



सत्यमेव जयते

Working Plan of Dibrugarh Forest Division For 2021-22 to 2031-32



**Environment and Forest Department
Government of Assam**



**THE WORKING PLAN
OF
DIBRUGARH FOREST DIVISION
(Eastern Assam Circle)
For the period from 2022-2023 to 2031-2032**

Volume-I



**Written by
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In association with Sri Ajay Deuri Bharali, IFS, SWPO

**Assam Forest Department
Government of Assam**

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Message from PCCF &HoFF

Forestry management in India as well as in Assam has passed through various phases. The National Forest Policy of 1988 has recognized the importance of managing our forests on silvicultural principles commensurate with the societal and environmental concerns. National Forest Policy emphasized that no forest shall be permitted to work without the approved management plan in a prescribed format. Working Plan is a tool for scientific forest management. It is very useful for evaluating the status of forest resource of a division, assessing the impact of past management practices and deciding about suitable management interventions for future. The practice of systematic management planning of the forests in India was established in the colonial period through a written statement of prescriptions titled as “Working Plan” for a fixed period, generally for 10 years in the post-independent period. The concept of "sustained yield" though a limited version of sustainability, finds mention in almost every Working Plan of the country. Periodical up-dating and revision of Working Plans is essential to keep pace with the trends emerging out of forest–people interface and to address other national and international obligations. The preparation of Working Plan is a highly technical and time-framed scheduled operation. The preparation of the Working Plan is based on stock maps which is prepared through ground surveys. Recently, the use of modern tools like remote sensing, GIS & GPS is being done for preparing the forest cover maps of divisions. Every Working Plan includes the area-specific scientific prescriptions for proper management of forests of a particular forest division.

Working Plan of Dibrugarh Forest Division has been written by Sri Yunush Salim, DCF. After several round of discussion in State Level Consultative Committee Meeting, the IRO, MoEFCC, Shillong has approved the Working Plan. It is encouraging that after a prolonged period the Division has got an approved Working Plan. I hope, the concerned authority including the DFO, Dibrugarh Division, making use of Strength and Opportunity of the Division will implement the prescriptions of the Plan and fulfil the objectives of the Plan.

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Message from CCF, REWP

To sustainably manage, conserve and utilize the forest resources and to bring uniformity in forest management planning across the country, Ministry of Environment and Forests, Government of India adopted a uniform code, the National Working Plan Code in 2014. There has been a paradigm shift in the objectives of management of forests and forest management has become more people centric and oriented to provide the goods and services from forests on sustained basis, with an emphasis on ecological services and harvest of usufructs as well. This apart, the focus has shifted to environmental stability, biodiversity monitoring and management, restoration of ecological balance of the disturbed areas, protective functions of the forest resources and other socio-economic benefits. The concept of sustainability in forest management thus implies not only sustainability of productive functions but also environmental functions (soil and water conservation, carbon sequestration etc.) and socio-economic benefits (meeting livelihood and basic needs) to forest dwellers and other forest dependent communities.

Involvement of forest fringe communities in the protection and management of forest resources through micro-plans and eco-development plans has become imperative and must find linkages to the working plan. Joint Forest Management is sharing of responsibilities, authority and usufructs between the village community or the forest user group and the forest department. Forest community rights related to use of community forest resources like minor forest produce, grazing grounds, water bodies, etc. recognized under the provisions of the Forest Rights Act 2006 or any other State Act/Rule can be exercised within the frame of sustainable management. The forests are also sources of water (surface, sub-surface and ground water). Over exploitation of the ground water resources results in declining ground water levels; there is an urgent need to augment the ground water resources through suitable management interventions. It is desirable to have forest management practices dovetailed with the principles of watershed based development approach especially in the source areas of water. Climate is an active factor in the physical environment of all living things. Forests are linked to climate change in three ways; i) they are source of greenhouse gas (GHG) emissions; ii) they offer mitigation opportunities to stabilize GHG concentrations; iii) they are impacted by climate change. Forests and wood products can effectively reduce the process of climate change in several ways. Growing trees absorb carbon dioxide from the atmosphere and store the carbon so efficiently that about half the dry weight of a tree is carbon. This carbon remains locked up in the form of wood and wood products. Trees outside forests (TOF) are located on the lands other than forests, including agricultural lands. They not only contribute nearly one fourth of the total growing stock of the country but also have become major source of wood in India. So there is a need to describe and comprehend the dynamics of trees and shrubs on rural and urban land, and their interaction with forest ecosystem. This will lead to a better understanding of off-forest tree management and towards integrated and sustainable management of forests as natural resources.

Incorporating all the above aspects, the Working Plan of Dibrugarh Division is prepared. It is the DFO to implement the prescriptions of the Working Plan and achieve the desired goal.

Smt. Sonali Ghosh, IFS
Chief Conservator of Forests
Research Education & Working Plans, Assam



PREFACE

Working Plan has been the main instrument for scientific management of forests. It is a very useful document for evaluating the status of forests and biodiversity resources of a forest division, assessing the impact of past management practices and deciding about suitable management interventions for future. All forests are to be sustainably managed under the prescriptions of a working plan/scheme. Forest Management Planning must provide for sustainable management of forests and its biodiversity as enshrined in the National Forest Policy, encompassing the ecological (environmental), economic (production) and social (including cultural) dimensions. The objectives for attaining this goal include conservation of forests and reducing forest degradation, maintenance and enhancement of ecosystem services including ecotourism, enhancement of forest productivity together with establishment of regeneration to improve forest health and vitality as per ecological and silvicultural requirements of the species, progressively increasing the growing stock and carbon sequestration potential, maintenance of biological diversity, sustainable yield of forest produce, prevention of soil erosion and stabilization of the terrain; improvement and regulation of hydrological regime.

Forests and wood products can effectively reduce the process of climate change in several ways. Growing trees absorb carbon dioxide from the atmosphere and store the carbon so efficiently that about half the dry weight of a tree is carbon. This carbon remains locked up in the form of wood and wood products. Enhanced carbon sequestration through recognised and innovative silvicultural practices, eco-restoration of degraded/mined out forestlands, improved biomass productivity, etc. will help in improving forest health and vitality. Forest soil must be kept healthy and fertile. The growth of forest crops must be kept vigorous to attain the most desirable level of biomass production within an optimal time scale.

REDD stands for reducing emissions from deforestation and forest degradation. REDD+ (Plus) includes forest conservation, sustainable management of forests and enhancement of carbon stocks, and has been adopted by the United Nations Framework Convention on Climate Change (UNFCCC) as a tool for climate change mitigation. Deforestation happens when forests are cleared and such land is put to other than forest land use. Forest degradation implies a gradual depletion of forests driven by demand for biomass and disturbances like fire and soil erosion, which, result in dwindling carbon density and ultimately leading to complete loss of forests. Implementation of REDD+, therefore requires efforts/mechanisms to measure forest carbon, interventions and payments to local people in addition to alternative activities such as fodder development to avoid lopping of tree branches, efficient cooking energy devices, etc.

Information on growing stock and its growth is necessary for efficient planning and management of forests. The forest inventory, survey and mapping provide this important input. Assessment of forests resources makes use of a combination of geomatics and field inventory data. For the first time in the country, inventory and mapping of the entire vegetation including herbs, shrubs, grasses and climbers along with trees, has been brought within the ambit of the forest resource assessment. This will also include inventory

of the non timber forest products (NTFPs) and medicinal and aromatic plants (MAPs) which will ultimately help to prepare the livelihood plans for the local communities in a more effective manner. Fragmented patches of forest need to be covered in the survey and assessment so as to provide focused management prescriptions for ensuring no discontinuous forest patch is left out from the purview of survey.

Geomatics (Remote sensing, GIS and GPS) has got a wide range of applications in forest management. One can find application of geomatics in almost every forest management practice e.g. forest cover mapping in different canopy density classes, change detection (degradation as well as improvement), forest fire detection, burnt area mapping, biodiversity mapping, afforestation planning, wildlife habitat suitability mapping, boundary demarcation, encroachment mapping and so on. For many of these applications, there are no practical alternatives to geomatics based methods.

A network of grid based permanent sample plots should be identified and established in different strata of the forests to provide necessary database for growth/increment. These permanent sample plots are necessary to assess the role of forests as source or sink for greenhouse gases on a long term basis and to study carbon sequestration and storage in trees both above and below ground biomass (stem and roots), deadwood, litter, soil and harvested wood products for different forest types of India with an emphasis on different management regimes. Establishment and maintenance of these plots be carried out by silvicultural wing for continuous collection of data.

Preparation of working plan is a highly technical exercise under taken at regular interval in each forest division. It is based on stock and vegetation maps which is prepared through ground surveys. Use of modern tools like remote sensing, GIS and GPS is utilized for preparing the forest cover maps of forest divisions. There has been a paradigm shift in the objectives of forest management it has become more people centric and oriented to provide the goods and services from forests on sustained basis, with an emphasis on ecological services and harvest of usufructs as well. The working plan should be in consonance with general planning, which is village based. Therefore the working plan should encompass the village as a unit and re-align the compartments accordingly.

Working plan for the Dibrugarh forest division, Assam for the period 2022-2023 to 2031-2032 is prepared in accordance with the guidelines stipulated in the National Working Plan Code, 2014. The Division is situated between 27°5' & 27°42'N latitude and 94°41' E 95°30' E longitude and covers a total area of 217.95 sq. kms. The working plan is prepared for sustainably managing the division, keeping in mind the availability of resources and the issues occurring and expected to occur in the coming ten years. Measures to control the pressure on the forest reserves and increase the forest productivity with increased green cover in the division have been emphasized in this working plan. The working plan of Dibrugarh Division is a technical document prepared to manage the forest under Dibrugarh Division on sustainable basis with the overall objective to conserve biodiversity, soil and water regime, enhance production of forest produce to meet the market needs and also the needs of the local people.

The sample plots of plot size 0.1 Ha were laid as per the GPS coordinates worked out by the North Eastern Space Applications Centre, Shillong (NESAC) with support from the o/o. Addl. PCCF (RE&WP), Department of Environment and Forest, Assam. NESAC also supported the division by mapping the forest types, canopy density, slope, aspect and land uses. The thematic maps were further validated on the ground with support from IORA Ecological Solutions. Other relevant survey including plantations, socio-economic survey (*forest and fringe villages*) were conducted as per guidelines of NWPC, 2014. Mapping of Tree outside the forest, Forest carbon stocks, Compartment wise growing stocks, Water bodies in the division, Delineation of microwatersheds, Estimation of USF, LULUCF, Mapping of working circles were carried out with support from IORA Ecological Solutions. The findings of the survey were duly discussed with the relevant stakeholders and then finalized. All the field data was provided by NESAC and the major findings were communicated to the forest department reflecting forest type, growing stock, land use which was further verified on the ground and final calculations were done. This Working Plan has been prepared in consideration to ever-intensifying forest-degradation, and suggests appropriate prescriptions for increasing forest productivity to meet fuelwood, fodder, timber needs, enhancing carbon sink and generate revenue, enhance biodiversity and restore the ecosystems services of Dibrugarh division. It is believed that this working plan will help achieving the stated objectives in a systematic, organized manner and lead to sustainable management of forests in Dibrugarh Forest Division.

The following working circles are proposed in Dibrugarh Forest Division.

- Joint Forest Management Working Circle.
- Plantation and Regeneration Working Circle.
- Forest Protection Working Circle.
- NTFP and Bamboo (overlapping) Working Circle.
- Soil and Water Conservation (overlapping) Working Circle.
- Wildlife Management and Biodiversity Conservation (overlapping) Working Circle.

Joint Forest Management Working Circle

This is the pivotal working circle as the success of this Working Plan depends entirely on the successful management of the JFM working circle. Joint Forest Management is sharing responsibilities, authority and usufructs between the village community with the forest department. The management of the forests is done in accordance with the provisions of a micro-plan prepared by the community on participatory rural appraisal (PRA) basis with the technical help of forest department. The concept of this Working Circle will be participatory approach, participatory planning, participatory implementation and participatory sharing of the outturn as per "The Assam Joint (peoples' participation) Forestry Management Rules 1998". The areas allotted to this Working Circle will consist of fringe forest areas that are poorly stocked or productive blank areas.

Plantation and Regeneration Working Circle

Plantation working circle is to cover existing plantations done by the department, blanks and under stocked areas unsuitable for ANR, clear felled areas, road side, river side, railway side areas and lands under compensatory afforestation etc., which are suitable for plantations, will be identified and divided into

different plan period along with prescription of sustainable management. Every effort shall be made to restore the ecology of such areas to their previous status. All the plantation areas shall also focus on enhancement of the carbon stocks. Effort shall be made to register such plantations under REDD+.

NTFP and Bamboo (overlapping) Working Circle

The NTFP working circle shall comprise largely of fringe forest areas or such other areas, which are fit for sustainable extraction of a particular NTFP without declining of the biological diversity. The WPO will prescribe appropriate steps restricting or stopping collection or extraction of any forest produce in a specific area (closed area) for certain period (closed season). NTFPs shall be managed on JFMC areas, fringe forest areas, community forest areas with the help of community after imparting proper training to them regarding time of harvesting, grading and storage for sustainable management and value addition etc. This working circle will be an overlapping working circle covering all the areas where NTFP can be profitably managed in a sustainable manner through scientific management. The Main NTFP products that are being extracted are bamboo, Canes, Rattans etc.

Forest Protection Working Circle

From view point of forest protection, this working circle shall include forest area comprising of 70 percent and above density areas of the Division. Such areas shall not be worked for timber or other NTFPs but shall be preserved by providing highest degree of protection. It becomes absolutely essential to keep the core of the forest areas/ representative ecosystems intact and free from human disturbances. After many years in future, when the ecosystem starts functioning again at its peak productivity, sustainable extraction from these forests may be allowed. Till that time, these forests shall function as nature's laboratories, which will keep on imparting insights about the functioning of the nature, to a keen observer. Mission of the Working Circle will be to consolidate the boundary of the forests by renewing and digitizing the boundary pillars; ejection of encroached, area restoration such areas and to carry out all protection measures against all potential threats.

Soil and Water Conservation (overlapping) Working Circle

The effective soil conservation measures along with the catchment and watershed management are the pre conditions for a sustainable forest management. The forests are also sources of water (surface, sub-surface and ground water). Over exploitation of the ground water resources results in a decline in ground water levels, there is an urgent need to augment the ground water resources through suitable management interventions. It is desirable to have forest management practices dovetailed with the principles of watershed based development approach especially in the source areas of water. Such areas should have restrictions on tree felling but there should be operations to improve the water regimes and natural regeneration. Many water streams originate from the RF.'s of the Division and many streams and rivers originated from other states pass through the RF.'s of this Division. There are some major wetlands, namely, and Missimi Beel, and many small water bodies within the Reserved forests of the Division. Special provisions shall be made in the working plan to sustain water resources and to address the livelihood issues of the people living in and around the natural inland water sources. Further, areas susceptible to soil

erosion such as steep slopes and areas in the vicinity of perennial streams shall be focused for soil and water conservation using mechanical or vegetative control measures.

Wildlife Management and Biodiversity Conservation (overlapping) Working Circle

This will be an overlapping circle to cover all the areas of the Division. The plan should prescribe measures for wildlife habitat conservation and identification of corridors for movement of elephants and their protection and management for reducing man-animal conflict. Further, this Division comprises a part of Dehing Patkai Wildlife Sanctuary and also a part of Elephant reserve- Dehing Patkai Elephant reserve- a sizeable population of Asiatic elephants exists in the said elephant reserve. There is a strong need of developing wild elephant habitat in almost all the RFs and civil areas of the Division to reduce man-elephant conflict. There is also necessity to bring some areas with water bodies and peripheral land mass into some special management under wet land conservation for proper management under this circle. The main objectives of the circle as aligned with the objectives of Dehing Patkai Wildlife Sanctuary shall be –

- i) To improve and restore the demographic indicator of growth relating to population of all endangered, endemic, rare species of animals and plants.
- ii) Management of wildlife and improvement of its habitat.
- iii) Reduction of man animal conflict.
- iv) Rescue and rehabilitation of wild animal
- v) Ensuring that development of roads, railways in these areas does not create habitat fragmentation.
- vi) To identify and promote ecotourism in the areas rich in wildlife.

It is expected that this Working Plan will meet the necessity of a long awaited Forest Management Plan. This Working Plan takes into account the prevailing forest-degradation conditions and suggests appropriate prescriptions for increasing Forest Productivity to meet Fuelwood, Fodder, Timber Needs, Enhancing Carbon Sink, Enhancing Biodiversity and restoring the Ecosystems Services of Dibrugarh Division. It is our belief that this working plan will help achieving the stated objectives in a systematic manner and lead to sustainable management of forests in Dibrugarh Forest Division.

Disclaimer: All field data, information pertaining to this Plan were collected by the SWPO. Maps are revalidated by NESAC and IORA. Data, information, map etc in raw form were received from IORA. Writer is not responsible for any wrong or erroneous information.

Dated: The 22nd July'2022

Yunush Salim, AFS, DCF

Acknowledgement

It is always a pleasure to achieve a distinctive job. It is equally a great joy when such job is achieved with enthusiastic teamwork. Preparation of this Working Plan is indeed a teamwork where number of individuals contributed with their dedication and sincerity. The success of any project depends largely on the encouragement, guidance and support of many others. It would not have been possible without the kind support and help of many individuals and organizations. I take the privilege to express my gratitude to the people who have been instrumental in the successful completion of this Forest Management Plan.

I express my deepest sense of gratefulness to Ms. Imtiena Ao, IFS, Deputy Director General of Forests, IRO, NEZ, MoEFCC, Shillong for her continuous support. I take privilege to offer my deepest gratitude and greatest appreciation to Mr. W.I. Yatbon, IFS Deputy Inspector General of Forests, IRO, NEZ, MoEFCC, Shillong for his continuous endeavour and valued guidance in bringing out this Working Plan. Without his encouragement and guidance this project would not have been materialized.

I offer my sincere gratitude to the APCCFs,SPCCF and CCF namely Dr. Alaka Bhargava, IFS, Sri. MK Yadava, IFS, Sri TV Reddy, IFS Sri Anurag Singh, IFS, Sri N Anand, IFS and Smt Sonali Ghosh, IFS who led the Research Education and Working Plan Wing, Assam during the course of working Plan preparation for their continuous guidance and support. I am thankful to Sri Suvasish Das, IFS, Sri Samir Baidya, AFS and Smt. Himamoni Handique, Research Officer for their co-operation and help. Mr. Rajib Rudra Tatiang, HOD, Zoology, Digboi College and Wildlife Biologist deserves special thanks for he provided some relevant information including updated list of fauna.

I am thankful to all DFOs including Shri. Ajoy Deuri Bharali, IFS, Sri Prabhakar Das IFS, Sri Fuding Terang ,AFS, Sri Dilip Deka, AFS,Sri Pradipta Baruah, AFS and Sri Sandeep Bande IFS who were in charge of Dibrugarh Division during the course of working Plan preparation for their support and contribution in the form of various information and data which were vital for the Working Plan.

The GPS co-ordinates for the sample plots were worked out by the North Eastern Space Applications Centre, Shillong (NESAC) with active support from staffs of GIS Cell of the o/o. Addl. PCCF (RE&WP), Assam. The thematic maps were validated on the ground with support from IORA Ecological Solutions Pvt. Ltd (IORA). I offer my sincere acknowledgement to NESAC, IORA and staffs of GIS Cell of o/o. Addl. PCCF (RE&WP), Assam for their valuable contributions.

Shri. Ajoy Deuri Bharali, IFS, who was the Special Working Plan Officer for Dibrugarh Division, initiated the process including field data collection, enumeration etc. followed by validating thematic maps etc. with assistance of IORA and NESAC. After his retirement from Service I carried forward his work with his continuous encouragement. I offer my deep sense of gratitude to Shri. Ajoy Deuri Bharali, IFS.

Dated: The 22nd July'2022

Yunush Salim, AFS, DCF



/ GOVERNMENT OF INDIA
/ INTEGRATED REGIONAL OFFICE



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No. 12-2/27/2014/RONE/AS/DIBRUGARH/WP/JJ/

July 22, 2022

o

The Principal Chief Conservator of Forests & HoFF,
Aranya Bhawan, Rop Konwar Jyoti Prasad Agarwala Path,
Near Srimanta Sankardev Kalakhetra,
Panjabari, Guwahati — 781 037

Sub: Approval of revised Working Plan of Dibrugarh — reg.

Ref: i) This office letter of even no. dated 09.05.2022
ii) Your email dated June 25, 2022.

Sir,

The Working Plan of Dibrugarh Forest Division has been examined in accordance with the provisions of Forest (Conservation) Act, 1980 as amended from time to time, National Forest Policy, 1988 as well as orders of the Hon'ble Supreme Court of India in WP (C) 202 of 1995.

After careful consideration of the revised Working Plan, approval of the Central Government under Section—2 of Forest (Conservation) Act, 1980 of the Working Plan of Dibrugarh Forest Division, is hereby conveyed subject to the observance of following conditions:-

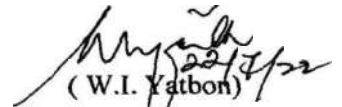
1. The approval shall be effective from the date of issuance of this letter and is for a period of 10 years i.e. 2022-23 to 2031-32.
2. All the prescriptions of the Working Plan regarding regeneration, protection and management of the forest will be strictly complied with and any change in the prescriptions of Working Plan will be treated as deviation for which prior approval of competent authority as per National Working Plan Code 2014 (Chapter V) shall be obtained in advance.
3. Any alteration in the plan leading to deviations or involving important technical points shall be made available with necessary draft amendments to the Deputy Director General of Forests (Central) through the PCCF and shall be implemented only after amendments are duly approved by the Deputy Director General of Forests (Central).
4. Sufficient budgetary allocations must be ensured for implementation of various prescriptions regarding protection, regeneration and development of the forests and a) the prescriptions mentioned in the Working Plan must be carried out as per schedule. All the felling must be commensurate with regeneration and in case the regeneration works in the areas worked in a year are not taken up in the subsequent year, then felling of trees in forest area shall not be undertaken unless facts are appraised to Central Government and concurrence is obtained

- for taking up felling operations as per working plan prescriptions. The Hon'ble Supreme Court of India's orders in this regard will be strictly complied with.
5. The standing instructions issued by the Hon'ble Supreme Court from time to time in W.P. (C)No. 202/95 as well as in similar petitions shall be meticulously followed.
 6. The domestic requirement of fuel wood from the branches etc and the construction timber should be the first priority of the local people and the balance timber may be utilized for the Forest Based Industries.
 7. The approved saw/veneer mills will have to submit the monthly returns as per the Hon'ble Supreme Court order dated 03/12/2005 in WP (C) 202/95 dated 12.05.2001 to the State Government with a copy to this office. The monthly returns are to be duly verified and checked by the Forest Officer authorized by the State Government.
 8. Rights and concessions, if any, should be given to the rights holders on the principle of sustainability of the forests.
 9. Thinning of plantation, if any, should be done after proper assessment of the Plantation taking into consideration the spp., site quality, the expected stand number and basal area for the given age from relevant yield tables and stand tables.
 10. No thinning shall be carried out on the slopes over 30° (steep slopes), areas having blanks or under stocked or in the areas of 20m strip on both sides along the streams and nallahs and 50m strip on both sides along the rivers.
 11. The monitoring of the thinning, if any, will be done by territorial DFO and CCF (30 % and 10%) respectively. A certificate regarding this to be submitted regularly to this office.
 12. No new construction of roads in the forest area shall be taken up for the purpose of extraction of timber.
 13. The material obtained from thinning, if any, is to be transported to the notified depots and no timber should remain in the felled compartments.
 14. Every year after any thinning as per prescription taking into consideration, a report regarding the yield removed shall be communicated to the Regional Office of MoEF&CC with an annual plan of operation to commensurate regeneration in the working plan area before commencement of new forestry operation year (in the month of September).
 15. Adequate fire protection measures shall be taken up and adequate funds for this purpose shall be made available by the State Government.
 16. Intensive protection measures against biotic interference and encroachment in forest shall be taken up. The case of forest settlement and encroachment shall be expedited and all the Acts, **Rules**, Orders of Hon'ble Supreme Court of India shall be followed in letter and spirit. Action should be taken for demarcation of forest areas and budgetary provision should be made for the same.
 17. It shall be ensured that no activity is permitted/taken up in forest area in violation of the provisions of Forest (Conservation) Act, 1980.
 18. No exotic spp. is to be introduced in the Plantation Working Circle and in any of the compartment for regeneration.
 19. Shifting cultivation shall be discouraged and practice shall be devised to contain such cultivation within already affected area with right land use practices and through social forestry/energy plantations etc.
 20. Annual updating of compartment history & control forms with the proposed major deviations if any shall be intimated to the Regional Office of MoEF&CC in the month of September every year.
-

21. The Working Plan Officer is to revise this Working Plan 2 (two) years before the expiry so that there will be a continuity on the Management of the Reserved Forest.
22. A Mid-term review of the progress of implementation of prescriptions as well as efficacy of the Working Plan shall be carried out in the year 2024-25 so that deviations if any causing short falls in achievements of target can be adjusted by the Standing Consultative Working Plan Committee in consultation with the Deputy Director General of Forests (Central).
23. A copy each of the approved final Working Plan is to be sent to the Regional Office, MoEF&CC, Shillong, ICFRE, IGNFA and FSI, Dehradun.
24. The Central Government reserves the right to review/modify or withdraw this approval at any point of time depending upon the management needs and orders of the Central Government /Court.

