding and lack of a material base cause a reduction of researches, both in volume and number of trends.

Most of the research institutions lack funds that result in reducing the volume of work. They are not able to properly study all biodiversity components. The research institutes, laboratories, and working groups are being rapidly dissolved. The national collections of plants, animals, and microorganisms are being destructed. There are no programs concerning all-round research of biodiversity. Urgent measures are required to stop the process of degradation threatening the biological diversity of the country.

The biodiversity monitoring is quite limited, being included in rare thematic researches, which do not represent common research system. The most favorable situation is in the forestry system, where monitoring is implemented by systematically estimating the forest resources, controlling the mountain forest state in protected nature areas. However, this does not meet the requirements of all-round and effective monitoring.

No methodology or scientific substantiation of monitoring exists in the country. There is no monitoring system for biological components in the country. Many institutions carry out specific estimation of environment and biodiversity components, e.g. scarce observations of particular plant and animal species areas and numbers. Many authors periodically estimate the numbers of reptiles, snow leopard, wild ram, argali, and nesting birds; these estimations are contradicting and ignoring each other. The numbers of game animals and birds are estimated within restricted areas of hunting enterprises. Some rare and endangered animal species, listed in the Red Data Book of Tajikistan, are inventoried.

The work on biodiversity monitoring, implemented earlier in zapovedniks and zakazniks, is now reduced; no research is being carried out; no Nature Chronicles are being written, due to lack of funds and local trained staff. Funding the Academy institutes, observation stations,

and laboratories was quite limited in the last decade; just scarce investigations are being realized.

To create a monitoring system in Tajikistan, the existing network of protected areas, as well as specially selected representative landscapes, could be used. Laws and regulations of environment and biodiversity monitoring should be developed.

1.5.4. Informational Exchange. Environmental Education and Training

The research institutions have rich collections of scientific, specialized, and research materials. However, the latter have not been used in recent years, neither for informational exchange. New subject-matter issues are of poor quality and rarely used. Particularly insufficient is the present popular scientific literature promoting public awareness of biological and landscape diversity conservation, creation of informational databases, access to and exchange of information, as well as coordination of activities in this field.

There is no proper system of inter-institutional exchange of information on biodiversity conservation; rare activities in different branches are not interconnected or included in a common system.

The existing educational and training system does not provide sufficient trained specialists. Staff deficiency is observed almost in all branches of natural sciences, forestry, environment protection, etc.

The initial environmental knowledge is taught at schools, gymnasia, lyceums, and colleges. The general environmental training is carried out at all educational institutions, including universities. In last 2 years, new departments and faculties on ecology and environment protection were established at universities. The Tajik State National University trains specialists in ecology, biology, chemistry, and geology. The Tajik State Pedagogical University trains teachers of geography, ecology, chemistry, and biology. The Tajik Technological University has the department of life security, which focuses on developing regulations of impact on environment. The universities of Khudjand, Kulyab, and

Khorog have departments, focusing on issues of environment protection and biodiversity conservation.

NGOs organize seminars and lectures to popularize knowledge of biodiversity conservation. The Ministry for Nature Protection of Tajikistan organizes press-conferences, meetings, round tables, etc., within the program on environmental education. However, there are no permanently operating centers of environmental education, no teaching material base and specialists, particularly analysts, in the educational system.

The teaching programs on environmental education, including biodiversity conservation, are included in many pre-university courses with a number of subjects: botany, zoology, general biology, geography, etc. Moreover, various seminars and lectures on biodiversity are organized.

New curricula are developed at high and secondary schools for training specialists in ecology and environment protection. However, lack of the material and technical base of educational institutions, new teaching methods, and informational network produces negative impact on the teaching quality.

Despite the program of environmental education being adopted in the republic, the population still remains unaware of the importance of environment protection. The knowledge of flora and fauna of their country (particularly species, which need protection) is insufficient. The TV and radio environmental programs are very rare, low-effective, too formal. There are few deep analytical materials, aimed at forming public opinion and environmental thinking.