This is issued with the approval of the Deputy Director General of Forests (Central).

Yours faithfully,



(W.I. Yatbon)

Deputy Inspector General of Forests (Central)

Copy to.

1. The Director General of Forests & Special Secretary, Government of India, Ministry of Environment, Forests and Climate Change, Jorbagh Road, Aliganj, New Delhi - 110003.



Deputy Inspector General of Forests (Central)

DIBRUGARH DIVISION (LOCATION MAP) C.F., E.A.C., JORHAT

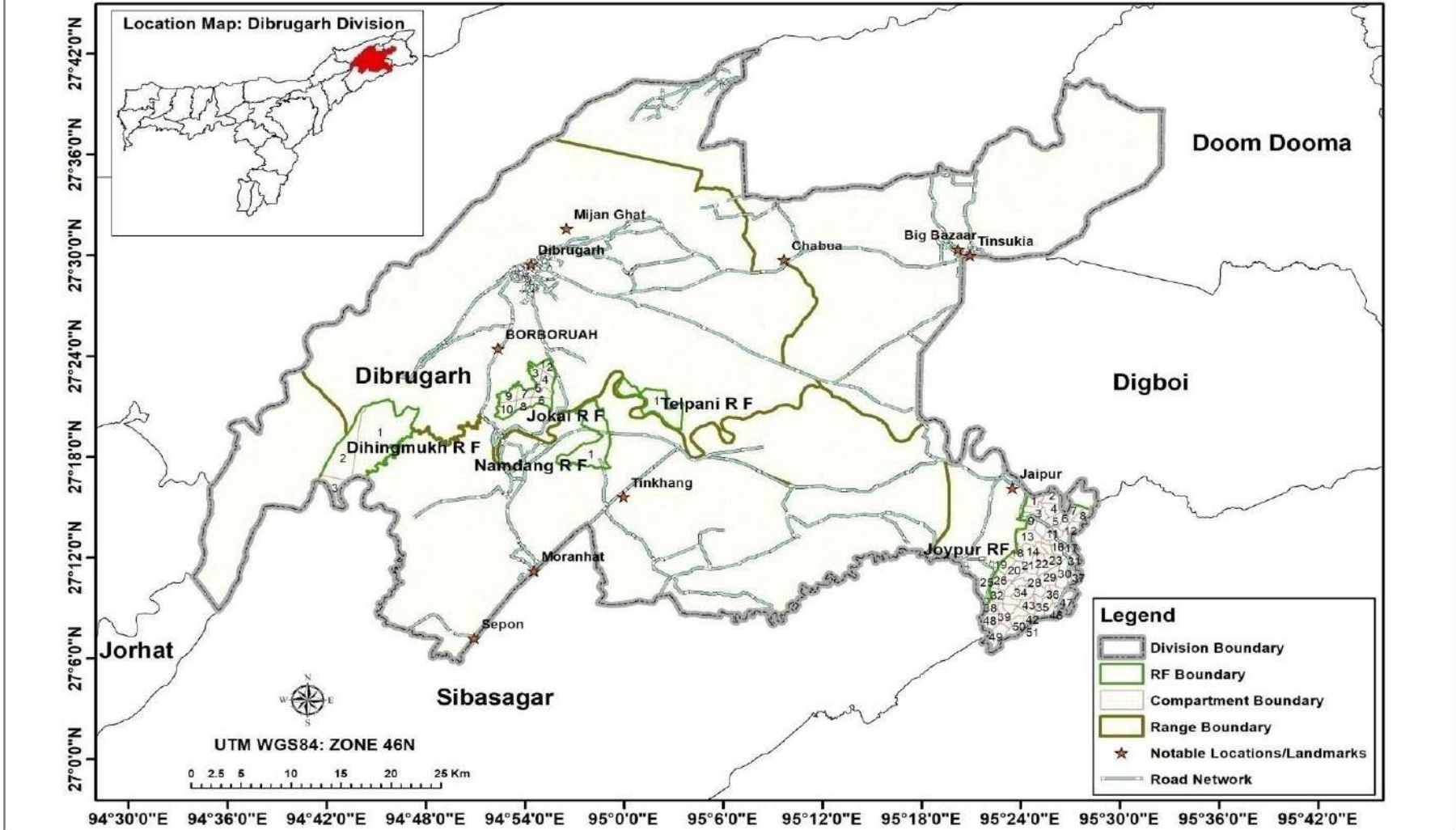


Figure 1: Location Map of Dibrugarh Division, Assam

I. Abbreviations

ACF	Assistant Conservator of Forests
AACP	Assam Agricultural Competitiveness Project
AFR	Assam Forest Regulation
APCCF	Additional Principal Chief Conservator of Forests
APFBC	Assam Project on Forest and Bio-Diversity Conservation
AR/ANR	Artificial Regeneration/Aided Natural Regeneration
BCD	Biodiversity Conservation and Development
BMC	Bio-Diversity Management Committee
BTAD	Bodoland Territorial Area District
CAI	Current Annual Increment
CAMPA	Compensatory Afforestation fund Management and Planning Authority
CASFoS	Central Academy for State Forest Service
CCF	Chief Conservator of Forests
CF	Conservator of Forests
DBH	Diameter at Breast Height
DCF	Deputy Conservator of Forests
DFO	Divisional Forest Officer
DGF & SS	Director General of Forests and Special Secretary
DGPS	Differential Global Positioning System
DSMs	Defence Series Maps
EC	Environmental Clearance
FAO	Food and Agriculture Organization
FC	Forest Clearance
FCA	Forest Conservation Act
FDA	Forest Development Agency
FRA	Forest Rights Act
FRH	Forest Rest House
FSI	Forest Survey of India
FSR	Forest Schedule of Rates
FYP	Five Year Plan
GCS	Geographic Co-ordination System
GDP	Gross Domestic Product
GHGs	Green House Gases
GIM	Green India Mission
GIS	Geographic Information System
GPS	Global Positioning System
Ha	Hectare
HoD	Head of Department
HoFF	Head of Forest Force
ICFRE	Indian Council of Forestry Research and Education
IGNFA	Indira Gandhi National Forest Academy
IIFM	Indian Institute of Forest Management
ITRF	International Terrestrial Reference Frame
IUCN	International Union for Conservation of Nature
IVI	Importance Value Index
JFM	Joint Forest Management
JFMC	Joint Forest Management Committee
LULUCF	Land Use and Land Use Change and Forestry
MAI	Mean Annual Increment
MAPs	Medicinal and Aromatic Plants
MAR	Monitoring Assessment and Reporting
MEoF	Minister of Environment and Forests
MFP	Minor Forest Produce
MHW	Mixed Hard Wood
MIS	Management and Information System
MODIS	Moderate-resolution Imaging Spectroradiometer
MoU	Memorandum of Understanding

MRV	Measuring Reporting and Verification
MSL	Mean Sea Level
NAP	National Afforestation Project
NBM	National Bamboo Mission
NaRMIL	National Resource Management and Integrated Livelihood
NFI	National Forest Inventory of India
NGO	Non-Governmental Organization
NH	National Highway
NP	National Park
NPV	Net Present Value
NREGS	National Rural Employment Guarantee Scheme
NREP	National Rural Employment Programme
NRSC	National Remote Sensing Centre
NTCA	National Tiger Conservation Authority
NTFP	Non-Timber Forest Produce
NWAP	National Wildlife Action Plan
NWDB	National Wastelands Development Board
OSMs	Open Series Maps
PA	Protected Area
PBRs	Peoples Biodiversity Registers
PCCF	Principal Chief Conservator of Forests
PCU	Project Co-ordination Unit
PESA	Panchayats (Extension to Scheduled Areas) Act
PIU	Project Implementation Unit
PF	Protected Forests
PRA	Participatory Rural Appraisal
PRF	Proposed Reserved Forest
PWPR	Preliminary Working Plan Report
RAPCCF	Regional Additional Principal Chief Conservator of Forests
RBA	Relative Basal Area
RBAFs	Relative Basal Area Frequencies
RD	Relative Density
REDD	Reducing Emissions from Deforestation and Forest Degradation
REWP	Research Education and Working Plan
RET	Rare, Endangered and Threatened
RF	Reserved Forests
RoFR	Recognition of Forests Rights
RFO	Range Forest Officer
RS	Remote Sensing
SC	Schedule Caste
SD	Standard Deviation
SF	Social Forestry
SFDs	State Forest Departments
SFM	Sustainable Forest Management
SMC	Soil and Moisture Conservation
SOI	Survey of India
ST	Schedule Tribes
TOF	Trees Outside Forests
UF	Unclassified Forests
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
WC	Working Circle
WGS	World Geodetic Survey
WII	Wildlife Institute of India
WLS	Wildlife Sanctuary
WP	Working Plan
WPO	Working Plan Officer
WPU	Working Plan Unit

EXECUTIVE SUMMARY

I. Introduction: The Working Plan for the Dibrugarh Forest Division, Assam for the period 2022-2023 to 2031-2032 is prepared as per the National Working Plan Code, 2014. The Working Plan for the Division has views of implementing conservation strategies and protection of the forest reserves. The Division is situated between 27°5' & 27°42' N latitude and 94°41' E 95°30' E longitude covering an area of 21,794.648 hectares.

Dibrugarh Forest Division was reorganized in the year 1960 as a part of the erstwhile Lakhimpur Forest Division. Subsequently, two new Forest Divisions, namely Dibrugarh Forest Division and Digboi Forest Division were carved out. Further, in 1974, another new Division, namely, Doom- Dooma Forest Division was constituted. In 1986, Dibru Saikhowa Reserved Forest was declared as a Wildlife Sanctuary. It was transferred to the newly created Tinsukia Wildlife Division in the year 1989. In 2001, Padumoni Reserved Forest, Bherja Reserved Forest, and Borjan Wildlife Sanctuary were transferred to Tinsukia Wildlife Division. Further, an area of 2,406.96 hectare of Jeypore Reserved Forest was notified as a part of Dehing-Patkai Wildlife Sanctuary in 2004. The current spread of this Division covers a major part of Dibrugarh District and a part of Tinsukia District. The boundaries of the Division are demarcated by both artificial features like roads, village paths, etc. and natural features such as rivers, streams and edges of swamp areas. Some of the boundaries do not appear to have been maintained properly for some years. The general state of the boundaries is not quite satisfactory in the case of some Reserved Forests (RFs) surrounded by the villages.

Most of the RFs in the Division get inundated during the monsoon due to occurrence of floods. Though the terrain in general is plain, Jeypore RF comprises of low to medium hills and is located along the foothills of the Tirap District of Arunachal Pradesh. The terrain in the Division is cut by numerous rivulets (nallas), and spread with swamps and full of earthen mounds. The area is surrounded by Namsang, Buridihing and Dilli River and the altitudes range from 94 meter above msl at a point near the North-Eastern corner of Dihingmukh RF to 480 meter above msl at a point in the Jeypore RF. The Division falls under high humid zone and is characterized by high humidity and rainfall.

Forests under Dibrugarh Division are a part of upper Assam Rain Forest and Biodiversity hotspot as it harbours about 60 mammal species, 270 bird species, 47 reptile species, 15 Lizard species, 25 amphibian species, 375 species of butterflies besides numerous orchids, lichens etc. The most common mammal species of this sanctuary are hoolock gibbon, slow loris, pig-tailed macaque, stump-tailed macaque, capped langur, Asian elephant, Bengal tiger, Indian leopard, gaur, Chinese pangolin, Himalayan black bear, Himalayan squirrel, leopard cat, clouded leopard, porcupine, crab eating mongoose, sambar, sun bear, binturong, barking deer, golden cat and marbled cat. Among the bird species majority are resident (63.7%), some are winter visitors (23.1%), and very few are summer visitors (2.5%). About 10.7% are altitudinal migrants, coming mainly from the higher reaches of the western, central and eastern Himalayas. Avifauna includes slender-billed vulture, white-winged wood duck, greater adjutant, lesser adjutant, greater spotted eagle, beautiful nuthatch, marsh babbler, tawny-breasted wren-babbler, yellow-vented warbler, broad-billed warbler, white-naped yuhina, white-

cheeked partridge, great hornbill, brown hornbill, Oriental darter and painted stork, osprey, kalij pheasant, grey peacock pheasant, besra, black baza and hill myna. The birds of Dehing Patkai rainforest thrive in the diversity of micro habitats in the predominantly evergreen forest such as dense evergreen forest, rivers and streams, evergreen forest edge, swamps, semi-open evergreen forest that includes the logged areas where openings are present, agriculture (cultivations, fallows and tea gardens) along the edge and habitations on evergreen forest edge. Most species are habitat specialists i.e. they are found only in a single micro habitat, with dense evergreen forest harbouring the maximum of 111 of the total 281 birds species recorded in Jeypore, of which insectivores are the most dominant guild with 79 species. 44 species were recorded along rivers or streams, 37 species in evergreen forest edge and 23 species in the semi-open evergreen forest. The insectivorous, carnivorous and most of the omnivorous birds help control the insect and rodent pests in the forest as well as in the agricultural ecosystem adjoining the forest. Frugivores like the hornbills, barbets, pigeons, and koel, along with some of the omnivores like crows, mynas and starlings that feed on fruits serve as seed dispersers. Nectarivores, some of the insectivores and omnivores that feed on nectar help in plant pollination. There are terrestrial piscivores like the kingfishers, brown fish owl and osprey and 31 aquatic species that depend on the rivers and streams inside the forest and the agricultural fields along the forest edge.

The different trees of this four-layered rainforest are laden with many exotic species of orchids and bromeliads. There is an abundance of ferns, epiphytes, wild banana, orchids, arums, climbers and linas in this humid forest habitat. Some of the important tree species found in this forest area are – Hollang, Mekai, Dhuna, Udiyam, Nahar, Samkothal, Bheer, Hollock, Nahor, Au – tenga (elephant apple), different species of Dimoru etc. The towering Hollong tree which is also the state tree of Assam dominates the emergent layer of this rainforest.

The forests are wet tropical evergreen Assam valley forests.

The important species of over wood are *Dipterocarpus macrocarpus*, *Mesua ferrea*, *Castanopsis indica*, *Shorea assamica*, *Vaticalanceae folia*, *Amoora wallichii*, *Dysoxylum binectiferum* etc. The other species found in understorey are *Garcinia lanceaefolia*, *Michelia muni*, *Baccaure usupida*, *Bischofia javanica*, *Myristica limifolia* etc. The shrub and herb layer has *Glochidion spp.*, *Alpinia spp.*, *Mallotus philippinensis*, wild banana, tree fern, pepper etc. The ground cover mainly has *Melastoma*, *Leea* and other species.

Anthropogenic activity including industrialization, urbanization and many other factors caused shrinkage of the forest and habitat fragmentation.

a) Vision statement: The vision statement of the Working Plan of Dibrugarh Division is that after implementation of these Working Plan prescriptions, one can see-

1. A forest as it was 50 years ago with four layered floral richness and with good stock of timber Trees-so as to fetch sizeable revenue to the State.
2. A forest of very rich biodiversity- to give abode to all endemic, endangered, rare species of flora and fauna.

3. A Forest with maximum green foliage that can supply maximum oxygen to the atmosphere.
4. A forest of heavy Carbon Sink- enabling greater amount of carbon sequestration.
5. A forest capable of sustainable yield – facilitating to harvest forest produces uninterruptedly.
6. A forest devoid of any biotic interference- devoid of any anthropogenic activity, illegal felling.
7. A forest devoid any kind of encroachment- ensuring its protected boundary.
8. A forest capable of supplying livelihood needs of local rural people- enabling local forest dependants, to harvest at their need.
9. A forest to ensure sustain flow of income and ecosystem services to local communities considering conservation and ecological security.
10. A forest of ideal habitat to wildlife - providing food, water and shelter to the wildlife.
11. A forest that may be a learning environment for forestry and environmental education.
12. A forest managed jointly by Government and the local people.

b) Goals and objectives of management:

Goals:

- Carry out forest protection measures covering all the reserved forests leading to Conservation of Forests and reducing forest degradation.
- Plan to retrieve encroached forest areas and to restore forest cover.
- Enhancement of forest productivity together with establishment of regeneration to improve forest health and vitality as per ecological and silvicultural requirements of the species
- Management of flood affected areas and prevention of soil erosion and stabilization of terrain through afforestation activities,
- People's involvement in planning and management of forests fulfilling socio-economic and livelihood needs of needs of the people.
- Adopt suitable management practices to fulfil the fodder and NTFP needs,
- Reduce Man-elephant conflicts ensuring fodder plant growth in wildlife habitat.
- Maintenance and enhancement of ecosystem services including ecotourism, developing synergic models for ecotourism focusing wildlife conservation in the high sensitive zones of the rainforest.
- Progressively increasing growing stock and carbon sequestration potential.
- Maintenance of biological diversity.
- Sustainable yield of forest produce.
- Simultaneous implementation of Indian Forest Act, Assam Forest Regulation 1891(Amendment Act 1995), Wildlife (Protection) Act, Forest Conservation Act, Biological Diversity Act, and Forest Rights Act.

Objectives:

- i) To determine the status of existing boundaries/boundary pillars of Reserved forests in the Division,
- ii) To plan the ejection of encroachers from the RF. areas on highest priority,
- iii) Carry out afforestation of endemic species to increase forest cover of the reserved forests,
- iv) Carry out afforestation of riparian areas and control of soil erosion,
- v) Plantations of NTFP and other species in JFMC protected areas,

- vi) Awareness of forest fringe villages to reduce forest degrading activities like grazing, lopping, shifting cultivation, and
- vii) Carry out ecotourism activities with participation of the fringe population.

c) SWOT analysis: The Division has unique forest type, i.e. the tropical/wet evergreen forest, with high diversity of flora and fauna. Further, the forest department has a sizable strength of trained staff. The dense forest with un-operated bamboo clumps and varied strata and presence of wilderness provides an opportunity to establish ecotourism in the Division. There are increased occurrences of encroachment, poaching and illegal felling in the forest reserves. The paucity of fund forms an important hurdle for development of the Division. Other pressures that act as obstacle in the developmental processes are grazing and recurrent flooding instances in the plains.

The detail SWOT analysis carried out for prescriptions and strategies for achieving the goals and objectives is presented in Table 1.

Table 1: SWOT Analysis of the Dibrugarh Forest Division, Assam.

STRENGTHS	WEAKNESS
<ul style="list-style-type: none"> ● Rich biodiversity ● Good water resources ● Fertile soil condition ● Unique forest type- tropical/wet evergreen forest ● Trained and skilled manpower 	<ul style="list-style-type: none"> ● Defficiency of new blood in the Department ● Species prone to poaching ● Paucity of fund ● Lack of adequate resources ● Devoid of approved Working Plan
OPPORTUNITIES	THREATS
<ul style="list-style-type: none"> ● Ecotourism potential ● Potential to create carbon sinks ● Utilization of Revolving fund. ● Scope of afforestation in degraded forests 	<ul style="list-style-type: none"> ● Illegal felling, poaching ● Recurrent flood ● Encroachment ● Anthropogenic- Grazing etc

d) Expected outcome: The Expected Outcomes of the Working Plan are:

- Conservation of forests, reduce forest degradation, restoration of degraded forests, increase of forest stock and sustained yield.
- Ensure people's involvement for forest conservation and protection and thereby attain the objective for sustainable supply of forest produce for fringe village communities and generation of green livelihoods.
- Restoration of woodland leading to long term carbon sequestration.
- Conservation of soil and water resources
- Management of flood affected/low lying areas by afforestation activities and reduced erosion.
- Ecosystem services including ecotourism activities will be developed.
- Sustainable JFMC/NTFP plantation area development and Biodiversity conservation with a focus on rare and endangered species of floral-faunal components.
- Mitigation of human-elephant conflict.

e) Abstract of Plan Prescriptions: The abstract of plan prescriptions in the Working Plan of Dibrugarh Forest Division, Assam, for the plan period 2022-23 to 2031-2032 is summarized in table 2 and the details are provided in Part II as per the format laid out under National Working Plan Code 2014.

Table 2: Abstract of work prescribed for Dibrugarh Forest Division, Assam for 2022-23 to 2031-32

Chapter No.	Name of the Working Circle	Prescribed activity	Physical target over a period of ten years
Part 2 Chapter 2	Joint Forest Management Working Circle	Development of nursery under Joint Forest Management Working Circle for the period of 2022-2023 to 2031-2032.	a) Establishment of 5 community forest nurseries. b) 1,00,000 seedlings in each nursery.
		Area to be protected by JFMC	5684.535 hectare
		Plantation under joint forest management working circle for the period of 2022-2023 to 2031-2032.	2100 hectares as production forest. Maintenance= 2100ha x5 years
		JFMC training and awareness programmes for the period of 2022-2023 to 2031-2032. (4 programs twice a year for ten years, each programme 30 persons).	a) 40 training. b) 40 awareness programme. c) 2400 beneficiaries target.
		Ecotourism development in Jokai RF and Namdang RF (<i>Jeep safari of captured and released wild animals</i>)	2 units.
Part 2 Chapter 3	Plantation and Regeneration Working Circle	Proposed works under Plantation and regeneration working circle in Dibrugarh Division for the period of of 2022-2023 to 2031-2032.	8450 hectares
Part 2 Chapter 4	Forest Protection Working Circle	a) Intensive protection measures will be taken for protection with greater emphasis to forest areas with canopy density over 60 percent, grassland of Jeypore Reserved forest. b) Ejection plan. c) Boundary pillars (Main pillars 1 every kilometer and sub pillars 3 every 1 km). d) Creation of barriers including rajor-wire permanent fencing etc. to check biotic interference wherever necessary.	a) Strengthening the forest protection squads/personnel with modern equipments, logistics, vehicle and manpower. b) Ejection plan 1440 hectares. c) Main boundary pillars 168 d) Sub pillars 504 e) Creation of barriers including rajor-wire permanentfencing etc. to check biotic interference
Part 2 Chapter 5	NTFP (overlapping) and Bamboo Working Circle	a) NTFP Plantation b) NTFP Maintenance = 395 hect. c) Bamboo Plantation d) Bamboo Maintenance = 325 hect	a) 395 hectares b) Maintenance = 395hect c) 325 hectares d) Maintenance = 325hect
Part 2 Chapter 6	Soil and Water Conservation (overlapping) Working Circle	a) Soil and water conservation intervention 2466 hect. b) Proposed treatment area.	2466hect.
Part 2 Chapter 7	Wildlife Management and Biodiversity Conservation (overlapping) Working Circle	a) Habitat improvement including plantation of fodder, fruit and other indigenous species. b) Creation and maintenance of patrolling paths 150 km c) Construction of at least 5 protection camps and 2 watch towers spread across the sanctuary. e) Creation of Village Forest Protection Committee/Eco Development Committee in fringe villages f) Protection of buffer area village forests through Village Forest Protection	a) Enrichment plantations 500 hectares. b) Patrolling paths 150 km c) 5 protection camps and 2 watch towers b) Establishment of 2 anti-wildlife depredation unit. c) Elephant proof trenching 3,75,000 m ³ . d) Safe elephant corridors 4 nos. e) 160 nos. wildlife awareness camps.

		Committee. g) Training of staff, including exposure visits within and outside the state f) Procurement anti-poaching kits/equipment and other logistics. h) Procurement of Vehicle and Wireless sets.	f) Procurement anti-poaching kits/equipment and other logistics. g) Procurement of 2 SUV/MUV Vehicle and Wireless sets
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f) Abstract of Works Prescribed During the Plan Period Along with Annual Target:The abstract of works prescribed in the Working Plan of Dibrugarh Forest Division, Assam, for the plan period 2022-2023 to 2031-2032 showing its year wise target is summarized below in table 3 as per the format laid out under National Working Plan Code 2014.

Table 3. Year-wise physical target of achievement:

Chapter No.	Name of the Working Circle	Prescribed activity	Physical target over a period of ten years									
			Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Part- 2 Chapt- 2 Para-2.9	Joint Forest Management Working Circle	Estd of 5 nos. community forest nurseries having 1,00,000 seedlings	1no	-	1no	-	1no	-	1no	-	1no	-
		Plantation 2100 hectares as production forest.	210	210	210	210	210	210	210	210	210	210
		Joint Forest Management Working Circle (Maintenance) 5040hect.	-	210	420	630	630	630	630	630	630	630
		JFMC training and awareness programmes (4 programs twice a year for ten years, each programme 30 persons). a) 40 training. b) 40 awareness programme. c) 2400 beneficiaries target.	8	8	8	8	8	8	8	8	8	8
		Ecotourism in Jokai RF and Namdang RF (Jeep safari of captured and released wild animals)	2	2	2	2	2	2	2	2	2	2
Part 2 Chapt- 3 Para-3.9	Plantation and Regeneration Working Circle	Plantation and regeneration works = 8450 hectares	816	910	900	936	756	873	800	826	842	793
		Plantation and regeneration Working Circle (Maintenance)= 29976 hect	-	816	1726	2626	3562	4318	4375	4265	4191	4097

Part 2 Chapt- 4 Para-4.7 4.10	Frest Protection Working Circle	a) Intensive protection measures will be taken for protection of all RFs b) Ejection plan. (1446hect.)	486	480	480	-	-	-	-	-	-	-	
		c) Boundary pillars (Main pillars 1 every kilometer and sub pillars 3 every 1 km) = 504 nos	64	64	64	64	64	64	64	56	-	-	-
		d) Sub Pillars = 1344nos	168	168	168	168	168	168	168	168	-	-	-
		Creation of barriers including rajor-wire permanent fencing etc. to check biotic interference wherever necessary. = 80 KM(approx)	16	16	16	16	16	-	-	-	-	-	-
Part 2 Chapt- 5 Para-5.6	NTFP and Bamboo (overlapping) Working Circle	a) NTFP Plantation Creation = 395 hect.	45	40	50	45	35	30	40	35	35	40	
		Maintenance = 1975hect.	-	45	85	135	180	215	200	200	185	175	
		b) Bamboo Plantation Creation = 325 ha.	30	30	35	35	35	35	35	35	25	30	-
		b) Bamboo Plantation Maintenance = 1625 hect	-	30	60	95	130	165	170	175	175	165	-
Part 2 Chapt- 6 Para-6.7	Soil & Water Conservation Working Circle	Soil and water conservation works Proposed treatment area = 2466hect.	250	250	250	250	250	250	250	250	250	216	
Part 2 Chapt- 7 Para-7.9	Wildlife Management and Biodiversity Conservation (overlapping) Working Circle	a)Enrichment plantations=50 hectares.	25	25									
		b) Establishment of 1 anti-wildlife depredation unit.	1	1	1	1	1	1	1	1	1	1	
		c) Elephant proof trenching of earthwork = 3,75,000 m ³ . (unit x1000 m ³)	75	75	75	75	75	-	-	-	-	-	-
		d) Safe elephant corridors 4 nos. (Continuous for 10 years)	4	4	4	4	4	4	4	4	4	4	4
		e) 160 nos. wildlife awareness camps.	16	16	16	16	16	16	16	16	16	16	16

III. Glossary of terms

Sl.No.	Term	Definition
1	Abiotic	Pertaining to the non-living parts of an ecosystem, such as soil particles, bedrock, air, and water.
2	Afforestation	The establishment of a forest or stand in areas where the preceding vegetation or land use was not forest.
3	Agroforestry	A collective name for land-use systems and practices in which trees and shrubs are deliberately integrated with non-woody crops and (or) animals on the same land area for ecological and economic purposes.
4	Artificial Regeneration	Establishing a new forest by planting seedlings or by direct seeding (as opposed to natural regeneration).
5	Aspect	The direction toward which a slope faces; its exposure in relation to the sun.
6	Basal Area	The area of the circle formed by the cross-section of a tree taken 1.3 m above the ground.
7	Benefit/Cost Analysis	A set of procedures for defining and comparing the quantified benefits and costs of a project or a course of action; used as an aid to decision making.
8	Biodiversity	The biological diversity of plants, animals, and other living organisms in all their forms and levels of organization, including the biological diversity of genes, species, and ecosystems.
9	Biofuel	Biomass or materials derived from biomass that can be used to generate energy.
10	Biomass	The dry weight of all organic material, living or dead, above or below the soil surface.
11	Biosphere	The portion of the earth comprising the lower atmosphere, the seas, and the land surface (mantle rock) in which living organisms exist.
12	Biosphere Reserve	A management model proposed by the United Nations Man and the Biosphere program, in which a core area is preserved free from human disturbances, surrounded by buffer zones, which then lead into more intensive areas of disturbance and human activity.
13	Biota	The animal and plant life (fauna and flora) of a given area.
14	Block Cutting	Removal of the crop in blocks in one or more operations, generally for wildlife management purposes, encouraging regeneration, or protecting fragile sites.
15	Breast Height	The standard height, 1.3 m above ground level, at which the diameter of a standing tree is measured.
16	Buffer Zone	A strip of land where disturbances are not allowed, or are closely monitored, to preserve aesthetic and other qualities adjacent to roads, trails, waterways, and recreation sites.
17	Canopy	The more or less continuous cover of branches and foliage formed collectively by the crowns of adjacent trees.
18	Carbon Sequestration	The uptake and storage of carbon. Trees and plants, for example, absorb carbon dioxide, release the oxygen and store the carbon. Fossil fuels were at one time biomass and continue to store the carbon until burned.
19	Carbon Sink	An area where the rate of carbon uptake by living organisms exceeds the rate of carbon release. The surplus carbon is actively sequestered into organic or inorganic forms.
20	Carrying Capacity	The average number of livestock and (or) wildlife that can be sustained on a management unit, compatible with management objectives for the unit. It is a function of site characteristics, management goals, and management intensity.
21	Climate Change	An alteration in measured quantities (e.g., precipitation, temperature, radiation, wind, and cloudiness) within the climate system that departs significantly from previous average conditions and is seen to endure, bringing about corresponding changes in ecosystems and socio-economic activity.
22	Conservation	The management or control of human use of resources (biotic and abiotic) and activities on the planet, in an attempt to restore, enhance, protect, and sustain the quality and quantity of a desired mix of species, and ecosystem conditions and processes for present and future generations.
23	Contour Map	A topographic map that portrays relief by means of lines that connect points of equal elevation.
24	Crown	The live branches and foliage of a tree.

25	Crown Density	The amount and compactness of foliage of a tree crown.
26	Dbh (Diameter At Breast Height)	The stem diameter of a tree measured at breast height, 1.3 m above the ground.
27	Decision Support Systems (DSS)	Analytical tools (e.g., computer models) that aid decision making by providing information on the projected implications of alternative management actions.
28	Deforestation	The long-term removal of trees from a forested site to permit other site uses.
29	Degradation	(1) The erosional removal of materials from one place to another, which lowers the elevation of streambeds and floodplains. (2) Any process or activity that removes or lessens the viability of ecosystem functions and processes, and hence biological diversity.
30	Depletion	The use or consumption of a resource at a rate greater than the resource can be replenished within a defined time period. The notion of time is important, since many renewable resources can be restored if consumption is halted.
31	Ecosystem Services	Valuable, ongoing streams of benefits provided by healthy ecosystems, such as air and water purification, biodiversity maintenance, climate stabilization, mitigation of floods and droughts, detoxification and decomposition of wastes, generation and renewal of soil and soil fertility
32	Endemic Species	A species that is indigenous to a particular area; not introduced and often with a limited geographical range.
33	Environmental/Ecological Assessment	A process designed to contribute pertinent environmental information to the decision-making process of forest management and other resource projects and programs.
34	Evergreen	Never entirely without green foliage, leaves persisting until a new set has appeared.
35	Forage	Grasses, herbs, and small shrubs that can be used as feed for livestock or wildlife.
36	Forest	A complex community of plants and animals in which trees are the most conspicuous members and where the tree crown density—the amount of compactness of foliage in the tree tops—is greater than 10 percent.
37	Forest Cover	Forest stands or cover types consisting of a plant community made up of trees and other woody vegetation, growing more or less closely together.
38	Forest Cover Type	A group of forested areas or stands of similar composition which differentiates it from other such groups. Forest cover types are usually separated and identified by species composition and often also by height and crown closure classes. In detailed typing, age, site, and other classes may also be recognized.
39	Forest Encroachment	The intrusion or establishment of a significant number of trees on grassland(s).
40	Forest Fire	Any wildfire or prescribed fire that is burning in forest, grass, alpine, or tundra vegetation types
41	Forest Floor	“Layers of fresh leaf and needle litter, moderately decomposed organic matter, and humus or well-decomposed organic residue.
42	Forest Management	The practical application of biological, physical, quantitative, managerial, economic, social, and policy principles to the regeneration, management, utilization, and conservation of forests to meet specified goals and objectives while maintaining the productivity of the forest. Particularly, that branch of forestry concerned with the overall administrative, economic, legal, and social aspects and with the essentially scientific and technical aspects, especially silviculture, protection, and forest regulation. Includes management for aesthetics, fish, recreation, urban values, water, wilderness, wildlife, wood products, and other forest resource values.
43	Gap Analysis	A technique that assesses conservation plans and identifies ecosystems, land formations, or habitat types that are not currently adequately represented in the existing system of protected areas and reserves. Should be performed at regional, subregional, landscape, and watershed scales.
44	Genetic Diversity	Variation among and within species that is attributable to differences in hereditary material.
45	GPS (Global Positioning System)	A method of accurately determining or relocating a ground position using the signal from several satellites simultaneously. A small portable computer evaluates the time for each signal to reach it and then computes a three-dimensional location.

46	Global Warming	A real and projected trend in the warming of the earth's surface caused by natural changes in the global climate system and by human activities such as the release into the atmosphere of the gaseous by-products (principally carbon dioxide) of fossil-fuel consumption, which trap long-wavelength radiant energy.
47	Greenbelt	A strip of undisturbed soil and vegetation left along waterways or access routes to minimize the environmental impact from development.
48	Greenhouse Effect	The warming of the earth's atmosphere caused by increasing levels of carbon dioxide and other gases in the air, which trap the sun's heat within the atmosphere.
49	Greenhouse Gases	Those gases, such as water vapour, carbon dioxide, tropospheric ozone, nitrous oxide, and methane, that are transparent to solar radiation but opaque to long wave radiation. Their action is similar to that of glass in a greenhouse.
50	Ground Truthing	The use of a ground survey to confirm the findings of an aerial survey or to calibrate quantitative aerial observations.
51	Groundwater	Water below the level of the water table in the ground; water occupying the subsurface saturated zone.
52	Growing Stock	The volume estimate for all standing timber at a particular time.
53	Habitat	The environment in which a population or individual lives; includes not only the place where a species is found, but also the particular characteristics of the place (e.g., climate or the availability of suitable food and shelter) that make it especially well-suited to meet the life cycle needs of that species.
54	Harvest	To fell or remove timber, other than under a silviculture treatment.
55	Height Class	Any interval into which the range of tree or stand heights is divided for classification and use (commonly 3-, 5-, or 10-m classes); also the trees or stands falling into such an interval.
56	Hydrology	Science that deals with the waters above and below the land surfaces of the earth, their occurrence, circulation, and distribution, both in time and space, their biological, chemical, and physical properties, their reaction with their environment, including their relation to living beings.
57	Institutional Arrangements	"The laws, regulations, policies, social norms, and organizations governing and participating in resource use. Institutional arrangements specify who has access to resources, guide resource development activities, and define who will monitor and enforce the rules.
58	Intergovernmental Panel On Climate Change (IPCC)	A panel open to all members of the United Nations Environment Programme and the World Meteorological Organization. The IPCC assesses the scientific, technical, and socio-economic information relevant to the understanding of the risk of human-induced climate change.
59	Invasive Species	Any species not native to a particular ecosystem whose introduction causes, or is likely to cause, economic or environmental harm or harm to human health.
60	Litter	The surface layer of the forest floor that is not in an advanced stage of decomposition, usually consisting of freshly fallen leaves, needles, twigs, stems, bark, and fruits.
61	Livestock	Farm animals regarded as an asset.
62	Lopping	Chopping branches, tops, and small trees after felling into lengths such that the resultant slash will lie close to the ground.
63	Mean Annual Increment (MAI)	Stand volume divided by stand age. The age at which average stand growth, or MAI, reaches its maximum is called the culmination age. Harvesting all stands at this age results in a maximum average harvest over the long term.
64	Microclimate	The climate of small areas, such as under a plant or other cover, differing in extremes of temperature and moisture from the climate outside that cover.
65	Microplan	Microplan is a community based empowering tool for preparing a road map for development and management of forest and livelihood enhancement of the forest dependent communities with properly defined roles and responsibilities of all stakeholders, clearly set targets and well discussed deadlines.
66	Mitigation	To minimize, reduce, or moderate a certain force such as potential for wildfires.
67	Mortality	Death or destruction of forest trees as a result of competition, disease, insect damage, drought, wind, fire, and other factors (excluding harvesting).
68	Native Species	A species known to have existed on a site before the influence of humans.

69	Net Present Value (NPV)	A stand's present worth before harvesting once costs associated with its establishment and tending have been subtracted.
70	Non Timber Forest Products (NTFPs)	Any commodity obtained from the forest that does not necessitate harvesting trees. It includes game animals, fur-bearers, nuts and seeds, berries, mushrooms, oils, foliage, medicinal plants, peat, fuelwood, forage, etc.
71	Plantation Forest	Forest stands established by planting and (or) seeding in the process of afforestation or reforestation which are either of introduced species (all planted stands) or intensively managed stands of indigenous species, which meet the following criteria: one or two species at plantation, even age class, and regular spacing.
72	Plot	A carefully measured area laid out for experimentation or measurement.
73	Reforestation	The re-establishment of trees on denuded forest land by natural or artificial means, such as planting and seeding.
74	Regeneration	The act of renewing tree cover by establishing young trees naturally (natural seeding, coppice, or root suckers) or artificially (direct seeding or planting). Regeneration usually maintains the same forest type and is done promptly after the previous stand or forest was removed.
75	Reserve	An area of forest land that, by law or policy, is not available for harvesting. Areas of land and water set aside for ecosystem protection, outdoor and tourism values, preservation of rare species, gene pool, wildlife protection, etc.
76	Sapling	The stage of tree development in between the seedling and the pole stage. Saplings are typically 1–2 m tall and 2–4 cm in diameter, with vigorous growth, no loose, dead bark, and few (if any) dead branches.
77	Silviculture	The art and science of controlling the establishment, growth, composition, health, and quality of forests and woodlands to meet the diverse needs and values of landowners and society on a sustainable basis.
78	Spacing	The removal of undesirable trees within a young stand to control stocking, to maintain or improve growth, to increase wood quality and value, or to achieve other resource management objectives.
79	Species	A group of individuals that have their major characteristics in common and (usually) can only breed with each other.
80	Sustainability	A state or process that can be maintained indefinitely. The principles of sustainability integrate three closely interlined elements—the environment, the economy, and the social system—into a system that can be maintained in a healthy state indefinitely.
81	Temperate Forest	One of three main forest zones in the world. The woodland of rather mild climatic areas; composed mainly of deciduous trees.
82	Timber	Trees, whether standing, fallen, living, dead, limbed, bucked, or peeled.
83	Topography	The collective physical features of a geographic area, such as those represented on a map, especially the relief and contours of the land.
84	Volume	The amount of wood or fibre contained in a tree, stand, or forest, or parts of these measured in cubic units (e.g., cubic metres per hectare) inside the bark.
85	Wetland	A swamp, marsh, or other similar area that supports natural vegetation that is distinct from adjacent upland areas.

List of Flora:

The Dibrugarh Forest Division has habitat of diverse flora. Detail list of different flora is given in following Table.

Table 4: List of diverse flora found in Dibrugarh Forest Division, Assam

Trees			
Sl. No.	Species Name	Family	Local Name
1	<i>Actinodaphne angustifolia</i> (Bl.) Nees	Lauraceae	NK
2	<i>A. obovata</i> Blume.	Lauraceae	Patihonda
3	<i>Adina polycephala</i> Benth	Rubiaceae	NK
4	<i>Alangium chinense</i> (L) Harms.	Alanginaceae	Chikamorolia

5	<i>Albizzia procera</i> Benth	Leguminoceae	Boga koroï
6	<i>Aleurites fordii</i> Hemsl	Euphorbiaceae	Tang
7	<i>Alstonia scholaris</i> (L) R Br.	Apocynaceae	Chotiona
8	<i>Altingia excelsa</i> Bl.	Hemamelidaceae	Jutulitenga
9	<i>Aquilaria malaccensis</i> Benth	Thymelaceae	Sasi
10	<i>Ardisia depressa</i> Clark	Myrsianaceae	NK
11	<i>A.humilis</i> Vahl.	Myrsinaceae	Tolothapoka
12	<i>A. Pedunculosa</i> Wall	Myrsinaceae	NK
13	<i>A. Undulata</i> Clarke	Myrsinaceae	NK
14	<i>Artocarpus chaplasha</i> Roxb.	Moraceae	Cham kothal
15	<i>Baccaurea sapida</i> Muell. & Arg	Euphorbiaceae	Leteku
16	<i>Bridelia pubescens</i> .Kurz	Euphorbiaceae	NK
17	<i>Camellia sinensis</i> (L) Kuntze.	Theaceae	Sahpat
18	<i>Canarium bengalense</i> Roxb	Burseraceae	Dhuna
19	<i>Castanopsis indica</i> A.Dc.	Fagaceae	Hingori
20	<i>C. Armata</i> Sparh.	Fagaceae	Nk
21	<i>Cinamomum obtusifolium</i> Nees	Lauraceae	NogaDalchini
22	<i>C. cicieodaphane</i> Meissn.	Lauraceae	Gondhkoroi
23	<i>Crypteronia paniculata</i> Bl	Lythraceae	NK
24	<i>Cryptocarya floribunda</i> .Nees	Lauraceae	NK
25	<i>Dendrocalamus hamiltonii</i> Nees&Arn	Poaceae	Kako Bah
26	<i>Diospyros lanceaefolia</i> Roxb.	Ebenaceae	KenduGach
27	<i>D.variegata</i> Kurz.	Ebenaceae	Kolori
28	<i>Dipterocarpus retusus</i> Bl	Dipterocarpaceae	Holong
29	<i>Drimycarpus recemosus</i> (Roxb) Hk.F	Anacardiaceae	Amsia
30	<i>Dysoxylumnectiferum</i> (Roxb.) Hook. f	Meliaceae	Bandardima
31	<i>D. alliarium</i> (Buch-Hm.)Balakr	Meliaceae	Gendheli Poma
32	<i>D. Procerum</i> Hiern	Meliaceae	Lali amari
33	<i>Duabanga grandiflora</i> (Roxb.ex DC.)Walp	Lythraceae	Khokon
34	<i>Elaeocarpus ganitrus</i> Roxb	Eleocarpaceae	Rudraksha
35	<i>Ficus clavata</i> Wall	Moraceae	Nk
36	<i>F. fistulosa</i> Reinw	Moraceae	NK
37	<i>F. glaberrima</i> Bl	Moraceae	NK
38	<i>Garcinia cowa</i> Roxb	Clusiaceae	Thekera
39	<i>G. lanceafolia</i> (Roxb)	Clusiaceae	RupohiThekera
40	<i>G. xanthochymus</i> Hk.f	Clusiaceae	Teportenga
41	<i>Helicia excelsa</i> (Roxb.) Bl	Proteaceae	NK
42	<i>Juglans regia</i> Linn.	Juglandaceae	Kathbadam
43	<i>Lagerstroemia speciosa</i> (L) Pers.	Lythraceae	Ajar
44	<i>Lasianthus tubiferus</i> Hook.f.	Rubiaceae	NK
45	<i>Lindera griffithii</i> Meisn	Lauraceae	NK
46	<i>L. reticulata</i> .Benth	Lauraceae	NK
47	<i>L. elongata</i> Benth and Hook.	Lauraceae	Petarichua
48	<i>Litsea citrata</i> Bl.	Lauraceae	Mezankori
49	<i>L. khasiana</i> Meissn.	Lauraceae	NK
50	<i>L. laeta</i> Benth&Hook.f	Lauraceae	Bonhualu
51	<i>L. lanuginosa</i> Nees	Lauraceae	Nk
52	<i>L. oblonga</i> (Nees)Hook.f.	Lauraceae	NK

53	<i>L. sabifera</i> .Pers.	Lauraceae	Baghnola
54	<i>L. Thomsonii</i> Hk.f	Lauraceae	NK
55	<i>Maesa indica</i> Wall.	Myrsianaceae	Machpora
56	<i>M. montana</i> A.Dc	Myrsinaceae	NK
57	<i>Magnolia sphenocarpa</i> Hook.f.& Th	Magnoliaceae	Doloi Chopa
58	<i>Mallotus alba</i> Muell& Arg.	Euphorbiaceae	Moroliagach
59	<i>M.philippensis</i> (Lam) Muell&A	Euphorbiaceae	Senduri Guti
60	<i>Mangifera indica</i> L	Anacardiaceae	Aam
61	<i>Mecaranga denticulatum</i> Muell	Euphorbiaceae	NK
62	<i>Mesua ferrea</i> L.	Clausiaceae	Nahor
63	<i>Michelia champaca</i> Linn	Magnoliaceae	Titachopa
64	<i>Michelia hodgsonii</i> Hooker f. & T.	Magnoliaceae	Borhmothuri
65	<i>M. manii</i> King	Magnoliaceae	Kothalchopa
66	<i>M. oblonga</i> Wall ex H.Kf. Thomas.	Magnoliaceae	Ful chopa,
67	<i>Millettia cinerea</i> Benth	Fabaceae	Bokol Bih
68	<i>Myristica longifolia</i> .Wall	Myristicaceae	NK
69	<i>Olea dioica</i> Roxb.	Oleaceae	NK
70	<i>Ormosia robusta</i> (Weight)	Fabaceae	NK
71	<i>Phoebe lanceolata</i> Nees	Lauraceae	Bonsum
72	<i>Polyalthia jenkinsii</i> Benth	Annonaceae	Titasachi
73	<i>Premna bengalensis</i> Clarke	Verbenaceae	Gohora
74	<i>Pterospermum chelonides</i> DC.	Sterculiaceae	
75	<i>P. lanceafolium</i> Roxb	Sterculiaceae	Bon bogori,
76	<i>Randia griffithii</i> H.K.f	Rubiaceae	NK
77	<i>Sapium baccatum</i> Roxb.	Euphorbiaceae	Borkora
78	<i>Saprosma ternatum</i> H.K.f	Rubiaceae	NK
79	<i>Shorea assamica</i> Dyer.	Dipterocarpaceae	Mekai
80	<i>Sterculia balanhuas</i> linn.	Sterculiaceae	Hijol
81	<i>S.roxburghii</i> Wall.	Sterculiaceae	NK
82	<i>S.villosa</i> Roxb.	Sterculiaceae	Udal
83	<i>Syzigium cumini</i> (L) Skeel.	Myrtaceae	Borjamuk
84	<i>S.fruticosum</i> Roxb DC.	Myrtaceae	KutahiJamuk
85	<i>Syzigium reticulatum</i> (wt) Walp.	Myrtaceae	NK
86	<i>Syzygium oblatum</i> (Roxb)	Myrtaceae	NK
87	<i>Talauma phelloocarpa</i> King.	Magnoliaceae	Khorokiachopa
88	<i>Teinostachyum dullooa</i> Gamble.	Bambuseae	Dolo Bah
89	<i>Terminalia belerica</i> Roxb.	Combrataceae	Bhumuraguti
90	<i>T.chebula</i> Retz.	Combretaceae	Hilikha
91	<i>T. Myriocarpa</i> Heruk & Muell.	Combrataceae	Holokh
92	<i>Unona longiflora</i> Roxb.	Anonaceae	NK
93	<i>Vatica lanceafolia</i> Blume.	Dipterocarpaceae	Morsal.
94	<i>Ziziphus funiculosa</i> Ham.	Rhamnaceae	Nk
Bamboo			
Sl. No	Scientific Name	Local Name	
1	<i>Bambusa balcooa</i>	Bhaluka	
2	<i>Bambusa bambos</i>	Kotoha,Kotabanh	
3	<i>Bambusa mastersii</i> .	Beti banh	