There is no system of improving professional skills, no special courses on biodiversity, no inter-institutional plans on organizing courses of biodiversity conservation and sustainable management. All these factors reduce the environmental education network at all levels. The degree of involving the community, particularly the rural population, in environmental actions is ineffective.

A number of international conventions being signed, the access of the public to environmental information is still restricted, due to the weak participation of the population in decision-making in the field of environmental protection.

1.5.5. Local Potential Use

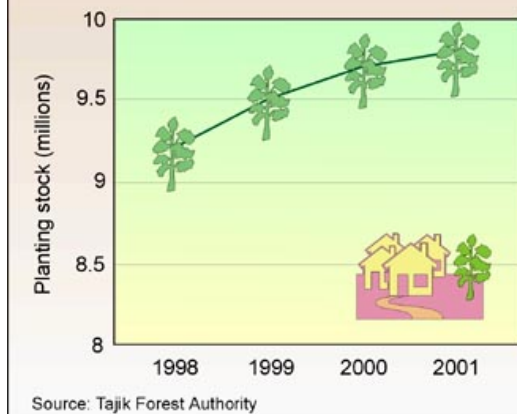
One of the effective tools of biodiversity conservation is increasing the role of the local potential through interacting with Khukumats, communities, various NGOs. All the existing institutional, human, and financial resources should be used at the district and regional levels.

The local policy of biodiversity conservation includes work on providing favorable environment for living nature through observing the ecological norms and standards in economic activity, reducing waste products and water pollution, introducing secure technologies, controlling imported chemicals, developing public initiatives (subbotniks, planting of trees), etc. Environmental education, propaganda of environmental safety, and access of the population to environmental information are very important at the present time.

All this is primarily the task of local environmental committees and local authorities. The effectiveness of its implementation is connected with improving the economic control tools.

Considering the many-year experience of people's traditions, the government of Tajikistan focuses on conserving folk trades and technologies. Most of these are based on nature (particularly plant resources) use.

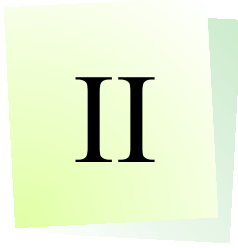
Fig. 1.46. Planting of trees in settlements



The national traditions in cookery, catering, food industry, based on using great number of plants, animals, and fish, remain the priority, supported by both the state system and businessmen.

Considering the need of sustainable management of flora, as well as national traditions, the President E.Sh.Rakhmonov called the people to take part in annual planting actions all over the country (fig. 1.46).

Realizing specific programs on: improving protected areas; expanding forest-shelter belts; planting trees; conserving and restoring mountain forests and coastal zones, will promote the drop in anthropogenic impact on environment. This is important task of environmental bodies, local authorities and the society.



NATIONAL STRATEGY

2.1. Strategy Priority

The biodiversity conservation strategy for rural countries provides sustainable development and guarantees the economic and social sustainability of the community and nature.

The guiding principles of the development and implementation of National Biodiversity Strategy and Action Plan (NBSAP) are adapted to the approaches of many Asian and European countries to the strategy development and follow the principles of the Convention on Biodiversity. The approval of these principles shows a NBSAP connection with other similar strategies

National Principles of Development and Implementation of National Biodiversity Strategy and Action Plan:

- Decisions are based on research, experience, and information; economic and social problems are considered.
- The availability of particular technologies provides environment protection and sustainable management.
- The public should actively participate and various groups should be involved in actions on biodiversity conservation; work on the public informing campaign should be improved.
- Programs executors should coordinate their work within and between the projects.
- The process of program realization should be "transparent", with easily accessible information, including financial information.
- Work should be effective, including the cost.
- Work should be integrated and continuous.
- Appropriate technologies and methods should be applied.
- Areas and state of natural ecosystems should be preserved and restored.
- Endemic species should be considered a priority.
- Where possible, work should be based on in-

and proves the approaches of Tajikistan are conformable with those of other countries.