4	<i>Bambusa nutans</i>	Deobanh, Jotia,	
5	<i>Bambusa pallida</i>	Bijuli, Jowa, Makal.	
6	<i>Bambusa teres</i>	Bhaluki, paura	
7	<i>Bambusa tulda</i>	Jati, Nal banh.	
8	<i>Dendrocalamus strictus</i>	Karail, Jati	
9	<i>Dendrocalamus giganteus.</i>	Worra	
10	<i>Dendrocalamus hamiltonii.</i>	Kakoa, Kakeo banh	
11	<i>Schizostachyum pergracile</i>	Madang	
12	<i>Schizostachyum griffithii</i>	Behti banh	
13	<i>Schizostachyum dullooa</i>	Dalu banh	
14	<i>Schizostachyum polymorphum</i>	Bajal banh, bajah banh.	
15	<i>Melocanna baccifera=M.bambusoides</i>	Tarai banh, Nah banh, Muli banh.	
Cane			
Sl. No	Scientific Name	Local Name	
1	<i>Calamus tennuis</i>	Jati Bet	
2	<i>Calamus flagellum</i>	Raidang Bet	
Shrubs			
1	<i>Blastus cochinchinensis</i> Lour	Melastomataceae	Futkola
2	<i>Boehmeria niivea</i> (L) Gaud.	Urticaceae	Riha
3	<i>Breynia patens</i> Benth	Euphorbiaceae	Nk
4	<i>Calamus jenkinsiana</i> Griff.	Aracaceae	Raidang bet
5	<i>Calamus tenuis</i>	Aracaceae	Jatibet
6	<i>Callicarpa arborea</i> Roxb.	Verbenaceae	Bonmola
7	<i>Callicarpa longifolia</i> Lam.	Verbenaceae	NK
8	<i>Camellia sinensis</i> (L)Kuntze.	Theaceae	Tea
9	<i>Casearia veraca</i> Roxb.	Flacourtiaceae	Bon kecheru
10	<i>Chasalia curviflora</i> Thw.	Rubiaceae	NK
11	<i>Citrus aurantium</i> Linn.	Rutaceae	Joratenga
12	<i>Clerodendron colebrookianum</i>	Verbenaceae	Nefafu
13	<i>C. Viscosum</i> Vent.	Verbenaceae	Dhopattita
14	<i>Croton caudatus</i> Geisel.	Euphorbiaceae	Lota mahudi
15	<i>Cryptolepis sinensis</i> (Lour.) Merr.	Apocynaceae	NK
16	<i>Eranthemum album</i> Nees.	Acanthaceae	NK
17	<i>E.platifolium</i> (Nees)	Acanthaceae	NK
18	<i>Ficus clavata</i> Wall.	Moraceae	Dimoru
19	<i>F. rostrata</i> Lamk.	Moraceae	NK
20	<i>Fissistigma wallichii</i> (Hk.f& Th)	Anonaceae	NK
21	<i>Garcinia cowa</i> Roxb	Guttiferae	Thekera
22	<i>Glochidion zeylanicum</i> A.Juss.	Euphorbiaceae	NK
23	<i>Goniothalamus sesquipedalis</i> Hk.f&Th.	Anonaceae	NK
24	<i>Helicia nilgirica</i> Beddome.	Proteaceae	NK
25	<i>Ixora acuminata</i> Roxb.	Rubiaceae	NK
26	<i>I. Nilgiricaus</i> R.Br.	Rubiaceae	NK
27	<i>I. Subsessilis</i> Wall.	Rubiaceae	NK
27	<i>Ixora villosa</i> Roxb.	Rubiaceae	NK
28	<i>Laportea crenulata</i> Gaud.	Urticaceae	Churatgach

29	<i>Lasianthus lucidus</i> Blume.	Rubiaceae	NK
30	<i>Leea indica</i> (Burn) Merr.	Leeaceae	Kukurathengia
31	<i>Litsea lancifolia</i> Roxb.	Lauraceae	NK
32	<i>L. salicifolia</i> (Roxb)	Lauraceae	Dighloti
33	<i>Livistona jnkensiana</i> Griff.	Aracaceae	Tokougoch
34	<i>Melastoma malabethricum</i> Linn.	Melastomaceae	RongaPhutukola
35	<i>Mimosa himalayana</i> Gamble.	Mimosaceae	Kauri kiat
36	<i>Morinda angustifolia</i> Roxb.	Rubiaceae	Akalbih
37	<i>M. Villosa</i> H.K. F.	Rubiaceae	NK
38	<i>Myrioneuron nutans</i> Wall.	Rubiaceae	NK
39	<i>Nerium indicum</i> Mill.	Apocynaceae	Korobi
40	<i>Pericampylus incanus</i> (Colebr) Meirs.	Manispermaceae	Garo lota
41	<i>Phlogacanthus guttatus</i> Nees.	Acanthaceae	NK
42	<i>P. curviflora</i> Nees.	Acanthaceae	Titaful
43	<i>Phyllanthus glauca</i> Wall.	Euphorbiaceae	Kola bahok
44	<i>Pinanga gracilis</i> (L) Blume.	Aracaceae	Ram tamul
45	<i>Psychotria silhentensis</i> Deb&Gans	Rubiaceae	NK
46	<i>Rauwolfia densiflora</i> Benth.	Apocynaceae	NK
47	<i>Roydsiasua violense</i> Roxb.	Capparidaceae	Modhumola
48	<i>Schizostachyum polymorphum</i> (Munro).	Poaceae	Bajal Banh
49	<i>Solanum khasianum</i> C.B.C.	Solanaceae	Borvekruri
50	<i>Spiradiclis cylindrica</i> Wakk.	Acanthaceae	NK
51	<i>Zallacca secunda</i> Griff.	Aracaceae	Jengoo pat
52	<i>Zizyphus Rugosa</i> Lamk.	Rhamnaceae	Bon Bogori
53	<i>Allophyllus zeylanicus</i> Linn Var.grandifolia	Sapindaceae	NK

Herbs

SI. No.	Species	Family
1	<i>A leucostachyus</i> Wall	Acanthaceae
2	<i>Alocasia forniculata</i> (Roxb) Scott.	Araceae
3	<i>Alpinea bracteata</i> Roxb.	Zingiberaceae
4	<i>Apostasia nuda</i> Br.	Aracaceae
5	<i>Aristida fusca</i>	Poaceae
6	<i>Arundinella leptochloa</i> (Nees ex Steud.) Hook.f	Poaceae
7	<i>Barleria cristata</i> Lin.	Acanthaceae
8	<i>Begonia roxburghii</i> A Dc.	Begoniaceae
9	<i>Canscora andrographiodes</i> Griff.	Gentianaceae
10	<i>Chloranthus officinalis</i> Bl.	Chloranthaceae
11	<i>Codonacanthus pauciflorus</i> Nees.	Acanthaceae
12	<i>Colocasia affinis</i> Schott.	Araceae
13	<i>Commelina obliqua</i> .Ham.	Commelinaceae
14	<i>Costus speciosus</i> (Koen) Smith.	Zingiberaceae
15	<i>Curculi goorchioides</i> Gaert.	Hypoxidaceae
16	<i>Cymbidium flexus</i> Nees.	Orchidaceae
17	<i>Dracaena petiolata</i> Hk.f&T.	Liliaceae
18	<i>Ebermaiiena stacerogyne</i> Nees.	Acanthaceae
19	<i>Elatostema acuminate</i> Brog.	Ericaceae
20	<i>Eupatorium wallichii</i> Dc.	Asteraceae
21	<i>Globba multiflora</i> Wall.	Zingiberaceae

22	<i>Hedychium gracile</i> Roxb.	Zingiberaceae
23	<i>Hedyotis costata</i> Br.	Rubiaceae
24	<i>Hedyotis glabra</i> R.Br.	Rubiaceae
25	<i>Hemizymnia fusua</i> Rich.	Poaceae
26	<i>Homalomena aromatic</i> Schott.	Araceae
27	<i>Hypopolytrum nemorum</i> (vahl) Spreng.	Cyperaceae
28	<i>Isachne albeus</i>	Poaceae
29	<i>Laporte acrenulata</i> Gaud.	Urticaceae
30	<i>Lasia spinosa</i> (L) Thw.	Araceae
31	<i>Oenanthes javanica</i> (Bt) Dc.	Apiaceae
32	<i>Oplismenus compositus</i> (L) P. Beauré.	Poaceae
33	<i>Pallia subumbellata</i> .C.B.el.	Commelinaceae
34	<i>Panicum brevifolium</i> Roxb.	Poaceae
35	<i>Panicum montanum</i> Roxb.	Poaceae
36	<i>Peliosanthes violacca</i> Wall.	Liliaceae
37	<i>Phrynium capitatum</i> Willd.	Marantaceae
38	<i>Phrynium pubescence</i>	Zingiberaceae
39	<i>Polygonum chinense</i> L.	Polygonaceae
40	<i>Polygonum serrulatum</i> Lag.	Polygonaceae
41	<i>Pothos cathcartii</i>	Araceae
42	<i>Pseudostachium polymorphum</i> Munro.	Poaceae
43	<i>Rhopalephora scaberrima</i> (Bl) Faden.	Commelinaceae
44	<i>Sarcopyramis nepalensis</i> Wall.	Melastomaceae
45	<i>Scleria terrestris</i> (L) Fass.	Cyperaceae
46	<i>Strobilanthus flaccidifolius</i> Nees.	Acanthaceae
47	<i>Thyzenolena maxima</i>	Poaceae
Climber and woody climber		
1	<i>Ampelopsis nerrifolia</i> D.Don.	Vitaceae
2	<i>Ampelopsis rubifolia</i> Planch.	Vitaceae
3	<i>Cissampelos Pereira</i> Lin.	Manispermaceae
4	<i>Cyclea bicristata</i> (Griff).	Menispermaceae
5	<i>Dalbergia pinnata</i> (Lour) Prain.	Papilionaceae
6	<i>Derris ferruginea</i> Benth.	Papilionaceae
7	<i>Dioscorea bulbifera</i> L	Dioscoreaceae
8	<i>D.glabra</i> Roxb.	Dioscoreaceae
9	<i>Enantheum album</i> .Nees.	Acanthaceae
10	<i>Erythralum scandens</i> Bl.	Oleaceae
11	<i>Ficus villosa</i> Bl.	Moraceae
12	<i>Fissistigma wallichii</i> (Hkf) Thm.	Annonaceae
13	<i>Gnetum scandens</i> Roxb.	Gnetaceae
14	<i>Hoya longifolia</i> Wall.ex Wight.	Asclepidiaceae
15	<i>H. Parasitica</i> Wall.	Asclepidiaceae
16	<i>H. Vaccinioides</i> Hook.f.	Asclepidiaceae
17	<i>Jesminumana stomosans</i> Wall	Oleaceae
18	<i>J. attenuatum</i> Roxb	Oleaceae
19	<i>J. Dispermum</i> Wall	Oleaceae
20	<i>J. Lanceolaria</i> Roxb	Oleaceae
21	<i>J.laurifolium</i> Roxb	Oleaceae

22	<i>Marsdenia tinctoria</i> Br	Asclepiadaceae
23	<i>Mikania micrantha</i> H. B & K	Asteraceae
24	<i>Mimosa himalayana</i> Gamble	Mimosaceae
25	<i>Modecca trilobata</i> Roxb	Passifloraceae
26	<i>Myrioneuronsmi lacifolia</i> Wall.	Oleaceae
27	<i>Myxopyrumsmi lacifolium</i> Bl	Oleaceae
28	<i>Oxymitra fornicata</i> (Roxb.) Hook. f. &	Annonaceae
29	<i>Pericampylus glaucus</i> (Colebr) Miers	Menispermaceae
30	<i>Piper attenuatum</i> Ham.	Piperaceae
31	<i>P. Griffithii</i> C.DC.	Piperaceae
32	<i>P. Hymanophyllum</i> Miq.	Piperaceae
33	<i>P. Syvaticum</i> Roxb.	Piperaceae
34	<i>Polygonum chinense</i> . Linn.	Polygonaceae
35	<i>Pothos cathcartii</i> Schott.	Araceae
36	<i>Rapidophora hookari</i> (Scott).	Araceae
37	<i>Rourea caudata</i> Planch.	Connaraceae
38	<i>Rubus hamiltoni</i> Hk.f .	Rosaceae
39	<i>Sabia limoniaceae</i> Wall.	Sabiaceae
40	<i>Smilex lancaefolia</i> Roxb.	Liliaceae
41	<i>Stemona tuberosa</i> Lour.	Stemonaceae
42	<i>Stephania glandulifera</i> Nees.	Menispermaceae
43	<i>S.hernandifolia</i> (Wall) Walp.	Manispermaceae
44	<i>Tetracera sarmentosa</i> L.	Deliniaceae
45	<i>Tetrastigma planicaulata</i> Hk.f.	Vitaceae
46	<i>Thunbergia coccnea</i> Wall.	Acanthaceae
47	<i>T. grandiflora</i> Roxb.	Acanthaceae
48	<i>Vitis capriolata</i> .D.Don.	Vitaceae
49	<i>V. elongata</i> Wall.	Vitaceae
50	<i>V.lanceolaria</i> Roxb.	Vitaceae
51	<i>V. trifolia</i> Linn	Vitaceae

Orchids

Sl. no	Species	Flowering	Habitat
	Acampe		
1	<i>Acampe praemorsa</i> (roxburgh)	Nov – Dec	Epiphyte on tree trunk
2	<i>Epidendrum praemorsum</i>	Nov – Dec	Epiphyte on tree trunks or large branches.
3	<i>Acampe rigida</i>	June – July	Epiphyte on tree trunks or large branches.
	Acanthephippium		
4	<i>Acanthephippium striatum</i>	June – July	Grow in shaded and humid places in dense forests, banks of streams
	Aerides		
5	<i>Aerides multiflora</i>	May – July	Shaded and humid places in dense forests, banks of streams
6	<i>Aerides odorata</i>	May – June	Epiphyte in lowland forest
	Agrostophyllum		
7	<i>Agrostophyllum planicaule</i>	Aug – Oct	Epiphyte deciduous and humid forest
8	<i>Agrostophyllum khasianum</i>	Aug – Octr	Epiphyte deciduous and humid forest
	Bryobium		
9	<i>Bryobium pudicum</i>	April – Aug	Epiphyte, deciduous and evergreen forest
	Bulbophyllum		

10	<i>Bulbophyllum affine</i>	June – Aug	Epiphyte, humid forest
11	<i>Bulbophyllum andersonii</i>	October	Epiphyte, humid forest
12	<i>Bulbophyllum careyanum</i>	October – December	Epiphyte on tree trunks in humid forest
13	<i>Bulbophyllum delitescens</i>	June – July	Epiphyte in humid evergreen near a waterfall
14	<i>Bulbophyllum odoratissimum</i>	May – Sept	Epiphyte in humid evergreen near a waterfall
15	<i>Bulbophyllum roxburghii</i>	April – July	Epiphytic in evergreen forest
16	<i>Bulbophyllum spathulatum</i>	April	Epiphytic in evergreen forest
	Calanthe		
17	<i>Calanthe sylvatica</i>	Aug – Sept	Terrestrial in damp places
	Callostylis		
18	<i>Callostylis rigida</i>	Jan – March.	Epiphytic on trees in mixed forests
	Ceratostylis		
19	<i>Ceratostylis subulata</i>	May – Aug	Epiphyte in dense humid forest
	Cleisocentron		
20	<i>Cleisocentron pallens</i>	June – July	Epi. on tree trunks humid forests
21	<i>Cleisocentron trichromum</i>	Jan – March	Epiphytic on trees in mixed forests
	Cleisostoma		
22	<i>Cleisostoma appendiculatum</i>	Aug– Oct	Epiphytic, tree trunks in evergreen forests
23	<i>Cleisostoma filiforme</i>	April – June	Epiphytic, tree trunks in evergreen forests
24	<i>Cleisostoma paniculatum</i>	Sept – Feb	Epiphytic, tree trunks in evergreen forests
25	<i>Cleisostoma simondii</i>	Aug– Oct	Epiphyte, thick-barked tree trunks in humid forest
26	<i>Cleisostoma subulatum</i>	May – June	Epiphyte, tree trunk in dense humid forest
	Coelogyne		
27	<i>Coelogyne fimbriata</i>	Oct– Dec	Epiphyte, on tree trunk in humid forest
28	<i>Coelogyne ovalis</i>	Aug– Dec	Epiphyte on tree trunk in humid forest
29	<i>Collabium chinense</i>	June – July	Shaded and humid places in dense forests
	Crepidium		
30	<i>Crepidium acuminatum</i>	June – July	Terrestrial in dense evergreen forest on rocky terrain, also in the lowlands
	Cymbidium		
31	<i>Cymbidium aloifolium</i>	April – May	Epiphyte on tree trunk in humid forest
32	<i>Cymbidium bicolor</i>	May – June	Epiphyte on tree trunk in humid forest
33	<i>Cymbidium dayanum</i>	June – July	Epiphyte on tree trunk in humid forest
	Dendrobium		
34	<i>Dendrobium acinaciforme</i>	June – Aug	Epiphyte on tree trunk in humid forest
35	<i>Dendrobium aduncum</i>	May	Epiphyte on a small tree evergreen forest
36	<i>Dendrobium aphyllum</i>	April – May	Epiphyte in mixed deciduous forest
37	<i>Dendrobium densiflorum</i>	April – July	Epiphyte tree trunk in evergreen forest
38	<i>Dendrobium fimbriatum</i>	March – May	Epiphyte in humid evergreen forest
39	<i>Dendrobium fugax</i>	March – October	Epiphyte, evergreen, mixed deciduous forest
40	<i>Dendrobium lituiflorum</i>	April – May	Epiphytic on tree trunks in open forests
41	<i>Dendrobium moschatum</i>	April – June	Epiphytic on tree trunks in open forests
42	<i>Dendrobium nobile</i>	April – May	Epiphyte, humid evergreen forest, in lowlands
43	<i>Dendrobium stuposum</i>	June – Aug	Epiphytic, tree trunks, open, mountain

			forests
44	<i>Dendrobium sulcatum</i>	April – May	Epiphytic on tree trunks in dense forests
45	<i>Dendrobium terminale</i>	April – June	Epiphytic on tree trunks at forest
46	<i>Dendrobium transparens</i>	April – May	Epiphytic on tree trunks at forest
	Didymoplexis		
47	<i>Didymoplexis pallens</i>	May – June	Terrestrial, growing in bamboo forest
	Dienia		
48	<i>Dienia ophrydis</i>	May – June	Terrestrial in open humid evergreen forest
	Eria		
49	<i>Eria connata</i>	July – Sept	Epiphyte in dense humid evergreen forest
50	<i>Eria ferruginea</i>	June – July	Epiphyte in dense humid evergreen forest
51	<i>Eria lasiopetala</i>	March – April	Epiphyte in humid forest
	Eulophia		
52	<i>Eulophia dabia</i>	Aug – Dec	Terrestrial, grow on open and loose soil
	Gastrochilus		
53	<i>Gastrochilus calceolaris</i>	Oct – Nov	Epiphyte in humid forest
54	<i>Gastrochilus dasypogon</i>	Oct – Nov	Epiphyte in humid forest
55	<i>Gastrochilus inconspicuus</i>	June – July	Epiphyte, humid evergreen forest
	Geodorum		
56	<i>Geodorum densiflorum</i>	June – July	Terrestrial in evergreen forest, grass land
	Goodyera		
57	<i>Goodyera procera</i>	April – June	Terrestrial, bank of a small stream and in evergreen forest, also on rock in a stream
	Habenaria		
58	<i>Habenaria stenopetala</i>	Aug – Oct	Terrestrial in evergreen forest
	Hetaeria		
59	<i>Hetaeria affinis</i>	Jan– Feb	Terrestrial, secondary evergreen forest
	Liparis		
60	<i>Liparis mannii</i>	Nov– Jan	Epiphyte in humid evergreen forest
61	<i>Liparis viridiflora</i>	April – May	Epiphyte in humid evergreen forest
	Luisia		
62	<i>Luisia trichorrhiza</i>	March – May	Epiphyte, humid forest, grow on exposed trees
63	<i>Luisia tristis</i>	April – May	Epiphyte in humid evergreen forest,
	Micropera		
64	<i>Micropera rostrata</i>	April – May	Epiphyte on tree trunk in evergreen forest
	Mycaranthes		
65	<i>Mycaranthes floribunda</i>	Dec – March	Epiphyte in dense humid evergreen forest
66	<i>Mycaranthespannea</i>	May – July	Epiphyte in dense evergreen forest
67	<i>Micropera rostrata</i>	April – May	Epiphyte on tree trunk in tropical forest
	Nervilia		
68	<i>Nervilia juliana</i>	May – July	Terrestrial, grow on open and loose soil
	Oberonia		
69	<i>Oberonia mucronata</i>	Sept – Oct	Epiphyte on tree trunk in tropical forest
	Papilionanthe		
70	<i>Papilionanthe teres</i>	April – May	Epiphyte, mixed deciduous forest, also on solitary roadside trees
	Phaius		
71	<i>Phaius mishmensis</i>	Nov – Jan	Terrestrial, in e humid evergreen forest

72	<i>Phaius tankervilleae</i>	Nov – Jan	Terrestrial, damp places in forests
	Phalaenopsis		
73	<i>Phalaenopsis deliciosa</i>	May – July	Epiphyte along a large river, in a shady spot in humid evergreen forest
74	<i>Phalaenopsis mannii</i>	March – May	Epiphytic on tree trunks in EG forests
75	<i>Phalaenopsis parishii</i>	March – April	Epiphytic on tree trunks in open forests
	Pholidota		
76	<i>Pholidota articulata</i>	July – Oct	Epiphyte in dense humid evergreen forest close to a waterfall
77	<i>Pholidota imbricata</i>	June – Aug	Epiphyte on tree humid evergreen forest
	Pinalia		
78	<i>Pinalia acervata</i>	May – July	Epiphyte in dense humid evergreen forest
79	<i>Pinalia amica</i>	March – May	Epiphyte in dense humid evergreen forest
80	<i>Pinalia pumila</i>	Jan – March	Epiphyte, humid forest
	Podochilus		
81	<i>Podochilus cultratus</i>	April – May	Epiphyte, tree trunk, wet evergreen forest
	Pomatocalpa		
82	<i>Pomatocalpa undulatum</i>	March – May	Epiphyte in the wet evergreen forest
	Rhynchostylis		
83	<i>Rhynchostylis retusa</i>	May – June	Epiphyte, evergreen, mixed deciduous forest,
	Robiquetia		
84	<i>Robiquetia spatulata</i>	May – July	Epiphyte humid evergreen forest
	Spiranthes		
85	<i>Spiranthes sinensis</i>	June – Aug	Epiphyte in wet evergreen tropical forest
86	<i>Podochilus khasianus</i>	Feb-April	Terrestrial in open grassland
	Tainia		
87	<i>Tainia latifolia</i>	March – May	Terrestrial, dense humid evergreen forest
88	<i>Tainia minor</i>	June – Aug	Terrestrial, dense humid evergreen forest
	Thelasis		
89	<i>Thelasis longifolia</i>	June – Aug	Epiphytic in evergreen forest
	Thrixspermum		
90	<i>Thrixspermum centipeda</i>	May – Aug	Epiphyte, mixed deciduous humid forest
	Trichotosia		
91	<i>Trichotosia velutina</i>	Aug – Sept	Epiphyte on tree trunks in humid forest
	Tropidia		
92	<i>Tropidia curculigoides</i>	Sept – Nov	Terrestrial, dense humid evergreen forest
	Vanda		
93	<i>Vanda tessellata</i>	April – June	Epiphytic on trees in mixed forests
94	<i>Vanda testacea</i>	May – June	Epiphytic on tree trunks in dense forests
	Zeuxine		
95	<i>Zeuxine glandulosa</i>	March- April	Grow in dense forest, shady place
96	<i>Zeuxine goodyeroides</i>	Jan – Feb	Grow in dense forest, shady place
97	<i>Zeuxine lindleyana</i>	March – April	Terrestrial, growing in grass land
98	<i>Zeuxine sstrateumatica</i>	Jan–March	Terrestrial, growing in grass land