The interrelation between NBSAP and the Convention provides the identity of strategies of different countries and is a scheme of biodiversity conservation, coordinated on the international scale.

2.2. Strategy Goals

The main goal of the strategy is to preserve and manage the biodiversity and to conserve ecosystems, thus providing the sustainable economic and social development of Tajikistan.

The components of the Biodiversity Conservation Strategy are:

- a. complex economic and social evaluation of national biological resources;
- b. regeneration and conservation of the genetic pool of plants and animals;
- c. biodiversity conservation *in-situ* and *ex-situ*;
- d. providing biological safety of the country;
- e. sustainable use of biological resources to reduce poverty and to improve quality of human life.

2.3. Strategy Objectives

The Strategy objectives are to take consecutive and purposeful actions according to the terms and volume of funding. Special attention is given to the legislative and institutional capacities.

The main objectives of National Strategy are:

- Develop the economic mechanism, promoting a conservation and sustainable management of the biological and landscape diversity.

- Seek for funds inside and outside the country to provide the biodiversity conservation and its sustainable management.
- Provide sustainable development and management of the country biodiversity at the level of ecosystems, species, intraspecific forms, and useful inherited forms.
- Determine the needs of the country in the biodiversity use, basing on governmental priorities, with specific conditions of the country being considered.
- Define technologies and methods of the biodiversity management and alternatives of its conservation on the part of governmental bodies, institutions, and organizations.
- Determine and improve the role of the public in biodiversity conservation.
- Make a contribution to implementation of the program on the poverty alleviation by 2005.

The approval of strategy for the nearest 5 years will create objective basis to meet the commitments of the Convention on Biodiversity.

2.4. Methods of Strategy Development

According to the requirements of the Convention on Biodiversity, Article 6, the key elements of Strategy development are:

- determine the biodiversity components;
- collect and evaluate data for monitoring;
- determine process and activities having affect on biodiversity;
- evaluate possible economic consequences on the biodiversity sustainable management;
- determine the value of biological resources;
- evaluate primary measures on biodiversity conservation and sustainable management.

Strategy Components and the Convention on Biodiversity

The components, included in the Strategy of Biodiversity, are developed in the process of discussions at seminars. They are conformable with the articles (7-19) of the Convention on Biodiversity.

- *Article 7.* Identification and monitoring
- *Article 8.* Conservation *in-situ*
- *Article 9.* Conservation *ex-situ*
- *Article 10.* Sustainable management of biodiversity components
- *Article 11.* Providing incentives
- *Article 12.* Research and training
- *Article 13.* Public opinion and awareness
- *Article 14.* Assessing ecological impact and minimizing negative effects
- *Article 15.* Access to genetic resources
- *Article 16.* Access to and exchange of technologies
- *Article 17.* Exchange of information
- *Article 18.* Technical and scientific cooperation
- *Article 19.* Biotechnology; distributing its benefits

The research process, including the creation of information database and collection of initial information on the biodiversity and its state, was the base for planning biodiversity conservation that will ensure the implementation of the Convention components at the national level.

The planning process considered the need of both inventory and monitoring of biological resources and economic benefits resulting from the undertaken measures on biodiversity conservation. This will help to develop practical mechanisms for evaluating economic losses and benefits, related to biodiversity.

Table 2.1. Strategy objects and their internal diversity

Approaches	Object	Object internal diversity
Population and Species	Organism	Diversity of genes, cells, tissue, and organs
	Population	Diversity of individuals within a population, including genetic diversity. Diversity of elements of an intrapopulation structure
	Species	Diversity of populations, intraspecific forms, and subspecies
Ecosystem	Community of organisms	Species diversity
	Ecosystem	Diversity of species, communities, and abiotic environment
	Ecosystem complex of the related territories	Diversity of ecosystems
	Biosphere	Global diversity of species. Global diversity of ecosystems

Priorities were based on the analysis of great volume of information. The database should be constantly renewed, because of dynamic state of the biodiversity.

The biodiversity analysis was based on the evaluation of the internal potential, with the assessment of legislative base, informational network, and organizational capacity being considered.

The informational base of Strategy was also the analysis of the human impact on biodiversity and the internal/external risk factors.

The country potential of the biotic wealth sustainable management has been considered while developing the Action Plan.

2.5. Main strategic trends of work on biodiversity conservation and sustainable management

Considering the natural and historic conditions of biodiversity development and the present state of biodiversity components within National Strategy, effective measures should be taken on the following priorities:

- establishing a joint center for biological diversity management within the framework of the general state policy;
- improving the scientific research base of biodiversity conservation and biosafety;
- improving management of available protected areas and establishing new areas, which will serve an environmental base for providing further sustainable use of biodiversity;
- biodiversity conservation *in situ* and *ex situ*;
- organizing a biological monitoring system and creating an electronic database and databank on biodiversity;
- restoring the structures and functions of degraded ecosystems;
- providing sustainable management of biological resources (pastures, forests, wildlife, etc.); reducing human negative impact on urban ecosystems and biodiversity;
- using indigenous traditional methods on biodiversity conservation and sustainable management;
- developing regulations and standards for biodiversity conservation and sustainable management, and economic measures on stimulating this work;

- improving a legislative base for implementing state policy on biodiversity;
- improving regional interaction and international cooperation on biodiversity issues;
- providing scientific information and developing a personnel training system;
- improving NGOs' work; involving the public in the biodiversity decision-making process; and providing environmental education of the population.

The above trends of National Strategy are the base for elaborating Action Plan on biodiversity conservation and sustainable management in Republic of Tajikistan.

2.6. Priorities of Biodiversity Conservation

1. General Biodiversity Issues:

- Improving the biodiversity conservation policy in order to reach sustainable management of biological resources.
- Improving the legislation base to provide the Biodiversity Convention implementation.
- Developing long-term programs of research and biological monitoring.
- Investigating and estimating the climate change impact on biodiversity.
- Organizing and implementing forest-restoration work in all forest types.
- Compiling and publishing the Red Data Book of Tajikistan (second edition).
- Publishing the Green Book of Tajikistan (rare plant communities).
- Developing and implementing a national program of juniper, floodplain, xerophytic forest, and light forest restoration.
- Developing and taking measures on conservation and sustainable management of biological resources in the Tien Shan and Pamir-Alai transboundary mountain systems.
- Developing and implementing branch and area plans of actions to preserve and restore ecosystems and landscapes.
- Developing national program on pasture restoration and sustainable management.
- Developing monitoring of forest resources and creating an informational system.
- Developing complex program of environmental education in the sphere of biodiversity.

- Providing financial, technical, methodological, and consulting support in developing and publishing educational and popular scientific manuals on biodiversity conservation.
- Providing an economic evaluation and running the list of biological resources, used in the national economy.
- Involving donor countries in biodiversity conservation of global value.
- Creating a database of flora, fauna, and microorganism biodiversity.
- Determining priorities in co-operation on biodiversity conservation (establishing transboundary nature reserves, migration corridors, green corridors, regional ecological networks, and shared environmental regions).
- Developing national criteria, indicators, and regulations under commitments of environmental Conventions.
- Preparing the text of Convention on Cultural and Natural Landscape Conservation in Central Asia.
- Initiating the development of the Central Asia Ecological Network.
- Ratifying the Cartagena Protocol on Biosafety.

2. Creation of the National Ecological Network:

- Developing a concept and methodological instructions on creating the ecological network.
- Drawing up an area map of the national ecological network (1:1000 000).
- Determining and mapping areas to be included in the national ecological network.

3. Biodiversity Conservation at the geosystem level:

- Developing a draft law of creating a national ecological network.