Source: A checklist of orchids in Tinsukia District by Khyanjeet Gogoi, Daisa Bordoloi Nagar, Talap, Tinsukia in EastHimalayan Society for Spermatophyte Taxonomy ISSN: 0973-9467

List of Fauna:

The detail list of different fauna found in this division is shown in Table 5

Table 5: List of Fauna in Dibrugarh Division, Assam

Mammals			
Sl. No.	Vernacular Name	Scientific Name	Status
1	Chinese Pangolin	<i>Manis pentadactyla</i>	Rare
2	Flying fox	<i>Pterocarpus giganteus</i>	Rare
3	Slow Loris	<i>Nycticebus bengalensis</i>	Threatened
4	Stump-tailed Macaque	<i>Macaca arctoides</i>	Rare
5	Assamese Macaque	<i>Macaca assamensis</i>	Common
6	Northern Pig-tailed Macaque	<i>Macaca leonina</i>	Rare
7	Pig tailed macaque	<i>M. nemestrina</i>	Rare
8	Rhesus Macaque	<i>Macaca mulata</i>	Threatened
9	Capped Langur	<i>Trachypithecus pileatus</i>	Common
10	Western Hoolock Gibbon	<i>Hoolock hoolock</i>	Threatened
11	Asiatic black bear	<i>Ursus thibetanus</i> (Schedule-1)	Few
12	Malayan Sunbear Sloth Bear	<i>Melursus ursinus</i>	Rare
13	Indian Wild Dog (Dhole)	<i>Cuon alpinus</i>	Rare
14	Yellow throated marten	<i>Martes flavigula</i>	Threatened
15	Hog Badger	<i>Arctonyx collaris</i>	Threatened
16	Binturong	<i>Arctictis binturong</i>	Threatened
17	Jackal	<i>Canis aureus</i>	Threatened
18	Jungle Cat	<i>Felis chaus</i>	Common
19	Fishing Cat	<i>Prionailurus viverrinus</i>	Rare
20	Golden Cat	<i>Catopuma temminckii</i>	Rare
21	Leopard Cat	<i>Prionailurus bengalensis</i>	Endangered
22	Marble Cat	<i>Pardofelis marmorata</i>	Endangered
23	Clouded Leopard	<i>Neofelis nebulosa</i>	Endangered
24	Common Leopard	<i>Panthera pardus</i>	Few
25	Royal Bengal Tiger	<i>Panthera tigris</i>	Endangered
26	Asian Elephant	<i>Elephus maximus</i>	Endangered
27	Wild Pig	<i>Sus scrofa</i>	Common
28	Sambar	<i>Cervus unicolor</i>	Rare
29	Indian Muntjac	<i>Muntiacus muntjak</i>	Threatened
30	Small Indian Civet	<i>Viverricula indica</i>	Common
31	Large Indian Civet	<i>Viverra zibetha</i>	Common
32	Common Palm Civet	<i>Paradoxurus jerdoni</i>	Rare
33	Masked Palm Civet	<i>Paguma larvata</i>	Rare
34	Crab Eating Mongoose	<i>Herpestes urva</i>	Common
35	Grey Mongooses	<i>Herpestes edwardsii</i>	Common
36	Small Asian Mongoose	<i>Herpestes javanicus</i>	Common
37	Small Asian Clawed Otter	<i>Amblonyx cinereus</i>	Rare
38	Gaur (dung and tracks).	<i>Bos gaurus</i>	Threatened
39	Serow	<i>Capricornis sumatraensis</i>	Rare
40	Malayan Giant Squirrel	<i>Ratufa bicolor</i>	Rare
41	Hoary-bellied Himalayan Squirrel	<i>Callosciurus pygerythrus</i>	Threatened
42	Pallas' red-bellied squirrel	<i>Callosciurus erythraeus</i>	Common

43	Himalayan Stripped Bellied Squirrel	<i>Tamiops maclellandii</i>	Common
44	Northern Red Giant Flying Squirrel	<i>Petaurista petaurista candidula</i>	Common
45	Asian Red-cheeked squirrel	<i>Dremomys rufigenis</i>	Common
46	Parti-colored flying squirrel	<i>Hylopetes alboniger</i>	Common
47	Hoary bamboo rat	<i>Rhizomys pruinosus</i>	Common
48	Chinese or crestless Himalayan porcupine	<i>Hystrix brachyura</i>	Rare
49	Brushtailed Porcupine	<i>Atherurus macrourus</i>	Rare
50	Rufous tailed hare	<i>Lepus nigricollis Syn.ruficaudatus</i>	Threatened
51	Chinese Pangolin	<i>Manis pentadactyla</i>	Threatened
52	White-tailed Mole	<i>Parascaptor sp.</i>	Rare
53	House Rat	<i>Rattus rattus</i>	Common
54	Himalayan Rat	<i>Rattus nitidus</i>	Common
55	House mouse	<i>Mus musculus</i>	Common
56	Northern tree shrew	<i>Tupaia belangeri</i>	Common
57	Indian Flying Fox	<i>Pteropus giganteus</i>	Threatened
58	Dobson's Horseshoe Bat	<i>Rhinolophus yunanensis</i>	Common
59	Greater False Vampire Bat	<i>Megaderma lyra</i>	Common
60	Gangetic Dolphin	<i>Platanista gangetica</i>	Endangered

Avifauna(Birds)			
Sl. No.	Common Name	Scientific name	Status
Phasianidae			
1	Red Jungle Fowl	<i>Gallus gallus</i>	R, C
2	White-cheeked Partridge	<i>Arborophila atrogularis</i>	R, r (NT)
3	Rufous-throated Partridge	<i>Arborophila rufogularis</i>	R, r
4	Kaleej Pheasant	<i>Lophura leucomelanos</i>	R, r
5	Grey Peacock Pheasant	<i>Polyplectron bicalcaratum</i>	R, r
6	Barred Buttonquail	<i>Turnix suscitator</i>	R, C
7	Small Buttonquail	<i>Turnix sylvatica</i>	R, C
8	Blue-breasted Quail	<i>Coturnix chinensis</i>	R, r
9	Black Francolin	<i>Francolinus francolinus</i>	R, C
10	Swamp Francolin	<i>Francolinus gularis</i>	R, r, VU
Anatidae			
11	Ruddy Shelduck	<i>Tadorna ferruginea</i>	WM, C
12	White-wing Wood Duck	<i>Cairina scutulata</i>	R, r (EN)
13	Lesser Whistling Teal	<i>Dendrocygna javanica</i>	R, C
14	Openbill stork	<i>Anastomus oscitans</i>	R, C
15	Lesser Adjutant Stork	<i>Leptoptilos javanicus</i>	R, C (VU)
Ardeidae			
16	Cattle Egret	<i>Bulbulcus ibis</i>	R, C
17	Little Egret	<i>Egretta arzetta</i>	R, C
18	Large Egret	<i>Casmerodius albus</i>	R, C
19	Little Heron	<i>Butorides striatus</i>	R, C
20	Indian Pond Heron	<i>Ardeola grayii</i>	R, C
21	Cinnamon Bittern	<i>Ixobrychus scinnamomeus</i>	R, r
22	Yellow Bittern	<i>Ixobrychus sinensis</i>	R, r
Phalacrocoracidae			

23	Indian Cormorant	<i>Phalacrocorax fuscicollis</i>	R, r
24	Great Cormorant	<i>Phalacrocorax carbo</i>	WM, C
25	Little Cormorant	<i>Microcarbo niger</i>	R, C
	Anhingidae		
26	Oriental Darter	<i>Anhinga melanogaster</i>	NT, R, r
	Accipitridae		
27	Crested Serpent Eagle	<i>Spilornis cheela</i>	R, C
28	Eurasian Sparrowhawk	<i>Accipiter nisus</i>	R, C
29	Crested Goshawk	<i>Accipiter trivirgatus</i>	R, r
30	Pied Harrier	<i>Circus melanoleucos</i>	WM, r
31	Black Kite	<i>Milvus migrans</i>	R, r
32	Shikra	<i>Accipiter badius</i>	R, C
33	Long-billed Vulture	<i>Gyps indicus</i>	R, r (CR)
34	Indian White-backed Vulture	<i>Gyps bengalensis</i>	CR, R, r
35	Greater Grey-headed Fish-Eagle	<i>Ichthyophaga ichthyaetus</i>	NT, R, r
	Falconidae		
36	Common Kestrel	<i>Falco tinnunculus</i>	WM, C
	Rallidae		
37	White-breasted Waterhen	<i>Amaurornis phoenicurus</i>	R, C
38	Water Cock	<i>Gallicrex cinerea</i>	R, r
39	Purple Moorhen	<i>Porphyrio porphyrio</i>	WM, C
40	Common Moorhen	<i>Gallinula chloropus</i>	WM, C
	Charadriidae		
41	Little-ring Plover	<i>Charadrius dubius</i>	R, C
42	Lesser Sand Plover	<i>Charadrius mongolus</i>	WM, C
43	Little Stint	<i>Calidris minuta</i>	WM, C
44	Red-wattled Lapwing	<i>Vanellus indicus</i>	R, C
45	River Lapwing	<i>Vanellus duvaucelii</i>	R, C
	Scolopacidae		
46	Common Snipe	<i>Gallinago gallinago</i>	WM, r
47	Pintail Snipe	<i>Gallinago stenura</i>	WM, C
48	Common Greenshank	<i>Tringa nebularia</i>	
49	Common Sandpiper	<i>Actitis hypoleucos</i>	WM, C
	Laridae		
50	River Tern	<i>Sterna aurantia</i>	WM, C
	Columbidae		
51	Pompadour Green Pigeon	<i>Treron pompadoura</i>	R, C
52	Yellow-footed Green Pigeon	<i>Treron phoenicoptera</i>	R, C
53	Thick-billed Green Pigeon	<i>Treron curvirostra</i>	R, C
54	Pin-tailed Green Pigeon	<i>Treron apicauda</i>	R, C
55	Wedge-tailed Green Pigeon	<i>Treron sphenura</i>	R, C
56	Green Imperial Pigeon	<i>Ducula aenea</i>	R, C
57	Mountain Imperial Pigeon	<i>Ducula badia</i>	R, C, VU
58	Purple Wood Pigeon	<i>Columba pulchricollis</i>	R, C
59	Ashy Wood Pigeon	<i>Columba pulchricollis</i>	
60	Spotted Dove	<i>Streptopelia chinensis</i>	R, C
61	Oriental Turtle Dove	<i>Streptopelia orientalis</i>	R, r
62	Red Collared Dove	<i>Streptopelia tranquebarica</i>	R, r

63	Emerald Dove	<i>Chalcophaps indica</i>	R, r
64	Eurasian Collard Dove	<i>Streptopelia decaocto</i>	R, r
65	Barred Cuckoo Dove	<i>Macropygia unchall</i>	R, r
Psittacidae			
66	Rose-ringed Parakeet	<i>Psittacula krameri</i>	R, C
67	Alexandrine Parakeet	<i>Psittacula eupatria</i>	R, C
68	Red-breasted Parakeet		R, C
69	Blossom-headed Parakeet		R, r
Cuculidae			
70	Drongo Cuckoo	<i>Surniculus lugubris</i>	SM, r
71	Large Hawk Cuckoo	<i>Heirococyx sparverioides</i>	
72	Common Hawk Cuckoo	<i>Heirococyx varius</i>	R, r
73	Indian Cuckoo	<i>Cuculus micropterus</i>	R, C
74	Rufous-bellied Plaintive Cuckoo	<i>Cacomantis merulinus</i>	R, r
75	Pied Crested Cuckoo	<i>Clamator jacobinus</i>	SM, r
76	Red-winged Crested Cuckoo	<i>Clamator coromandus</i>	R, r
77	Asian Koel	<i>Eudynamys scolopacea</i>	R, C
78	Green-billed Malkoha	<i>Phaenicophaeus tristis</i>	R, C
79	Lesser Coucal	<i>Centropus bengalensis</i>	R, C
80	Greater Coucal	<i>Centropus sinensis</i>	R, C
Strigidae			
81	Spotted Owlet	<i>Athene brama</i>	R, r
82	Collared Owlet	<i>Glaucidium brodiei</i>	R, r
83	Asian Barred Owlet	<i>Glaucidium cuculoides</i>	R, r
84	Brown Fish Owl	<i>Ketupa zeylonensis</i>	R, r
85	Spotted Scops Owl	<i>Otus spilocephalus</i>	R, r
Caprimulgidae			
86	Grey Nightjar	<i>Caprimulgus indicus</i>	R, r
Apodidae			
87	Asian Palm Swift	<i>Cypsiurus balasiensis</i>	R, C
88	Himalayan Swiftlet	<i>Collocalia fuciphaga</i>	R, r
89	House Swift	<i>Apus affinis</i>	R, C
Trogonidae			
90	Red-headed Trogon	<i>Herpactes erythrocephalus</i>	R, C
Coraciidae			
91	Indian Roller	<i>Coracias benghalensis</i>	R, C
92	Oriental Broad-billed Roller	<i>Eurystomus orientalis</i>	
Alcedinidae			
93	White-breasted Kingfisher	<i>Halcyon smyrensis</i>	R, C
94	Common Kingfisher	<i>Alcedo atthis</i>	R, C
95	Crested Kingfisher	<i>Magaceryle lugubris</i>	R, C
96	Ruddy Kingfisher	<i>Halcyon coromanda</i>	R, r
97	Oriental Dwarf Kingfisher	<i>Ceyx erithacus</i>	R, r
98	Pied Kingfisher	<i>Ceryle rudis</i>	R, C
99	Blue-eared Kingfisher	<i>Alcedo meninting</i>	R, r
100	Stork-billed Kingfisher	<i>Halcyon capansis</i>	R, r
Meropidae			
101	Green Bee-eater	<i>Merops orientalis</i>	R, C

102	Blue-bearded Bee-eater	<i>Nyctornis athertoni</i>	R, r
	Upupidae		
103	Hoopoe	<i>Upupa epops</i>	R, C
	Bucerotidae		
104	Oriental Pied Hornbill	<i>Anthracoceros albrostris</i>	R, C
105	Brown Hornbill	<i>Anorrhinus austeni</i>	R, r, En (NT)
106	Wreathed Hornbill	<i>Aceros undulatus</i>	R, C
107	Great Pied Hornbill	<i>Buceros bicornis</i>	R, r (NT)
	Megalaimidae		
108	Coppersmith Barbet	<i>Megalaima haemocephala</i>	R, C
109	Blue-throated Barbet	<i>Megalaima asiatica</i>	R, C
110	Lineated Barbet	<i>Megalaima lineata</i>	R, C
111	Great Barbet	<i>Megalaima virens</i>	R, r
112	Golden-throated Barbet	<i>Megalaima franklinii</i>	R, r
	Picidae		
113	Fulvous-breasted Woodpecker	<i>Dendrocopos macei</i>	R, r
114	Grey-headed Woodpecker	<i>Picuscanus</i>	R, r
115	Greater Yellownape Woodpecker	<i>Chrysophlegma flavinucha</i>	R, C
116	Lesser Yellownape Woodpecker	<i>Picus chlorolophus</i>	R, C
117	Rufous Woodpecker	<i>Celeus brachyurus</i>	R, C
118	Bay Woodpecker	<i>Blythipicus pyrrhotis</i>	R, C
119	Himalayan Flameback	<i>Dinopium shorii</i>	R, C
120	Greater Flameback	<i>Chrysocolaptes guttacristatus</i>	R, r
121	Pale-headed Woodpecker	<i>Gecinulus grantia</i>	R, r
122	Crimson-breasted Woodpecker	<i>Dendrocopos cathpharius</i>	R, r
123	White-browed Piculet	<i>Sasia ochracea</i>	R, r
124	Speckled Piculet	<i>Picumnus innominatus</i>	R, r
	Pittidae		
125	Blue Pitta	<i>Pita cyanea</i>	R, r
126	Blue-naped Pitta	<i>Pitta nipalensis</i>	R, r
	Aegithinidae		
127	Common Lora	<i>Aegithina tiphia</i>	R, r
	Campephagidae		
128	Rosy Minivet	<i>Pericrocotus roseus</i>	WM, r
129	Scarlet Minivet	<i>Pericrocotus flammeus</i>	R, C
130	Grey-chinned Minivet	<i>Pericrocotus solaris</i>	R, C
131	Long-tailed Minivet	<i>Pericrocotus ethologus</i>	R, C
132	Large Cuckoo-shrike	<i>Coracina macei</i>	R, C
133	Black-winged Cuckoo-shrike	<i>Coracina melaschistos</i>	R, C
134	Large Wood-shrike	<i>Tephrodornis gularis</i>	R, C
135	Pied Flycatcher-shrike	<i>Hemipus picatus</i>	R, r
	Lanidae		
136	Brown Shrike	<i>Lanius cristatus</i>	WM, r
137	Grey-backed Shrike	<i>Lanius tephronotus</i>	R, r
	Monarchidae		
138	Asian Paradise Flycatcher	<i>Terpsiphone paradisi</i>	SM, r
	Motacillidae		
139	White Wagtail	<i>Motacilla alba</i>	WM, C

140	Grey Wagtail	<i>Motacilla cinerea</i>	WM, r
141	Citrine Wagtail	<i>Motacilla citreola</i>	WM, C
142	Paddyfield Pipit	<i>Anthus rufulus</i>	R, C
	Paridae		
143	Great Tit	<i>Parus major</i>	R, C
144	Sultan Tit	<i>Melanochloa sultanea</i>	R, C
145	Green-backed Tit	<i>Parus monticolus</i>	R, r
	Timaliidae		
146	Striated Marsh-Warbler	<i>Megalurus palustris</i>	R, C
147	Abott's babbler	<i>Malacocinda abbotti</i>	R, C
148	Rufous-capped Babbler	<i>Stachyris ruficeps</i>	R, C
149	Golden Babbler	<i>Stachyris chrysaea</i>	R, C
150	Spot-throated Babbler	<i>Pellorneum albiventre</i>	R, C
151	Pygmy Wren Babbler	<i>Pnoepyga pusilla</i>	R, C
152	Chestnut-capped Babbler	<i>Timalia pileata</i>	R, C
153	White-browed Scimitar Babbler	<i>Pomatorhinus schisticeps</i>	R, C
154	Streak-breasted Scimitar Babbler	<i>Pomatorhinus ruficollis</i>	R, C
155	Wedge-billed Wren Babbler	<i>Sphenocichla humei</i>	R, r, En (NT)
156	Marsh Babbler	<i>Pellorneum palustre</i>	R, r, En (NT)
157	Striped Tit Babbler	<i>Macronous gularis</i>	R, C
158	Yellow-eyed Babbler	<i>Chrysomma sinense</i>	R, C
159	Striated Babbler	<i>Turdoides earlei</i>	R, C
160	Slender-billed babbler	<i>Turdoides longitostris</i>	R, r (VU)
161	Jungle Babbler	<i>Turdoides striatus</i>	R, C
162	Silver-eared Mesia	<i>Leiothrix argentauris</i>	R, C
163	White-crested Laughing Thrush	<i>Garrulax leucolophus</i>	R, r
164	White-throated Laughing thrush	<i>Garrulax albogularis</i>	R, r
165	Greater-necklace Laughing Thrush	<i>Garrulax pectoralis</i>	R, C
166	Lesser-necklace Laughing Thrush	<i>Garrulax monileger</i>	R, C
167	Striated Laughing Thrush	<i>Garrulax striatus</i>	R, C
168	Rufous-vented Laughing Thrush	<i>Garrulax gularis</i>	R, C
169	Rufous-necked Laughing Thrush	<i>Garrulax ruficollis</i>	R, r
170	Blue Rock-Thrush	<i>Monticola solitarius</i>	WM, C
171	Red Faced Liocichla	<i>Liocichla phoenicea</i>	R, C
172	White-naped Yuhina	<i>Yuhina bakeri</i>	R, r, En
173	White-bellied Yuhina	<i>Yuhina zantholeuca</i>	R, r
174	Black-chinned Yuhina	<i>Yuhina nigrimenta</i>	R, r
175	Whiskered Yuhina	<i>Yuhina flavicollis</i>	R, C
176	Nepal Fulvetta	<i>Alcippe nipalensis</i>	R, C
177	Long-tailed Sibia	<i>Heterophasia picaodes</i>	R, C
178	Beautiful Sibia	<i>Heterophasia pulchella</i>	R, r, En
179	Cutia	<i>Cutiani palensis</i>	R, r
180	Common Tailorbird	<i>Orthotomus sutorius</i>	R, C
181	Mountain Tailorbird	<i>Orthotomus cuculatus</i>	R, C
	Phyllocopidae		
182	Grey-cheeked Warbler	<i>Seicercus poliogenys</i>	R, C
183	Grey-hooded Warbler	<i>Seicercus xanthoschistos</i>	R, C
184	Greenish Warbler	<i>Phylloscopustro chiloides</i>	WM, r

	Cettidae		
185	Black-faced Warbler	<i>Abroscopus schisticeps</i>	R, C
186	Rufous-faced Warbler	<i>Abroscopus albogularis</i>	R, C
187	Grey-sided Bush-warbler	<i>Cettia brunnifrons</i>	R, C
188	Aberrant-bush warbler	<i>Cettia flavolivacea</i>	R, r
	Muscicapidae		
189	Grey-headed Canary-flycatcher	<i>Culicicapa ceylonensis</i>	R, r
190	Pale Blue-flycatcher	<i>Muscicapa unicolor</i>	R, r
191	Little Pied-flycatcher	<i>Ficedula westermanni</i>	R, r
192	White Gorgeted-flycatcher	<i>Ficedula monileger</i>	R, r
193	Sapphire Flycatcher	<i>Ficedula sapphira</i>	R, r
194	Rufous Gorgeted-flycatcher	<i>Ficedula strophitata</i>	R, r
195	Snowy Browed-flycatcher	<i>Ficedula hyperythra</i>	R, r
196	Pygmy Blue-flycatcher	<i>Muscicapella hodgsoni</i>	R, r
197	Magpie Robin	<i>Copsychus saularis</i>	R, C
198	Common Stonechat	<i>Saxicola torquata</i>	WM, r
199	Grey Bushchat	<i>Saxicola ferrea</i>	R, C
200	White-rumped Shama	<i>Copsychus malabaricus</i>	R, r
201	Rufous-breasted Bush Robin	<i>Tarsiger indicus</i>	R, r
202	White-crowned Forktail	<i>Enicurus leucogenys</i>	R, C
203	Black-backed Forktail	<i>Enicurus immaculatus</i>	R, C
204	Slaty-backed Forktail	<i>Enicurus schistaceus</i>	R, C
205	Small Niltava	<i>Niltava macgrigoriae</i>	R, C
206	Green Cochoa	<i>Cochoa viridis</i>	SM, r
207	White-capped Water-redstart	<i>Chaimarrornis leucocephalus</i>	R, r
208	Daurian Redstart	<i>Phoenicurus aureus</i>	WM, r
209	Plumbeous Water-redstart	<i>Rhyacornis fuliginosus</i>	R, C
	Cisticolidae		
210	Grey-breasted Prinia	<i>Prinia hodgsonii</i>	R, C
211	Striated Prinia	<i>Prinia criniger</i>	R, C
212	Beavan's Prinia	<i>Prinia rufescens</i>	R, C
	Turdidae		
213	Blue Whistling Thrush	<i>Myophonus caeruleus</i>	R, C
214	Orange headed Thrush	<i>Zoothera citrina (SV)</i>	SM, r
215	Scaly Thrush	<i>Zoothera dauma</i>	WM, C
	Chloropseidae		
216	Blue-winged Leafbird	<i>Chloropsis cochinchinensis</i>	R, C
217	Golden-fronted Leafbird	<i>Chloropsis aurifrons</i>	R, C
218	Asian Fairy-bluebird	<i>Irena puella</i>	R, C
	Pycnonotidae		
219	Red-vented Bulbul	<i>Pycnonotus cafer</i>	R, C
220	Red-whiskered Bulbul	<i>Pycnonotus jocosus</i>	R, C
221	White-throated Bulbul	<i>Alophoixus flaveolus</i>	R, C
222	Ashy Bulbul	<i>Hemixos flava</i>	R, C
223	Himalayan Bulbul	<i>Pycnonotus leucogenys</i>	R, r
224	Striated Bulbul	<i>Pycnonotus striatus</i>	R, C
225	Black Bulbul	<i>Hypsipetes leucocephalus</i>	R, r

226	Black-crested Bulbul	<i>Pycnonotus melanicterus</i>	R, C
227	Mountain Bulbul	<i>Hypsipetes maclellandii</i>	R, C
228	Crested Finchbill	<i>Spizixo scanifrons</i>	R, C
	Sittidae		
229	Velvet-fronted Nuthatch	<i>Sitta frontalis</i>	R, C
230	Chestnut-bellied Nuthatch	<i>Sitta castanea</i>	R, C
	Saturnidae		
231	Common Myna	<i>Acridotheres tristis</i>	R, C
232	Pied Myna	<i>Sturnus contra</i>	R, C
233	Jungle Myna	<i>Acridotheres fuscus</i>	R, C
234	Grey-headed Myna	<i>Sturnus malabaricus</i>	R, C
235	Hill Myna	<i>Gracula religiosa</i>	R, r
	Oriolidae		
236	Black-headed oriole	<i>Oriolus xanthonus</i>	R, C
237	Maroon Oriole	<i>Oriolus traillii</i>	R, C
	Dicruridae		
238	Black Drongo	<i>Dicrurus macrocercus</i>	R, r
239	Bronze Drongo	<i>Dicrurus aeneus</i>	R, C
240	Spangled Drongo	<i>Dicrurus hottentottus</i>	R, C
241	Ashy Drongo	<i>Dicrurus leucophaeus</i>	WM, r
242	Lesser Racket-tailed Drongo	<i>Dicrurus remifer</i>	R, r
243	Greater Racket-tailed Drongo	<i>Dicrurus paradiseus</i>	R, r
	Corvidae		
244	Rufous Treepie	<i>Dendrocitta vagabunda</i>	R, r
245	Grey Treepie	<i>Dendrocitta formosae</i>	R, r
246	Collared Treepie	<i>Dendrocitta frontalis</i>	R, r
247	Common Green Magpie	<i>Cissa chinensis</i>	R, r
248	Jungle Crow	<i>Corvus macrorhynchus</i>	R, C
249	Common Crow	<i>Corvus splendens</i>	R, C
250	White-throated Fantail	<i>Rhipidura albicollis</i>	R, r
251	Eurasian Jay	<i>Garrulus glandarius</i>	R, r
	Passeridae		
252	House Sparrow	<i>Passer domesticus</i>	R, C
	Ploceidae		
253	Baya Weaver	<i>Ploceus philippinus</i>	R, r
	Zosteropidae		
254	Oriental white-eye	<i>Zosterops palpebrosus</i>	R, C
	Estrildidae		
255	Scaly-breasted Munia	<i>Lonchura punctulata</i>	R, C
256	White-rumped Munia	<i>Lonchura striata</i>	R, C
257	Black-headed Munia	<i>Lonchura malacca</i>	R, C
	Tichodromidae		
258	Wallcreeper	<i>Tichodroma muraria</i>	W, V
	Dicacidae		
259	Fire-breasted Flowerpecker	<i>Dicaeum ignipectus</i>	R, C
260	Scarlet-backed Flowerpecker	<i>Dicaeum cruentatum</i>	R, C
	Nectariniidae		
261	Purple-rumped sunbird	<i>Leptocoma zeylonica</i>	R, C

262	Purple Sunbird	<i>Nectarinia asiatica</i>	R, r
263	Crimson sunbird	<i>Aethopyga siparaja</i>	R, C
264	Green-tailed Sunbird	<i>Aethopyga nipalensis</i>	R, C
265	Ruby-cheeked Sunbird	<i>Anthreptesingalensis</i>	R, C
266	Fire-tailed Sunbird	<i>Aethopyga ignicauda</i>	R, r
267	Streaked Spiderhunter	<i>Arachnothera magna</i>	R, r
268	Little Spiderhunter	<i>Arachnothera longirostra</i>	R, C
Aegithalidae			
269	Black-throated Bushtit	<i>Aegithalos concinnus</i>	R, C
Hirundinidae			
270	Common Swallow	<i>Hirundo rustica</i>	WM, C

R - Resident; C - Common; r - Rare; WM - Winter Migrant; SM - Summer Migrant; V - Vagrant; EN - Endangered; En - Endemic; NT - Near Threatened; VU - Vulnerable; CR - Critically Endangered; NR - New record

Snakes		
Sl.No	Common Name	Scientific Name
	Brahminy Worm Snake	<i>Indotyphlops braminus</i>
2	Diard's Worm Snake	<i>Argyrophis diardii</i>
3	Burmese Python	<i>Python molurus bivittatus</i>
4	Green Trinket Snake	<i>Elaphe prasina</i>
5	Copper Headed Trinket Snake	<i>Coelognathus radiatus</i>
6	Common Trinket Snake	<i>Coelognathus helena helena</i>
7	Banded Trinket Snake	<i>Oreocryptophis porphyraceus</i>
8	Collared Black-headed Snake	<i>Sibynophis collaris</i>
9	Indo-Chinese Rat Snake	<i>Ptyas korros</i>
10	Indian Rat Snake	<i>Ptyas mucosa</i>
11	White-barred Khukri Snake	<i>Oligodon albocinctus</i>
12	Blue Bronze-back Tree Snake	<i>Dendrelaphis cyanochloris</i>
13	Painted Bronze-back Tree Snake	<i>Dendrelaphis pictus</i>
14	Ornate Flying Snake	<i>Chrysopelea ornata*</i>
15	White-banded Wolf Snake	<i>Dinodon septentrionalis</i>
16	Yellow-speckled Wolf Snake	<i>Lycodon jara</i>
17	Common Wolf Snake	<i>Lycodon aulicus</i>
18	Banded Wolf Snake	<i>Lycodon fasciatus</i>
19	Zaw's Wolf Snake	<i>Lycodon zawi</i>
20	Blyth's Reticulate Snake	<i>Blythia reticulata</i>
21	Assam Snail Eater	<i>Pareas monticola</i>
22	Himalayan Keelback	<i>Amphiesma platyceps</i>
23	Striped Keelback	<i>Amphiesma stolatum</i>
24	Checkered Keelback Water Snake	<i>Xenochrophis piscator</i>
25	Yellow-spotted Keelback	<i>Xenochrophis flavipunctatus</i>
26	Orange-Collared Himalayan Keelback	<i>Rhabdophis himalayanus*</i>
27	Red-necked Keelback	<i>Rhabdophis subminiatus*</i>
28	Long-nosed Whip Snake	<i>Ahaetulla nasuta*</i>
29	Short-nosed Vine Snake	<i>Ahaetulla prasina*</i>
30	Green Cat Snake	<i>Boiga cyanea*</i>
31	Eastern Cat Snake	<i>Boiga gokool*</i>

32	Large-spotted Cat Snake	<i>Boiga multomaculata</i> *
33	Common Indian Cat Snake	<i>Boiga trigonata</i> *
34	Assam Cat Snake	<i>Boiga quincunciata</i> *
35	Thai Cat Snake	<i>Boiga siamensis</i> *
36	Common Mock Viper	<i>Psammodynaste pulverulentus</i> *
37	King Cobra	<i>Ophiophagus hannah</i> **
38	Monocled Cobra	<i>Najakouthia</i> **
39	Mac Clelland's Coral Snake	<i>Sinomicrurus macclellandi</i> **
40	Banded Krait	<i>Bungarus fasciatus</i> **
41	Lesser Black Krait	<i>Bungurus lividus</i> **
42	Greater Black Krait	<i>Bungarus niger</i> **
43	White Lipped Pit Viper	<i>Trimeresurus albolabris</i> **
44	Mountain Pit Viper	<i>Ovophis moticola</i> **
45	Jerdon's Pit Viper	<i>Protobothrops jerdonii</i> **
46	Pope's Pit Viper	<i>Trimeresurus popeiorum</i> **
47	Yunnun Bamboo Pit Viper	<i>Trimeresurus yunnensis</i> **
	NOTE: * Indicates Mildly-Venomous ** Indicates Venomous	
Lizards		
Sl. No.	Common Name	Scientific Name
1	Brook's House Gecko	<i>Hemidactylus brookii</i>
2	Asian House Gecko	<i>Hemidactylus frenatus</i>
3	Flat-tailed Gecko	<i>Hemidactylus platyrus</i>
4	Yellow-green House Gecko	<i>Hemidactylus flaviviridis</i>
5	Tokay Gecko	<i>Gekko gekko</i>
6	Indo-Pacific Gecko/ Fox Gecko	<i>Hemidactylus garnotii</i>
7	Indian Garden lizard	<i>Calotes versicolour</i>
8	Jerdon's Forest lizard	<i>Calotes jerdoni</i>
9	Emma Gray's Forest Lizard	<i>Calotes emma</i>
10	Norvill's Flying lizard	<i>Draco norvillii</i>
11	Bule –Throated lizard	<i>Ptyclobaenus gularis</i>
12	Many Lined Grass Skink	<i>Eutropis multifasciata</i>
13	Bronze Grass Skink	<i>Eutropis macularia</i>
14	Spotted Litter skink	<i>Sphenomorphus maculatus</i>
15	Bengal Monitor	<i>Varanus bengalensis</i>
Tortoise/Turtles		
Sl. No.	Common Name	Scientific Name
1	Asian leaf turtle	<i>Cyclemys gemeli</i>
2	Assam roofed turtle	<i>Pangshura sylhetensis</i>
3	Southeast Asian box turtle	<i>Cuora amboinensis</i>
4	Indian softshell turtle	<i>Nilssonina gangeticus</i>
5	Narrow headed softshell turtle	<i>Chitra indica</i>
6	Flapshell turtle	<i>Lissemys punctata andersoni</i>
Amphibians		
Sl.No	Common Name	Scientific Name
1	Myanmar pelobatid toad	<i>Xenophrys cf. parva</i>
2	Red eyed Shortleg	<i>Leptobrachium smithii</i>

3	Common toad	<i>Duttaphrynus melanostictus</i>
4	Marbled toad	<i>Duttaphrynus stomaticus</i>
5	Indian Hylid Frog	<i>Hyla annectans</i>
6	Ornate narrow mouth frog	<i>Microhyla ornata</i>
7	Himalayan tree frog	<i>Polypedates himalayaensis</i>
8	Common Tree Frog	<i>Polypedates teraiensis</i>
9	Warty tree frog	<i>Theloderma asperum</i>
10	Suffry's Tree Frog	<i>Rhacophorus suffry</i>
11	Twin spotted tree frog	<i>Rhacophorus bipunctatus</i>
12	Green tree frog	<i>Rhacophorus maximus</i>
13	Bush frog	<i>Philautu ssp.</i>
14	Indian Bull frog	<i>Hoplobatrachus tigerinus</i>
15	Jerdon's Bull frog	<i>Hoplobatrachus crassus</i>
16	Pointed-nosed Frog	<i>Clinotarsus alticola</i>
17	Common water frog	<i>Euphlyctis cyanophlyctis</i>
18	Pierre's Cricket frog	<i>Fejervarya pierrei</i>
19	Small-eared Torrent Frog	<i>Amolops gerbillus</i>
20	Cope's Assam Frog	<i>Hylarana leptoglossa</i>
21	Taipeh Frog	<i>Hylarana taipehensis</i>
22	Black-spotted Frog	<i>Hylarana nigrovittata</i>
23	Broad-headed Frog	<i>Limnonectes laticeps</i>
24	Two-striped Pigmy Tree Frog	<i>Chiromantis vittatus</i>
25	Bhamo Frog	<i>Humerana humeralis</i>

Fishes

	Common Name	Scientific Name
1	Clown knifefish	<i>Chitala chitala</i> (Hamilton-Buchanan)
2	Black knifefish	<i>Notopterus notopterus</i> (Pallas)
3	Indian longfin eel	<i>Anguilla bengalensis</i> (Gray & Hardwicke)
4	Indian River Shad	<i>Gudusia chapra</i> (Hamilton Buchanan)
5	Jaya	<i>Aspidoparia jaya</i> (Hamilton-Buchanan)
6	Morar	<i>Aspidoparia morar</i> (Hamilton-Buchanan)
7	Upstream carp	<i>Bangana(Labeo) dero</i> (Hamilton-Buchanan)
8	Bared trout	<i>Barilius barila</i> (Hamilton-Buchanan)
9	Silver hill trout	<i>B. barna</i> (Hamilton-Buchanan)
10	Hamilton trout	<i>B. bendelisis</i> (Hamilton Buchanan)
11	Spotted hill trout	<i>B. tileo</i> (Hamilton Buchanan)
12	Zebra danio	<i>Brachydanio rerio</i> (Hamilton-Buchanan)
13	Indian glassy hatchet	<i>Chela laubuca</i> (Hamilton-Buchanan)
14	Mrigal	<i>Cirrhinus mrigala</i> (Hamilton-Buchanan)
15	Reba carp	<i>C. reba</i> (Hamilton-Buchanan)
16	Giant danio	<i>Danio aequipinnatus</i> (McClelland)
17	-	<i>Danio dangila</i>
18	Silver/ Turquoise danio	<i>Danio/Devario devario</i> (Hamilton-Buchanan)
19	Indian Flying barb	<i>Esomus danricus</i> (Hamilton-Buchanan)
20	Bata labeo	<i>Labeo bata</i> (Hamilton-Buchanan)
21	-	<i>L. boga</i> (Hamilton-Buchanan)
22	Black Rohu	<i>L. calbasu</i> (Hamilton-Buchanan)

23	-	<i>Labeo dyocheilus</i> (McClelland)
24	Kuria labeo	<i>L. goni</i> us(Hamilton-Buchanan)
25	Rohu	<i>L. rohita</i> (Hamilton-Buchanan)
26	Pangusia	<i>L. pangusia</i> (Hamilton-Buchanan)
27	Diamond barb	<i>Ostreobramacotio</i> (Hamilton-Buchanan)
28	Olive barb	<i>P. saranasarana</i> (Hamilton-Buchanan)
29	Soft fin barb	<i>P. sophore</i> (Hamilton-Buchanan)
30	Fire fin/ two spot barb	<i>P. ticto</i> (Hamilton-Buchanan)
31	Indian trout	<i>Raimas bola</i> (Hamilton-Buchanan)
32	Yellow tail black tip rasbora	<i>Rasbora rasbora</i> (Hamilton-Buchanan)
33	Razor belly	<i>Salmostoma bacaila</i> (Hamilton-Buchanan)
34	Balitora minnow	<i>Psilorhynchus balitora</i> (Hamilton)
35	Leopard loach	<i>Acanthocobitis botia</i> (Hamilton-Buchanan)
36	Queen loach	<i>Botiadar</i> io (Hamilton)
37	Reticulated/Twin banded loach	<i>Botia rostrata</i> (Gunther)
38	Panther loach	<i>Lepidocephalichthys guntea</i> (Hamilton-Buchanan)
39	Day's mystus	<i>Mystus bleekeri</i> (Day)
40	Gangetic mystus	<i>M. cavasi</i> us(Hamilton- Buchanan)
41	-	<i>M. dibrugarensis</i> (Chaudhuri)
42	-	<i>M. tengra</i> (Hamilton- Buchanan)
43	White catfish	<i>Rita rita</i> (Hamilton-Buchanan)
44	Long whiskered catfish	<i>Sperata aor</i> (Hamilton-Buchanan)
45	Giant river catfish	<i>S. seenghala</i> (Sykes)
46	Pabo catfish	<i>Ompok pabo</i> (Hamilton- Buchanan)
47	Boal	<i>Wallago attu</i> (Boch& Schneider)
48	Gangetic ailia	<i>Ailiacoila</i> (Hamilton- Buchanan)
49	Garuabachcha	<i>Clupiso magarua</i> (Hamilton-Buchanan)
50	Batchwavacha	<i>Eutropiichthys vacha</i> (Hamilton-Buchanan)
51	-	<i>Silonia silondia</i> (Hamilton-Buchanan)
52	Stripped Glass catfish	<i>Pseudeutropius atherinoides</i> (Bloch)
53	Gangetic goonch	<i>Bagarius bagarius</i> (Hamilton-Buchanan)
54	Whiptail catfish	<i>Sisor rabdophorus</i> (Hamilton-Buchanan)
55	Butterfly catfish	<i>Erethistes(Hara) hara</i> (Hamilton- Buchanan)
56	Magur	<i>Clarius batrachus</i> (Linn)
57	Stinging catfish	<i>Heteropneustes fossilis</i> (Bloch)
58	Long fighting catfish	<i>Olyralongi caudata</i> (McClelland)
59	Silver needlefish	<i>Xenentodon cancila</i> (Hamilton- Buchanan)
60	Peacock eel	<i>Macrogathu sara</i> (Bloch & Schneider)
61	Striped spiny green eel	<i>M. pancalus</i> (Hamilton- Buchanan)
62	Tire track spiny eel	<i>Mastacembelus armatus</i> (Lacepede)
63	Gangetic mudeel	<i>Monopterus cuchia</i> (Hamilton-Buchanan)
64	Indian glassfish	<i>Chanda nama</i> (Hamilton- Buchanan)
65	Dwarf chameleon catfish	<i>Badis badis</i> (Hamilton-Buchanan)
66	Yellow tail mullet	<i>Sicamugil cascasia</i> (Hamilton- Buchanan)
67	Sleeper goby	<i>Glossogobius giuris</i> (Hamilton-Buchanan)
68	(Ass.Senga)	<i>Channa bleeheri</i> (Hamilton-Buchanan)
69	Blue dwarf snakehead	<i>Channa gachua</i> (Bloch & Schneider)

70	Peacock snakehead	<i>C. marulius</i> (Hamilton-Buchanan)		
71	Checkered snakehead	<i>C. punctata</i> (Bloch)		
Butterfly				
Sl. No.	Scientific name	Common name	Status as per Evans 1932	Species restricted to northeastern and eastern Himalaya in India
A. Family: Hesperidae				
i. Subfamily: Coeliadinae				
1	<i>Badamia exclamationis</i> (Fabricius, 1775)	Brown Awl	Common	-
2	<i>Hasora badra badra</i> (Moore, [1858])	Common Awl	Not Rare	-
3	<i>Choaspes benjaminii japonica</i> (Murray, 1875)	Indian Awlking	Not Rare	-
4	<i>Burara jaina</i> (Moore, [1866])	Orange Awlet	Not Rare	-
ii. Subfamily: Pyrginae				
6	<i>Sarangesa dasahara dasahara</i> Moore, [1866]	Common Small Flat	Common	-
7	<i>Celaenorrhinus leucocera</i> (Kollar, [1844])	Common Spotted Flat	Common	-
8	<i>Celaenorrhinus aurivittata aurivittata</i> (Moore,1878)	Dark Yellow-banded Flat	Not Rare	Endemic
9	<i>Pseudocoladenia dan fabia</i> Evans, 1949	Fulvous Pied Flat	Common	-
10	<i>Tagiades japetusravi</i> (Moore, [1866])	Common Snow Flat	Common	-
11	<i>Tagiades litgiosaltigiosa</i> Möschler, 1878	Water Snowflat,	Not Rare	-
12	<i>Tagiades ganaathos</i> Plötz, 1884	Suffused Snow Flat	Not Rare	-
13	<i>Gerosis phisara phisara</i> (Moore, 1884)	Dusky Yellow-breast Flat	Not Rare	Endemic
14	<i>Mooreana trichoneura pralaya</i> Moore, [1866]	Yellow-veined Flat	Not Rare	Endemic
15	<i>Seseria sambara sambara</i> Moore, [1866]	Sikkim White Flat	Not Rare	-
16	<i>Odontoptilum angulata angulata</i> (. Felder, 1862)	Chestnut Angle	Not Rare	-
17	<i>Psolos fuligo subfasciatus</i> Moore, 1878	Dusky Partwing/ Coon,	Common	Endemic
iii. Subfamily: Hesperinae				
18	<i>Ochus subvittatus subradiatus</i> (Moore, 1878)	Tiger Hopper	-	Endemic
19	<i>Ampittia dioscorides</i> (Fabricius, 1793)	Bush Hopper	Common	-
20	<i>Aeromachus pygmaeus</i> Fabricius, 1775	Pygmy Scrub Hopper	Not Rare	-
21	<i>Pithauria stramineipennis</i> Wood- Mason & deNicéville, [1887]	Light Straw Ace	Not Rare	Endemic
22	<i>Thoressa cerata</i> Hewitson, 1876	Northern Spotted Ace	Not Rare	Endemic
23	<i>Halpezemazema</i> Hewitson, 1877	Banded Ace	Common	Endemic
24	<i>Halpeaucma</i> Swinhoe, 1893 (IWPA SchII)	Indian Ace	Not Rare	-
25	<i>Halpeporusporus</i> (Mabille, [1877])	Moore's Ace	Not Rare	-
26	<i>Halpekusala</i> Fruhstorfer, 1911	Hill Ace	Common	Endemic
27	<i>Sebastonymadoloia</i> Hewitson, 1868	Tufted Ace	Not Rare	Endemic
28	<i>Cupitha purreea purreea</i> (Moore, 1877)	Wax Dart,	Not Rare	-
29	<i>Potanthus pseudomaesa</i> Moore, [1881]	Indian Dart	-	-
30	<i>Telicota colon</i> (Fabricius, 1775)	Common Palm Dart	Not Rare	-
31	<i>Telicota bambusae bambusae</i> Moore, 1878	Dark Palm Dart	Common	-
32	<i>Oriens gola pseudolus</i> Mabille, 1883	Common Dartlet	Not Rare	-
33	<i>Notocrypta paralysos asawa</i> Fruhstorfer, 1911	Common Banded Demon	Common	-
34	<i>Notocrypta curvifascia curvifascia</i> (C.&R. Felder, 1862)	Restricted Demon	Common	-
35	<i>Notocrypta feisthamelii alysos</i> Moore, [1866]	Spotted Demon	Common	-
36	<i>Ancistroides nigrita diocles</i> (Moore, [1866])	Chocolate Demon	Common	-
37	<i>Iambrix salsala salsala</i> (Moore, [1866])	Chestnut Bob	Common	-
38	<i>Koruthaialos butleri butleri</i> (de Nicéville, [1884])	Dark Velvet Bob	Rare	Endemic
39	<i>Arnetta atkinsoni</i> (Moore, 1878)	Atkinson's Bob	Not Rare	-
40	<i>Scobura cephalala</i> Hewitson, 1876	Extra Forest Bob	Not Rare	Endemic
41	<i>Matapa aria</i> Moore, [1866]	Common Red Eye	Common	-