Mesophyllic forest ecosystems



Swamps

- Developing a draft law of natural monuments.
- Organizing new and transforming the existing protected areas into microzakazniks and mic-roreserves in the following areas: mountains of the Zeravshan River Basin, southern side of the Hissar Range, the Shirkent Barrier in the Karatag River Basin, Varzob, the Romit Gorge (based on the Romit Reserve), southern side of the Karategin Range, southern side of the Peter the Great Range in the Khingou River Basin, southern side of the Vakhsh Range in the Shurobdarya Basin (Dashti Maidon Valley), Obi Mazar, mountains of the Yakhsu River Basin, the South Tajikistan Province, the Western Pamirs Mountain System (province), the Eastern Pamirs.

4. Nival Glacier Ecosystem Conservation:

- Developing laws regulating tourism, international hunting, and damage compensation.

5. High-Mountain Desert Ecosystem Conservation:

- Establishing a National Park in the mountain desert ecosystem. Developing regulations and improving its institutional capacity.
- Developing programs on restoration of teresken plant communities in the Pamirs.

6. High-Mountain Meadow and Steppe Ecosystem Conservation:

- Improving the nature protection regime in habitats of rare and endangered animals and plants.
- Regulating pasture management in habitats of valuable steppe communities.

7. Mid-Mountain Conifer Forest Ecosystem Conservation:

- Developing new and improving the existing regulations concerning a conservation and

sustainable management of forest resources.

- Creating permanently operating forest nurseries of juniper seedlings on the area of 100 hectares (Sogd Province, Shakhristan Region).

8. Mesophyllic Forest Ecosystem Conservation:

- Developing a specialized program of walnut forest area restoration.
- Inventorying biodiversity of mesophyllic forests.

9. Mid-Mountain Xerophytic and Light Forest Ecosystems Conservation:

- Creating microzakazniks to conserve valuable communities of pomegranate, fig, jujube, and persimmon forests.
- Inventorying xerophytic light forests.

10. Low-Mountain Semisavanna (Savannoide) Ecosystem Conservation:

- Expanding the area of wild medicinal plants.
- Creating a bank of wild flora seeds.

11. Foothill Semidesert and Desert Ecosystem Conservation:

- Establishing microreserves and microzakazniks in habitats of rare and endemic animal and plant species.
- Restoring saxaul in the buffer zone of the Tigrovaya Balka Reserve.

12. Wetland Ecosystem Conservation:

- Developing and implementing a program of water area restoration.
- Developing a program on minimizing the chemical contamination of wetland ecosystems.



Vitis vinifera



Mid-mountain savannoide ecosystem

- Developing and introducing recommendations on stopping erosion processes in the watershed area of the Nurek Reservoir.
- Organizing a system of wetlands monitoring.

13. Agroecosystem Conservation:

- Creating a database of genetic resources of fruit and vegetable, berry and melon crops.
- Creating a germ plasma bank of collection animal varieties.
- Developing recommendations on creating shelter belts and wild animal migration corridors.
- Establishing zakazniks to restore the populations of cultivated plant wild relatives and to prevent their degradation.

14. Urban Ecosystem Biodiversity Conservation:

- Developing draft laws and regulations on plants in urban ecosystems.
- Improving the environmental requirements to conserve biodiversity in the process of urban development.
- Determining valuable urban and rural green zones to include these in protected areas.

15. Species Conservation in-situ:

- Developing and passing the law on genetic resource conservation.
- Developing and passing the law on vegetation.
- Developing principles of identifying categories of rare species and communities (according to IUCN) and selecting them to be included in the Red Data Book of Tajikistan (second edition).
- Inventorying rare and endangered species within protected areas (Tigrovaya Balka, Romit, Dashti-Jum, and Zorkul reserves).

- Organizing monitoring of endangered species.

16. Conservation of Biodiversity Outside

Natural Habitats (ex-situ):

- Developing draft law and regulations of genetically modified organisms.
- Developing a national program of biodiversity conservation *ex-situ*.
- Establishing a center for genetic resources.
- Carrying out inventory and monitoring of biodiversity *ex-situ*.

2.7. Strategy Components

Biodiversity Conservation Strategy includes a number of interconnected components (or approaches to conservation), which, being combined, will help to reach the main goal of the plan. These components were developed on the basis of principle of integrity with related activities, as the implementation of single strategic component will not be a success without implementing support of other activities within the rest components. The Strategy components are:

A. Biodiversity Conservation *in-situ*

This approach considers the importance of conservation within wild nature and emphasizes the importance of biotic community and ecosystem conservation within protected areas and outside.

Geosystem (GS) Level:

- GS₁** – maintaining a general ecological balance of landscapes by creating a national ecological network, providing sustainable management of natural areas, and regeneration of degraded areas; planning of engineering structures.
- GS₂** – restoring degraded landscapes, providing their life balance by reducing soil erosion processes, creating green shelter-belts, and improving the control of pollution, etc.;
- GS₃** – preventing degradation of protected areas by improving institutional resources, methods of management, and monitoring.
- GS₄** – restoring landscapes when constructing cities, settlements and engineering structures.
- GS₅** – restoring landscapes implementing mining-ore industry.

GS₆ – establishing protected areas in the water territories of hydro-power knots and power stations.

GS₇ – establishing special nature management regime in nival zones.

GS₈ – restraining activities in large mountain watercourses.

Ecosystem (ES) Level. This approach considers biodiversity as important resource, on which local communities are dependent. A sustainable management is a mechanism correlating consumers' needs and natural resources conservation. Also, it is a tool of conservation *in-situ* outside protected areas, connected with providing incentives and means of subsistence for the population.

ES₁ – preventing forests degradation by maintaining them in proper state, regenerating valuable natural forest communities, increasing forest restoration, afforesting landslide and eroded areas, maintaining the integrity of forest funds, and creating a forest framework;

ES₂ – improving the state of natural ecosystems by providing control under anthropogenic impact and regenerating wild flora;

ES₃ – regulating water ecosystems management and preventing changes of hydrological conditions, conserving habitats of flora and fauna valuable species;

ES₄ – preventing degradation of high-mountain ecosystems by regulating their management, minimizing anthropogenic impact, and restoring biodiversity;

ES₅ – preserving and improving savannoide ecosystems by controlling nature management, and minimizing anthropogenic impact;

ES₆ – balanced using of agricultural ecosystems through improving land use technologies and structures;

ES₇ – improving state of environment in urban ecosystems by preventing green areas degradation and regulating biodiversity life.

ES₈ – regulating and establishing a special order of cattle grazing in mountain-meadow and –steppe ecosystems.

ES₉ – fostering the nature protection regime in water areas of tugai ecosystems.

ES₁₀ – reconsidering structure and status of nature protected areas.

ES₁₁ – preventing decrease of semidesert-desert ecosystems.

Population and Species Level (SL):

SL₁ – conserving diversity of biological species by implementing particular programs on preserving endemic, relic, and endangered species;

SL₂ – preventing a drop in numbers of species and populations in natural biocoenoses, which are genetic centers of origin and diversity;

SL₃ – conserving flora and fauna habitats, preventing ecosystems destabilization on migration routes of animals and birds, and preserving biocoenosis;

SL₄ – protecting native species, including prevention of alien and invasive species distribution;

SL₅ – restoring the species diversity of forest communities, conserving forest species, increasing forest productivity by sustainable nature management;

SL₆ – conserving diversity of game species by strict regulation of licensed hunting, implementing biotechnical measures, providing scientific substantiation for shooting game species, restoring hunting and fishing resources by regulation of numbers and structures of populations.

SL₇ – organizing specialized test points on plants growing and animals breeding listed in Red Data Book of Tajikistan.

SL₈ – restraining of economic activities in the habitats of valuable plant and animal species.