42	<i>Borbo cinnara</i> (Wallace, 1866)	Rice Swift	Common	-	
43	<i>Pelopidas</i> sp. Walker, 1870	Swift	-	-	
44	<i>Pelopidas assamensis</i> (de Nicéville, 1882) (IWPA Sch IV)	Great Swift	-	-	
45	<i>Boaris farri</i> (Moore, 1878)	Paintbrush Swift	Not Rare	-	
46	<i>Parnara guttatus</i> (Bremer & Grey, [1852])	Straight Swift	Common	-	
47	<i>Pseudoborbo bevani</i> (Moore, 1878)	Bevan's Swift	Not rare	-	
48	<i>Caltoris aurociliata</i> (Elwes& Edwards, 1897)	Yellow Fringed Swift	Rare	Endemic	
49	<i>Baoris chapmani</i> Evans, 1937	Small Paintbrush Swift	-	Endemic	
50	<i>Pyrroneura margherita</i> (Doherty, 1889)	Yellow-vein Lancer	Very Rare	Endemic	
B. Family: Papilionidae					
i. Subfamily: Papilioninae					
51	<i>Graphium eurypylus cheronus</i> (Jordan, 1909)	Great Jay	Not Rare	-	
52	<i>Graphium chironides chironides</i> (Honrath, 1884)	Veined Jay	Not Rare	-	
53	<i>Graphium agamemnon agamemnon</i> (Linnaeus, 1758)	Tailed Jay	Common	-	
54	<i>Graphium antiphates pompilius</i> (Fabricius, 1787)	Five Bar Swordtail	Common		
55	<i>Graphium xenocles xenocles</i> (Doubleday, 1842)	Great Zebra	Not Rare	Endemic	
56	<i>Graphium cloanthus cloanthus</i> (Westwood, 1841)	Glassy Blue Bottle	Not Rare	-	
57	<i>Graphium sarpedon sarpedon</i> (Linnaeus, 1758) (IWPA SchII)	Common Blue Bottle	Common		
58	<i>Lamproptera curius curius</i> (Fabricius, 1787)	White Dargontail	Not Rare		
59	<i>Papilio paradoxa telearchus</i> (Hewitson, 1852)(IWPA SchII)	Great Blue Mime	Rare		
60	<i>Papilio memnonagenor</i> Linnaeus, 1768(Female- <i>alcanor</i>)	Great Mormon	Common	-	
61	<i>Papilio polytesromulus</i> Cramer, [1775]	Common Mormon	Very Common	-	
62	<i>Papilio helenus helenus</i> Linnaeus, 1758	Red Helen	Common	-	
63	<i>Papilio nephelus</i> Westwood, 1845 (IWPA SchII)	Yellow Helen	Common	Endemic	
64	<i>Papilio protenor</i> Fruhstorfer, 1908	Spangle	Not Rare	-	
65	<i>Papilio bianorganesa</i> Doubleday, 1842	Common Peacock	Common	-	
66	<i>Papilio paris paris</i> Linnaeus, 1758	Paris Peacock	Common	-	
67	<i>Papilio castor castor</i> Westwood, 1842	Common Raven	Not Rare	Endemic	
68	<i>Papilio demoleus demoleus</i> Linnaeus, 1758	Lime Swallowtail	Very Common	-	
69	<i>Atrophaneura aidoneus</i> (Doubleday, 1845)	Lesser Batwing	Rare	-	
70	<i>Atrophaneura varuna astroion</i> (Westwood, 1842)	Common Batwing	Not Rare	-	
71	<i>Atrophaneura dasarada dasarada</i> (Moore, 1857) (IWPA Sch II)	Great Windmill	Not Rare	-	
72	<i>Atrophaneura polyeuctes polyeuctes</i> (Doubleday, 1842)	Common Windmill	Common	-	
73	<i>Pachliopta aristolochiae aristolochiae</i> (Fabricius, 1775)	Common Rose	Very Common	-	
74	<i>Troides aeacus aeacus</i> (C. & R. Felder, 1860)	Golden Birdwing	Not Rare	-	
C. Family: Pieridae					
i. Subfamily: Pierinae					
75	<i>Appias albina darada</i> (C. & R. Felder, [1865])	Common Albatross	Rare	-	
76	<i>Appias lycidae leonora</i> (Boisduval, 1836)	Chocolate Albatross	Common	-	
77	<i>Appias olferna</i> Swinhoe, 1890	Eastern Striped Albatross	Rare	Endemic	
78	<i>Catopsilia pomona pomona</i> (Fabricius, 1775)	Common Emigrant)	Common	-	
79	<i>Cepora nerissa nerissa</i> (Fabricius, 1775)	Common Gull	Common	-	
80	<i>Cepora nadina nadina</i> (Lucas, 1852)	Lesser Gull	Not Rare	-	
81	<i>Delias pasithoe pasithoe</i> (Linnaeus, 1767)	Red Base Jezebel	Not Rare	-	

82	<i>Hebomoia glaucippe glaucippe</i> (Linnaeus, 1758)	Great Orange Tip	Common	-
83	<i>Ixias pyrene latifasciata</i> Butler, 1871	Yellow Orange Tip	Common	-
84	<i>Leptosia nina</i> (Fabricius, 1793)	Psyche	Common	-
85	<i>Pareronia avatar</i> (Moore, [1858])	Pale Wanderer	Rare	Endemic
86	<i>Pieris canidia canidia</i> (Linnaeus, 1768)	Indian Cabbage White	Very Common	-
87	<i>Eurema andersoni jordani</i> Corbet & Pendlebury, 1932	One Spot Grass Yellow	Rare	-
ii. Subfamily: Coliadinae				
88	<i>Dercas verhuellid oubledayi</i> Moore, [1905]	Tailed Sulphur	Not Rare	-
89	<i>Eurema hecabe hecabe</i> (Linnaeus, 1758)	Common Grass Yellow	Very Common	-
90	<i>Eurema blanda silhetana</i> (Wallace, 1867)	Three spot Grass Yellow	Common	-
91	<i>Gandaca harina assamica</i> Moore, [1906]	Common Tree Yellow	Not Rare	Endemic
C. Family: Riodinidae				
i. Subfamily: Nemeobiinae				
92	<i>Abisara neophron neophron</i> (Hewitson, 1861)	Tailed Judy	Not Rare	-
93	<i>Zemeros flegyas flegyas</i> (Cramer, [1780])	Punchinello	Very Common	-
D. Family: Lycaenidae				
i. Subfamily: Poritinae				
94	<i>Poritia hewitsoni hewitsoni</i> Moore, [1866](IWPA SchII)	Common Gem	Not Rare	-
ii. Subfamily: Miletinae				
95	<i>Taraka hamada mendesia</i> Fruhstorfer, 1918	Forest Pierrot	Not Rare	-
iii. Subfamily: Curetinae				
96	<i>Curetis bulis bulis</i> (Westwood, 1851)	Bright Sunbeam	Not Rare	-
97	<i>Curetis saronis</i> Moore, 1877	Burmese Sunbeam	Not Rare	Endemic
iv. Subfamily: Theclinae				
98	<i>Arhopala silhetensis silhetensis</i> (Hewitson, 1862) (IWPA SchII)	Sylhet Oakblue	Rare	Endemic
99	<i>Arhopala centaurus pirthous</i> (Moore, [1884])	Centaur Oakblue	Not Rare	-
100	<i>Arhopala paramuta paramuta</i> (de Nicéville, [1884])	Hooked Oakblue	Not Rare	-
101	<i>Arhopala ace arata</i> Tytler, 1915 (IWPA 1972 Sch I)	Tytler's Dull Oakblue	Very Rare	Endemic
102	<i>Cheritra frejaevansi</i> Cowan, 1965	Common Imperial	Not Rare	-
103	<i>Chliaria othona othona</i> Hewitson, 1869 (IWPA SchI)	Orchid Tit	Not Rare	-
104	<i>Chliaria kina kina</i> (Hewitson, 1869) (IWPA SchII)	Blue Tit	Rare	-
105	<i>Zeltus amasa amasa</i> (Hewitson, 1865)	Fluffy Tit	Not Rare	-
106	<i>Hypolycaena erylus himavantus</i> Fruhstorfer, 1912	Common Tit	Common	-
107	<i>Rapala dienece</i> (Hewitson, 1878)	Scarlet Flash	Not Rare	-
108	<i>Rapala pheretimapetosiris</i> (Hewitson, 1863)	Copper Flash	Not Rare	-
109	<i>Ancemactesia ctesia</i> (Hewitson, 1865)	Bispost Royal	Not Rare	-
110	<i>Remelana jangala ravata</i> (Moore, [1866])	Chocolate Royal	Common	Endemic
111	<i>Ancema blanka minturna</i> (Fruhstorfer, 1912) (IWPA SchII)	Silver Royal	Rare	Endemic
112	<i>Surendra quercetorum quercetorum</i> (Moore, [1858])	Common Acacia Blue	Common	-
113	<i>Yasodatri punctatatri punctata</i> (Hewitson, 1863) (IWPA SchII)	Branded Yamfly	Rare	Endemic
114	<i>Loxura atymnus continentalis</i> Fruhstorfer, 1912	Common Yamfly	Common	-
115	<i>Spindasis lohita himalayanus</i> (Moore, 1884) (IWPA SchII)	Long-banded Silverline	Common	-
v. Subfamily: Lycaeninae				
116	<i>Heliophorus epicles latilimbata</i> Eliot, 1963	Purple Sapphire	Common	-
117	<i>Catochrysops strabo strabo</i> (Fabricius, 1793)	Forget-me-not	Common	-

vi.	Subfamily: Polyommatae			
118	<i>Anthene emolus emolus</i> (Godart, [1824])	Common Ciliate Blue	Common	-
119	<i>Anthene lycanina lycambes</i> (Hewitson, 1878)	Pointed Ciliate Blue	Not Rare	-
120	<i>Prosotas aluta coelestis</i> (Wood- Mason & deNicéville, [1887]) (IWPA SchII)	Banded Lineblue	Rare	-
121	<i>Chilades lajus lajus</i> (Stoll, [1780])	Lime Blue	Common	-
122	<i>Caleta elnanoliteia</i> (Fruhstorfer, 1918)	Elbowed Pierrot	Not Rare	-
123	<i>Castalius rosimon rosimon</i> (Fabricius, 1775)	Common Pierrot	Common	-
124	<i>Jamides celeno</i> (Cramer, [1775])	Common Cerulean	Common	-
125	<i>Jamides caerulea</i> (Druce, 1873)	Royal Cerulean	Rare	Endemic
126	<i>Jamides elpis pseudelpis</i> (Butler, 1879)	Glistening Cerulean	Not Rare	Endemic
127	<i>Prosotas nora ardates</i> (Moore, [1875])	Common Line Blue	Common	-
128	<i>Prosotas dubiosa indica</i> (Evans, [1925])	Tailless Line Blue	Common	-
129	<i>Prosotas bhutea</i> (deNicéville, [1884])	Bhulia Line Blue	Not Rare	-
130	<i>Nacaduba kurava euplea</i> Fruhstorfer, 1916	Transparent Sixline Blue	Common	-
131	<i>Megisba malaya sikkima</i> Moore, 1884	Malayan	Not Rare	-
132	<i>Neopithecops zalmora zalmora</i> (Butler, [1870])	Common Quaker	Common	-
133	<i>Pithecops fulgens fugens</i> Doherty, 1889 (IWPA SchII)	Blue Quaker	Rare	Endemic
134	<i>Acytolepis puspa gisca</i> (Fruhstorfer, 1910)	Common Hedge Blue	Common	-
135	<i>Udara dilectus dilectus</i> (Moore, 1879)	Pale Hedge Blue	Not Rare	-
136	<i>Pseudozizeeria maha maha</i> (Kollar, [1844])	Pale Grass Blue	Very Common	-
137	<i>Zizina otis otis</i> (Fabricius, 1787)	Lesser Grass Blue	Common	-
E.	Family: Nymphalidae			
i.	Subfamily: Danainae			
138	<i>Danaus genutia genutia</i> (Cramer, [1779])	Striped Tiger	Very Common	-
139	<i>Danaus chrysippus chrysippus</i> (Linnaeus, 1758)	Plain Tiger	Very Common	-
140	<i>Parantica aglea melanoides</i> Moore, 1883	Glassy Tiger	Common	-
141	<i>Parantica melaneus plataniston</i> (Fruhstorfer, 1910)	Chocolate Tiger	Common	-
142	<i>Parantica sita sita</i> (Kollar, [1844])	Chestnut Tiger	Not Rare	-
143	<i>Tirumala septentrionis septentrionis</i> (Butler, 1874)	Dark Blue Tiger	Not Rare	-
144	<i>Tirmulalimniace exotica</i> (Gmelin, 1790)	Blue Tiger	Very Common	-
145	<i>Euploea algeadeione</i> Westwood, 1848	Long-banded Crow	Not Rare	-
146	<i>Euploea core core</i> (Cramer, [1780])	Common Indian Crow	Common	-
147	<i>Euploea mulciber mulciber</i> (Cramer, [1777])(IWPA SchIV)	Striped Blue Crow	Common	-
148	<i>Euploea midamus rogenhoferi</i> C.&R. Felder, [1865] (IWPA SchII)	Blue Spotted Crow	Rare	-
149	<i>Euploea radamanthus radamanthus</i> (Fabricius, 1793)	Magpie Crow	Not Rare	-
150	<i>Polyura athamas</i> (Drury, [1773])	Common Nawab	Common	-
151	<i>Polyura arja</i> (C.&R. Felder, [1867])	Pallid Nawab	Not Rare	Endemic
ii.	Subfamily: Charaxinae			
152	<i>Charaxes eudamippus eudamippus</i> (Doubleday, 1843)	Great Nawab	Not Rare	--
153	<i>Charaxes delphis delphis</i> (Doubleday, 1843)(IWPA1972 Sch II)	Jewelled Nawab	Not Rare	Endemic
154	<i>Charaxes kahruha</i> (Moore, [1895])	Variiegated Rajah	Rare	-
155	<i>Charaxes bernardushierax</i> (C.&R. Felder, [1867])	Tawny Rajah	Common	-
156	<i>Charaxes marmax marmax</i> Westwood, 1847(IWPA SchII)	Yellow Rajah	Rare	-
iii.	Subfamily: Satyrinae			

157	<i>Elymnias hypermnestra undularis</i> (Drury, 1773)	Common Palmfly	Common	-
158	<i>Elymnias nesaea</i> Linnaeus, 1764	Tiger Palmfly	Not Rare	Endemic
159	<i>Ethope himachala</i> (Moore, 1857)	Dusky Diadem	Not Rare	Endemic
160	<i>Lethe chandica flonona</i> Fruhstorfer, 1911	Angled Red Forester	Not Rare	-
161	<i>Lethe vindhya vindhya</i> (C.&R. Felder, 1859)	Black Forester	Not Rare	Endemic
162	<i>Lethe mekara mekara</i> (Moore, [1858])	Common Red Forester	Common	Endemic
163	<i>Lethe satyavati</i> deNicéville, 1881 (IWPA1972Sch I)	Pallid Forester	Rare	Endemic
164	<i>Lethe sinorix sinorix</i> (Hewitson, 1863)	Tailed Red Forester	Rare	Endemic
165	<i>Lethe verma sintica</i> Fruhstorfer, 1911	Straight Banded Treebrown	Common	-
166	<i>Lethe europa niladana</i> Fruhstorfer, 1911	Bamboo Treebrown	Not Rare	-
167	<i>Melanitis zitenius zitenius</i> (Herbst, 1796)(IWPA SchII)	Great Evening Brown	Not Rare	-
168	<i>Melanitis phedimabela</i> Moore, 1857	Dark Evening Brown	Common	-
169	<i>Melanitis leda leda</i> (Linnaeus, 1758)	Common Evening Brown	Very Common	-
170	<i>Mycalasis perseus blasius</i> (Fabricius, 1798)	Common Bushbrown	Very Common	-
171	<i>Mycalasis adamsoni</i> Watson, 1897	Watson's Bushbrown	Rare	Endemic
172	<i>Mycalasis anaxias aemate</i> Fruhstorfer, 1911 (IWPA SchII)	White-Bar Bushbrown	Not rare	-
173	<i>Mycalasis malsarida</i> Butler, 1868 (IWPA SchII)	Plain Bushbrown	Rare	Endemic
174	<i>Mycalasis visala visala</i> (Moore, 1858]	Long-branded Bushbrown	Common	-
175	<i>Mycalasis francisca sanatana</i> Moore, [1858]	Lilacine Bushbrown	Not Rare	-
176	<i>Mycalasis gotama charaka</i> Moore, [1875](IWPA1972 Sch II)	Chinese Bushbrown	Rare	Endemic
177	<i>Mycalasis mineus mineus</i> (Linnaeus, 1758)	Dark Brand Bushbrown	Very Common	-
178	<i>Orsotriaena medus medus</i> (Fabricius, 1775)	Medus Brown	Common	-
179	<i>Ypthima baldus baldus</i> (Fabricius, 1775)	Common Five-ring	Very Common	-
180	<i>Ypthima huebneri huebneri</i> Kirby, 1871	Common Four Ring	Very Common	-
181	<i>Zipaetis scylax scylax</i> Hewitson, 1863	Dark Catseye	Not Rare	Endemic
iv.	Subfamily: Heliconiinae			
182	<i>Acraea issoria issoria</i> (Hübner, [1819])	Yellow Coster	Not Rare	-
183	<i>Cethosia cyane cyane</i> (Drury, [1773])	Leopard Lacewing	Not Rare	-
184	<i>Cethosia biblis tisamena</i> Fruhstorfer, 1912	Red Lacewing	Common	-
185	<i>Cirrochroa tyche mithila</i> Moore, 1872	Common Yeoman	Common	-
186	<i>Cirrochroa aoris aoris</i> Doubleday, [1847]	Large Yeoman	Not Rare	-
187	<i>Phalantha phalantha</i> (Drury, [1773])	Common Leopard	Common	-
188	<i>Vagrans egista sinha</i> (Kollar, [1844])	Vagrant	Not Rare	-
189	<i>Vindula erota erota</i> (Fabricius, 1793)	Cruiser	Not Rare	-
v.	Subfamily: Limentidinae			
190	<i>Athyma pravara acutipennis</i> Fruhstorfer, 1906 (IWPA SchII)	Unbroken Sergeant	Rare	Endemic
191	<i>Athyma kanwa phorkys</i> (Fruhstorfer, 1913) (IWPA SchII)	Dot-dash Sergeant	Rare	Endemic
192	<i>Athyma ranga ranga</i> Moore, [1858] (IWPA SchII)	Blackvein Sergeant	Rare	-
193	<i>Athyma inara inara</i> Westwood, 1850	Colour Sergeant	Not Rare	-
194	<i>Athyma perius perius</i> (Linnaeus, 1758)	Common Sergeant	Common	-
195	<i>Athyma cama cama</i> Moore, [1858]	Orange Staff Sergeant	Not Rare	-
196	<i>Athyma zerooca zerooca</i> Moore, 1872	Small Staff Sergeant	Not Rare	-
197	<i>Athyma selenophora bahula</i> Moore, 1858	Staff Sergeant	Not Rare	-
198	<i>Euthalia phemius phemius</i> (Doubleday, 1848)	White-edged Blue Baron	Not Rare	-
199	<i>Euthalia anosia anosia</i> (Moore, [1858]) (IWPA SchII)	Grey Baron	Rare	Endemic

200	<i>Euthalia monina kesava</i> (Moore, 1859)	Powdered Baron	Not Rare	Endemic
201	<i>Euthalia aconthea garuda</i> (Moore, [1858])(IWPA SchII)	Common Baron	Not Rare	-
202	<i>Lexias dirtea khasiana</i> (Swinhoe, 1890)(IWPA SchII)	Dark Archduke	Not Rare	Endemic
203	<i>Lexias cyanipardus cyanipardus</i> (Butler, [1869])	Great Archduke	Rare	Endemic
204	<i>Lebadeamartha ismene</i> (Doubleday, [1848])	Knight	Not Rare	-
205	<i>Moduza procris procris</i> (Cramer, [1777])	Commander	Not Rare	-
206	<i>Neptis hylas varmona</i> Moore, 1872	Common Sailer	Very Common	-
207	<i>Neptis harita harita</i> Moore, [1875]	Dingiest Sailer	Not Rare	Endemic
208	<i>Neptis pseudovikasi</i> (Moore, 1899)	False Dingy Sailer	Not Rare	-
209	<i>Neptis miah miah</i> Moore, 1857	Small Yellow Sailer	Not Rare	-
210	<i>Neptis ananta ochracea</i> Evans, 1924	Yellow Sailer	Rare	-
211	<i>Neptis cartica</i> Moore, 1872	Plain Sailer	Not Rare	Endemic
212	<i>Neptis clinia susruta</i> Moore, 1872	Sullied Sailer	Rare	-
213	<i>Neptis sankara amba</i> Moore, 1858	Broad-banded Sailer	Not Rare	-
214	<i>Nepis nata adipala</i> Moore, 1872	Clear Sailer	Rare	-
215	<i>Phaedyma columella ophiana</i> (Moore, 1972)	Short-banded Sailer	Not Rare	-
216	<i>Neptis magadha khasiana</i> Moore, 1872	Spotted Sailer	Rare	Endemic
217	<i>Pantoporia paraka paraka</i> (Butler, 1879)	Perak Lascar	Not Rare	Endemic
218	<i>Pantoporia hordonia hordonia</i> (Stoll, [1790])	Common Lascar	Common	-
219	<i>Tanaecia jahnu jahnu</i> (Moore, [1858])	Plain Earl	Not Rare	Endemic
220	<i>Tanaecia julii appiades</i> (Ménétrés, 1857)	Common Earl	Common	-
221	<i>Tanaecia lepidea sthavara</i> (Fruhstorfer, 1913)(IWPA SchII)	Grey Count	Not Rare	-
vi.	Subfamily: Cyrestinae			
222	<i>Cyrestis thyodamas thyodamas</i> Boisduval, 1846	Common Map	Common	-
223	<i>Chersonesia risa risa</i> (Doubleday, [1848])	Common Maplet	Not Rare	-
224	<i>Chersonesia rahrioides</i> Moore, [1899] (IWPA SchII)	Wavy Maplet	Rare	Endemic
225	<i>Dichorragia nesimachus nesimachus</i> (Doyère, [1840])	Constable	Not Rare	-
226	<i>Stibochiona nicea nicea</i> (Gray, 1846)	Popinjay	Not Rare	-
vii.	Subfamily: Bibiliinae			
227	<i>Ariadne merione tapestrina</i> (Moore, 1884)	Common Castor	Common	-
viii.	Subfamily: Apaturinae			
228	<i>Euripus nyctelius nyctelius</i> (Doubleday, 1845)	Courtsean	Not Rare	Endemic
ix.	Subfamily: Nymphalinae			
229	<i>Junonia iphita iphita</i> (Cramer, [1779])	Chocolate Pansy	Common	-
230	<i>Junonia lemonias</i> (Linnaeus, 1758)	Lemon Pansy	Common	-
231	<i>Junonia atlites atlites</i> (Linnaeus, 1763)	Grey Pansy	Not Rare	-
232	<i>Junonia almana almana</i> (Linnaeus, 1758)	Peacock Pansy	Common	-
233	<i>Symbrenthia lilaea khasiana</i> (Moore, [1875])	Common Jester	Common	-
234	<i>Hypolimnas bolina jacintha</i> (Drury, 1773)	Great Eggfly	Common	-
235	<i>Doleschallia bisaltide indica</i> Moore, 1899	Autumn Leaf	Not Rare	-
236	<i>Kallima inachus inachus</i> (Boisduval, 1846)	Orange Oak Leaf	Not Rare	-R
237	<i>Rhinopalpa polynice birmana</i> Fruhstorfer, 1898(IWPA SchII)	Wizard	Rare	Endemic
A.	Family: Hesperidae			
i.	Subfamily: Coeliadinae			
238	<i>Bibasis sena sena</i> (Moore, [1866]) (IWPA1972 Sch II)	Orange-tail Awl, <i>Bibasis sena sena</i>	-	
239	<i>Bibasis oedipodea belesis</i> (Mabille, 1876)	Branded Orange Awlet	-	
240	<i>Choaspes xanthopogon</i> (Kollar, [1844]) (syn.	Similar Awlking	Endemic	