Genetic Level (GL):

GL₁ – preventing reduction of intrapopulation genetic diversity of flora and fauna species in major natural ecosystems by taking measures on conserving their genetic centers of origin and diversity, and continuing research and monitoring of particular populations;

GL₂ – preventing degradation of the genetic pool of local and introduced taxa by maintaining their reproduction;

GL₃ – conserving biodiversity by supporting indigenous cultural traditions of the population.

GL₄ – preventing reduction of, and impact on wild relatives of fruit plants, being the genetic resource.

GL₅ – fostering protection of intraspecies diversity of valuable wild and forage plants.

B. Biodiversity Conservation ex-situ

Conservation outside the natural habitats of species is considered as a duplication of conservation in nature that provides protecting system of wide range of genetic resources aimed at their possible restoration in the former habitats:

ExS₁ – developing complex programs on studying and conserving biodiversity *ex-situ*, and coordinating work in this area by creating a genetic center and bank of genes;

ExS₂ – preventing a drop in numbers of taxa, cultivated *ex-situ* (plants, mushrooms, animals), by increasing the effectiveness of their conservation, improving and expanding activities of selection institutions, maintaining botanical and zoological collections, and creating relevant databases;

ExS₃ – preventing further degradation of international taxa, not typical for Tajikistan, by developing and using effective methods on *ex-situ* reproduction (botanical and zoological gardens, biotechnical centers, etc.);

ExS₄ – providing phytopathological and veterinary control for genetically modified organisms;

ExS₅ – developing an economic mechanism of biodiversity conservation *ex-situ*.

2.8. Principles of Biodiversity Conservation

Biodiversity conservation requires sustainable management of biological resources, policy of sustainable development pursued in the ecosystems management, and state protection of representative and unique natural areas. For this reason, the general and specific principles of biodiversity conservation, followed by most countries, have been adopted.

a) General principles:

- generations equality – the next generation has the same right to favorable environment,

landscapes, biological diversity, as the present generation;

- ecological equality – all people in the world have equal rights to a healthy environment and its natural resources;
- state obligations – biodiversity conservation and the economic prosperity of the country are the inherent obligations and concern of the state;
- public access to information and participation in the decision-making process – ensurance of the population active participation in the implementation of biodiversity conservation measures by means of adequate information.

b) Specific principles:

- principle of avoidance – every decision, which may have an impact on biodiversity should be accepted with maximum caution, taking into consideration all possible consequences;
- precautionary principle – in each action it is necessary to take into consideration the minimization of possible negative impacts, even though, the proofs are missing;
- principle of careful decision-making – all decisions, which have an impact on biodiversity, should have scientific motivations;
- principle of ecological compensation – any activities, method or material that could adversely affect biodiversity have to be replaced by less harmful ones;
- principle of translocation – any activities, which pose a threat to biodiversity have to be relocated to other sites less valuable from the biological point of view, in cases where there is no possibility to change or neutralize them;
- principle of ecological integrity – biological conservation should be based on the ecosystem approach, the analysis of habitats and relations between species;
- *in-situ* priority principle – in the protection of all species, *in-situ* measures should be absolutely dominant, and *ex-situ* protection considered only as a supplement thereto;



High-mountain meadows

- principle of regionalization – acceptance of full responsibility for biodiversity conservation in a region's territory, even when the biological objects occur in other countries; the same principle applies to separate regions of the country;
- polluter pays principle – physical and legal entities must compensate for the damage they cause to natural environment and biodiversity;
- principle of best available technology – ensurance and utilization of modern technologies with minimum negative impact on biodiversity.

2.9. Terms of Strategy Implementation

The Strategy components were classified according to period of implementation: short-term – less 5 years, mid-term – 10 years, long-term – more than 10 years (table 2, Annex). To implement many Strategy components at the geosystem level, at least 10 years are required. This Action Plan is to be implemented during a 10-year period. The terms of the Strategy components implementation at the ecosystem level are from 5 to 10 years, while those for the components, related to species conservation, genetic pool preservation and conservation *ex-situ* – 5 years.