	<i>C. Similis</i> Evans, 1932)			
241	<i>Hasora badra badra</i> (Moore, [1858])	Common Awl	-	
242	<i>Hasora chromus</i> (Cramer, [1780])	Common Banded Awl	-	
243	<i>Hasora taminatus</i> (Hübner, 1818)	White-banded Awl	-	
ii.	Subfamily: Pyriginae			
244	<i>Gerosis sinicanarada</i> (Moore, 1884)	White Yellow-breast Flat	Not Rare	Endemic
245	<i>Coladenia agni agni</i> (de Nicéville, [1884])	Brown Pied Flat	Rare	Endemic
246	<i>Capila zennara</i> (Moore, (1866])	Pale Striped Dawnfly	Very Rare	Endemic
247	<i>Capila pieridoides</i> (Moore, 1878)	White Dawnfly	Rare	Endemic
248	<i>Celaenorrhinus nigricans</i> (de Nicéville, 1885)	Small-banded Flat	Not Rare	-
249	<i>Celaenorrhinus andamanicus hanna</i> Evans, 1949	Andaman Yellow banded Flat	Very Rare	Endemic ??
250	<i>Darpapteria dealbata</i> (Distant, 1886)	Snowy Angle	Rare	Endemic
iii.	Subfamily: Hesperinae			
251	<i>Spialia galba</i> (Fabricius, 1793)	Indian Skipper	Common	-
252	<i>Ampittia maroides</i> de Nicéville, [1896]	Scarce Bush Hopper	Rare	Endemic
253	<i>Aeromachus stigmata obsoleta</i> (Moore, 1878)	Veined Scrub Hopper	Not Rare	-
254	<i>Aeromachus jhora creta</i> (deNicéville, 1885)	Grey Scrub Hopper	Rare	Endemic
255	<i>Halpe sikkima</i> Moore 1882	Sikkim Ace	Very Rare	Endemic
256	<i>Halpe kumara</i> de Nicéville, 1885	Plain Ace	Not Rare	Endemic
257	<i>Potanthus ganda</i> Fruhstorfer, 1911	Sumatran Dart	-	-
258	<i>Udaspes folus</i> (Cramer, [1775])	Grass Demon	Common	-
259	<i>Hyarotis adrastus</i> (Stoll, [1780]) (IWPA1972Sch IV)	Tree Flitter	Not Rare	-
260	<i>Suada swerga swerga</i> (de Nicéville, [1884])	Grass Bob	Not Rare	Endemic
261	<i>Scobura isota</i> (Swinhoe, 1893)	Khasi Forest Bob	Rare	Endemic
262	<i>Scobura cephaloides</i> (de Nicéville, [1889])	Large Forest Bob	Rare	Endemic
263	<i>Scobura phidita</i> (Hewitson, [1866])	Malay Forest Bob	Rare	Endemic
264	<i>Suastus gremius</i> (Fabricius, 1798)	Small Indian Palm Bob	Common	-
265	<i>Gangara thyrasis</i> (Fabricius, 1775)	Giant Redeye	Not Rare	-
266	<i>Erionota thrax thrax</i> (Linnaeus, 1767)	Palm Redeye	Not Rare	-
267	<i>Matapa cresta</i> Evans, 1949	Fringed Branded Redeye	-	-
268	<i>Caltoris kumara kumara</i> (Moore, 1878)	Blank Swift	-	-
269	<i>Baoris pagana</i> (de Nicéville, 1887)	Figure of-8 Swift	Not Rare	Endemic
270	<i>Caltoris cormasa</i> (Hewitson, 1876)	Full-stop Swift	Rare	Endemic
271	<i>Caltoris cahira carina</i> (Evans, 1937)	Colon Swift	Rare	Endemic
272	<i>Caltoris plebeia</i> (de Nicéville, 1887)	Tufted Swift	-	Endemic
273	<i>Caltoris brunneacaere</i> (de Niceville, 1891)	Dark-branded Swift	Not Rare	Endemic
274	<i>Pelopidas sinensis</i> (Mabille, 1877) (IWPA1972 Sch IV)	Chinese Branded Swift	Common	-
275	<i>Pelopidas mathiasmthias</i> (Fabricius, 1798)	Small Branded Swift	Common	-
276	<i>Polytremis minuta</i> (Evans, 1926)	Baby Swift	Very Rare	Endemic
277	<i>Salanoemia sala</i> (Hewitson, [1866])	Maculate Lancer	Very Rare	Endemic
278	<i>Plastingia naga</i> (de Nicéville, [1884])	Silver Spotted Lancer	Rare	Endemic
279	<i>Hidari bhawani</i> deNicéville, [1889]	Veined Palmer	Very Rare	Endemic
280	<i>Isma</i> sp. Distant, 1886	-	-	-
B.	Family: Papilionidae			
i.	Subfamily: Papilioninae			
281	<i>Papilio alcmenor alcmenor</i> C. &R. Felder,[1864]	Redbreast	Not Rare	-
282	<i>Papilio clytia</i> Linnaeus, 1758	Common Mime	Not Rare	-
283	<i>Troides helena cerberus</i> (C. &R. Felder, 1865)	Common Birdwing	Not Rare	-
B.	Family: Pieridae			
i.	Subfamily: Pierinae			
284	<i>Delias acalis pyramus</i> (Wallace, 1867)	Redbreast Jezebel	Not Rare	-

285	<i>Delias descombesi descombesi</i> (Boisduval, 1836)	Red spot Jezebel	Not Rare	Endemic
286	<i>Delias agostina agostina</i> (Hewitson, 1852)	Yellow Jezebel	Not Rare	Endemic
287	<i>Catopsilia pyranthe minna</i> (Herbst, 1792)	Mottled Emigrant	Common	-
288	<i>Pieris napimontana</i> Verity, 1908	Greenveined White	Not Rare	-
289	<i>Appiaslibythea</i> (Fabrcius, 1775) (IWPA1972Sch IV)	Striped Albatross	Rare	Endemic
290	<i>Appias lalage lalage</i> (Doubleday, 1842)	Spot Puffin	Not Rare	-
C. Family: Riodinidae				
i. Subfamily: Nemeobiinae				
291	<i>Abisara fylla</i> (Westwood, 1851)	Dark Judy	Common	-
292	<i>Abisara echerius</i> (Stoll, [1790])	Straight Plum Judy	Common	-
293	<i>Dodona henrici</i> Holland, 1887	White Punch	Very Rare	Endemic
D. Family: Lycaenidae				
i. Subfamily: Curetinae				
294	<i>Curetis acuta</i> Moore, 1877	Acute Sunbeam	-	-
ii. Subfamily: Miletinae				
295	<i>Spalgis epius</i> (Westwood, 1852)	Apefly	Not Rare	-
iii. Subfamily: Theclinae				
296	<i>Arhopala bazaloides</i> (Hewitson, 1878) (IWPA Sch II)	Tamil Oakblue	Rare	Endemic
297	<i>Arhopala fulla ignara</i> Riley & Godfrey, 1921 (IWPA1972 Sch II)	Spotless Oakblue	Rare	Endemic
298	<i>Arhopala perimuta perimuta</i> (Moore, [1858])	Yellowdisc Tailless Oakblue	Not Rare	Endemic
299	<i>Arhopala emolphus eumolphus</i> (Cramer, [1780])	Green Oakblue	Not Rare	-
300	<i>Arhopala atrax</i> (Hewitson, 1862)	Indian Oakblue	Common	-
301	<i>Arhopala athadaapha</i> deNiceville, 1895	Vinous Oakblue	Very Rare	Endemic
302	<i>Arhopala dispar dispar</i> Riley & Godfrey, 1921	Frosted Oakblue	Rare	Endemic
303	<i>Arhopala anarte</i> (Hewitson, 1862)	Magnificent Oakblue	Very Rare	Endemic
304	<i>Arhopala arvina ardea</i> (Evans, 1932) (IWPA1972 Sch I)	Purple Brown Tailless Oakblue	Very Rare	Endemic
305	<i>Arhopala ammonides</i> (Doherty, 1891)	Dark Bushblue	Rare	Endemic
306	<i>Arhopala ariel</i> (Doherty, 1891) (IWPA1972 Sch I)	Chocolate Bushblue	Very Rare	Endemic
307	<i>Arhopala birmana</i> (Moore, [1884])	Burmese Bushblue	Not Rare	Endemic
308	<i>Arhopala aberrans</i> (deNicéville, [1889])	Pale Bushblue	Rare	Endemic
309	<i>Flos adriana</i> (deNicéville, [1884])	Variegated plus blue	Not Rare	Endemic
310	<i>Simiskina phalena harterti</i> (Doherty, 1889) (IWPA Sch)	Broad-branded Brilliant	Very Rare	Endemic
311	<i>Ticherra acte acte</i> (Moore, [1858])	Blue Imperial	Not Rare	-
312	<i>Sinthusa nasaka amba</i> (Kirby, 1878) (IWPA1972 Sch II)	Narrow Spark	Rare	Endemic
313	<i>Sinthusa chandrana grotei</i> (Moore, [1884]) (IWPA1972 Sch II)	Broad Spark	Not Rare	Endemic
314	<i>Rapala maneschistacea</i> (Moore, 1879)	Slate Flash	Common	-
315	<i>Rapala iarbuisarbus</i> (Fabricius, 1787)	Common Red Flash	Common	Endemic
316	<i>Rapala rosacea</i> (de Nicéville, [1889])	Rosy Flash	Rare	Endemic
317	<i>Catapaecilma major emas</i> Fruhstorfer, 1912	Common Tinsel	Not Rare	-
318	<i>Tajuria maculata</i> (Hewitson, 1865)	Spotted Royal	Not Rare	Endemic
319	<i>Rachana jalindra jalindra</i> (Moore, [1884]) (IWPA1972 Sch II)	Banded Royal	-	-
320	<i>Creon cleobis</i> (Godart, [1824])	Broadtail Royal	Not Rare	-
321	<i>Dacalana penicilligera</i> (de Nicéville, 1890)	Double Tufted Royal	Not Rare	Endemic
322	<i>Horaga onyx onyx</i> (Moore, [1858]) (IWPA1972 Sch II)	Common Onyx	Not Rare	-

323	<i>Mota massyla</i> (Hewitson, 1869)	Saffron	Rare	Endemic
iv.	Subfamily: Lycaeninae			
324	<i>Heliophorus brahma</i> (Moore, [1858])	Golden Sapphire	Not Rare	Endemic
v.	Subfamily: Polyommatainae			
325	<i>Callenya melaena</i> (Doherty, 1889)	Metallic Hedge Blue	Rare	Endemic
326	<i>Callenya melaena melaena</i> (Doherty, 1889) (IWPA1972 Sch II)	Tiny Hedge Blue	Rare	Endemic
327	<i>Celatoxia marginata</i> (deNicéville, [1884])	Margined Hedge Blue	Not Rare	-
328	<i>Lycaenopsis transpectus</i> (Moore, 1879)	White-banded Hedge Blue	Not Rare	Endemic
329	<i>Udara selmacerima</i> (Corbet, 1937)	Bi-coloured Hedgeblue	Very Rare	Endemic
330	<i>Udara albocaerulea albocaerulea</i> (Moore, 1879) (IWPA1972 Sch II)	Albocaerulean	Rare	-
331	<i>Celastrina lavendularis limbata</i> (Moore, 1879)	Plain Hedge Blue	Not Rare	-
332	<i>Celastrina argiolus iyntea</i> (de Nicéville, [1884])	Jyntea Hedge Blue	Not Rare	Endemic
333	<i>Celastrina argiolus</i> (Linnaeus, 1758)	Hill Hedge Blue	Common	Endemic
334	<i>Monodontides musina musinoides</i> (Swinhoe, 1910)	Swinhoe's Hedge Blue	Not Rare	Endemic
335	<i>Nacaduba hermus nabo</i> Fruhstorfer, 1916	Pale Four-Lineblue	Not Rare	Endemic
336	<i>Nacaduba beroegythion</i> Fruhstorfer, 1916	Opaque Six-Lineblue		-
337	<i>Ionolyce helicon merguiana</i> (Moore, 1884) (IWPA1972 Sch II)	Pointed Lineblue	Not Rare	Endemic
338	<i>Nacaduba dana</i> (de Nicéville, [1884])	Dingy Lineblue	Not Rare	-
339	<i>Chilades pandava</i> (Horsfield, [1829])	Plains Cupid	Common	-
340	<i>Jamide salectoeurysaces</i> (Fruhstorfer, 1916)	Metallic Cerulean	Common	-
341	<i>Jamides bochus bochus</i> (Stoll, [1782])	Dark Cerulean	Common	-
342	<i>Zizeeriakarsandra</i> (Moore, 1865)	Dark Grass Blue	Common	-
343	<i>Lampides boeticus</i> (Linnaeus, 1767) (IWPA1972 Sch	Peablu	Common	-
344	<i>Syntarucus plinius</i> (Fabricius, 1793)	Zebra Blue	Common	-
345	<i>Una usta usta</i> (Distant, 1886) (IWPA1972 Sch II)	Singleton	Rare	Endemic
E.	Family: Nymphalidae			
i.	Subfamily: Charaxinae			
346	<i>Charaxes solon sulphurous</i> (Rothchild, 1899)	Black Rajah	Rare	Endemic
347	<i>Polyura schreiber assamensis</i> (Rothchild, 1899) (IWPA1972 Sch I)	Blue Nawab	Very Rare	Endemic
ii.	Subfamily: Satyrinae			
348	<i>Herona marathus</i> Doubleday, [1848] (IWPA1972 Sch II)	Pasha	Not Rare	Endemic
349	<i>Enispe euthymius euthymius</i> (Doubleday, 1845)	Red Caliph	Not Rare	Endemic
350	<i>Amathuxidia amythaon</i> (Doubleday, 1847)	Ko-hi-noor	Rare	Endemic
351	<i>Thaumantis diores</i> Doubleday, 1845	Jungleglory	Not Rare	Endemic
352	<i>Cupha erymanthis</i> (Drury, [1773])	Rustic	Common	-
353	<i>Discophora sondaica</i> zal Westwood, 1851	Common Duffer	Common	Endemic
354	<i>Discophora timora timora</i> Westwood, [1850]	Great Duffer	Not Rare	Endemic
355	<i>Faunis canens arecsilas</i> Stichel, 1933	Common Faun	Common	Endemic
356	<i>Ypthima fusca</i> Elwes & Edwards, 1893	Assam Threering	Not Rare	Endemic
357	<i>Ragadia crito</i> de Nicéville, 1890 (IWPA1972 Sch II)	Dusky-Striped Ringlet	Rare	Endemic
358	<i>Elymnias pealii</i> Wood-Mason, 1883 (IWPA1972 Sch I)	Peal's Palmfly	Very Rare	Endemic
iii.	Subfamily: Heliconiinae			
359	<i>Acraea violae</i> (Fabricius, 1793)	Tawny Coster	Common	-

360	<i>Argyreus hyperbius</i> (Linnaeus, 1763)	Tropical Fritillary	Not Rare	-
iv.	Subfamily: Limentidinae			
361	<i>Euthalia lubentina lubentina</i> (Cramer, [1777])(IWPA1972 Sch IV)	Gaudy Baron	-	-
362	<i>Euthalia telchinia</i> (Ménétrés, 1857)(IWPA1972 Sch I)	Blue Baron	Very Rare	Endemic
363	<i>Euthalia alpheda jama</i> (C. &R. Felder, [1867])	Streaked Baron	Not Rare	Endemic
364	<i>Limenitis daraxa</i> (Doubleday, [1848])	Green Commodore	Not Rare	Endemic
365	<i>Neptis nashona</i> Swinhoe, 1896	Less Rich Sailer	Rare	Endemic
366	<i>Neptis soma soma</i> Moore, 1858 (syn. <i>Neptisyerburyisikkima</i> Evans, 1924) (IWPA1972 Sch II)	Sullied Sailer (Yerbury's Sailer)	Not Rare	Endemic
367	<i>Pantoporia sandaka davidsoni</i> Eloit, 1969	Extra Lascar	-	-
368	<i>Pantoporia dindinga</i> (Butler, 1879)	Grey-lined Lascar	Very Rare	Endemic
369	<i>Pantoporia assamica</i> (Moore, 1881)	Assamese/Conjoined Lascar	Very Rare	Endemic
370	<i>Parthenos sylvia</i> (Cramer, [1776])	Clipper	Not Rare	-
v.	Subfamily: Bibiliinae			
371	<i>Ariadne ariadne</i> (Linnaeus, 1763)	Angled Castor	Common	-
vi.	Subfamily: Apaturinae			
372	<i>Mimathyma ambica ambica</i> (Kollar, [1844])	Indian Purple Emperor	Not Rare	-
373	<i>Hestina nama nama</i> (Doubleday, 1844)	Circe	Not Rare	-
vii.	Subfamily :Nymphalinae			
374	<i>Kaniska canace canace</i> (Linnaeus, 1763)	Blue Admiral	-	Endemic
375	<i>Vanessa indica indica</i> (Herbst, 1794)	Indian Red Admiral	Common	-

Odonates

Sl. No.	Common Name	Scientific Name
1	Shivalik Clubtail	<i>Anisogomphus occipitalis</i>
2	Common Clubtail	<i>Ictinogomphus rapax</i>
3	Shiva Clawtail	<i>Onychogomphus biforceps</i>
4	Ganga Clawtail	<i>Onychogomphus risi</i>
5	Common Hooktail	<i>Paragomphus lineatus</i>
6	Rusty Darner	<i>Anaciaeschna jaspidea</i>
7	Parakeet Darner	<i>Gyanacantha bayadera</i>
8	Fulvous Forest Skimmer	<i>Neurothemis fulva</i>
9	Asiatic Blood Tail	<i>Lathrecista asiatica</i>
10	Trumpet Tail	<i>Acisoma panorpoides</i>
11	Scarlet Marsh Hawk	<i>Aethriamanta brevipennis</i>
12	Little Blue Marsh Hawk	<i>Brachydiplax sobrina</i>
13	Emerald-banded Skimmer	<i>Cratilla lineata</i>
14	Ruddy Marsh Skimmer	<i>Crocothemis servilla</i>
15	Ruddy Meadow Skimmer	<i>Neurothemis intermedia</i>
16	Ground Skimmer	<i>Diplacodes trivialis</i>
17	Pied Paddy Skimmer	<i>Neurothemis tullia</i>
18	Brown-backed Red Marsh Hawk	<i>Orthetrum chrysis</i>
19	Blue Marsh Hawk	<i>Orthetrum glaucum</i>
20	Green Marsh Hawk	<i>Orthetrum sabina</i>
21	Blue-Tailed Forest Hawk	<i>Orthetrum triangulare</i>
22	Crimson-tailed Marsh Hawk	<i>Orthetrum pruinsum</i>
23	Stellate River Hawk	<i>Onychothemis testacea</i>
24	Blue-tailed Yellow Skimmer	<i>Palpoleura sexmaculata</i>

25	Wandering Glider	<i>Pantala flavescens</i>
26	Rufous Marsh Glider	<i>Rhodothemis rufa</i>
27	Common Picture Wing	<i>Rhyothemis variegata</i>
28	Iridescent Stream Glider	<i>Zygonyx iris</i>
29	Brown Dusk Hawk	<i>Zygomma petiolatum</i>
30	Crimson Marsh Glider	<i>Trithemis aurora</i>
31	Coral-Tailed Cloud Wing	<i>Tholymis tillarga</i>
32	Crimson Marsh Glider	<i>Trithemis aurora</i>
33	Brown Dusk Hawk	<i>Zygomma petiolatum</i>
34	Ruddy Meadow Skimmer	<i>Neurothemis intermedia</i>
35	Stream Glory	<i>Neurobasis chinensis</i>
36	Northern White Darlet	<i>Agriocnemis lacteola</i>
37	Pigmy Dartlet	<i>Agriocnemis pygmaea</i>
38	Black Marsh Dart	<i>Onychargia atrocyana</i>
39	Torrent Dart	<i>Euphaea ochracea</i>
40	Spreadwing Damselfly	<i>Lestes praemorsus</i>
41	Coromandel Marsh Dart	<i>Ceriagrion coromandelianum</i>
42	Black-tailed Marsh Dart	<i>Ceriagrion fallax</i>
43	Rusty Marsh Dart	<i>Ceriagrion olivaceum</i>
44	Blue Grass Dartlet	<i>Pseudagrion microcephalum</i>
45	Black Bambootail	<i>Prodasineura verticalis</i>
46	Emerald Echo	<i>Echo margarita</i>
47	Peacock Jewel	<i>Rhinocypha fenestrella</i>
48	Emerald Prince	<i>Rhinocypha unimaculata</i>
49	Blue Bayadera	<i>Bayadera indica</i>

(Source: Rajib Rudra Tariang, HOD, Department of Zoology, Digboi College)

v) List of other biota in Dibrugarh Division:

Table 6: List of lichen found in Dibrugarh Division, Assam.

Lichens					
S.N	Botanical name	Family	Growth form	Substratum	Abundance
1.	<i>Bacidia incongruens</i>	<i>Ramalinaceae</i>	Crustose	Bark	Rare
2.	<i>Buellia alboatra</i>	<i>Caliciaceae</i>	Crustose	Bark	Rare
3	<i>Calopadia fusca</i>	<i>Ectolechiaceae</i>	Crustose	Leaves	Common
4	<i>Caloplaca bassiae</i>	<i>Teloschistaceae</i>	Crustose	Bark	Rare
5	<i>Chiodecton leptosporum</i>	<i>Roccellaceae</i>	Crustose	Bark	Common
6	<i>Chrysothrix chlorina</i>	<i>Chrysothricaceae</i>	Leprose	Bark	Rare
7	<i>Cladonia coniocraea</i>	<i>Cladoniaceae</i>	Fruticose	Soil and rocks	Rare
8	<i>Coccocarpia palmicola</i>	<i>Coccocarpiaceae</i>	Foliose	Bark	Rare
9	<i>Collema pulcellum</i>	<i>Collemataceae</i>	Foliose	Bark	Rare
10	<i>Cryptothecia striata</i>	<i>Arthoniaceae</i>	Crustose	Bark and rocks	Common
11	<i>Dirinaria aegialita</i>	<i>Caliciaceae</i>	Foliose	Bark and rocks	Common
12	<i>Glyphis duriuscula</i>	<i>Graphidaceae</i>	Crustose	Bark	Common
13	<i>Graphis duplicata</i>	<i>Graphidaceae</i>	Crustose	Bark	Common
14	<i>Graphis scripta</i>	<i>Graphidaceae</i>	Crustose	Bark	Common
15	<i>Haematomma puniceum</i>	<i>Haematommataceae</i>	Crustose	Bark	Common
16	<i>Heterodermia diademata</i>	<i>Physciaceae</i>	Foliose	Bark and rock	Rare
17	<i>Lecanora indica</i>	<i>Lecanoraceae</i>	Crustose	Bark	Common

18	<i>Leptogium azureum</i>	<i>Lecanoraceae</i>	Crustose	Bark	Common
19	<i>Mazosia phyllosema</i>	<i>Roccellaceae</i>	Crustose	Leaves	Common
20	<i>Parmotrema crinitoides</i>	<i>Parmeliaceae</i>	Foliose	Bark and rock	Common
21	<i>Pertusaria quassiae</i>	<i>Pertusariaceae</i>	Crustose	Bark	Common
22	<i>Phaeographis acaesio radians</i>	<i>Graphidaceae</i>	Crustose	Bark	Common
23	<i>Phaeographis platycarpa</i>	<i>Graphidaceae</i>	Crustose	Bark	Common
24	<i>Pseudo pyrenula pupula</i>	<i>Trypetheliaceae</i>	Crustose	Bark	Common
25	<i>Strigula antillarum</i>	<i>Strigulaceae</i>	Crustose	Leaves	Common
26	<i>Strigula elegans</i>	<i>Strigulaceae</i>	Crustose	Leaves	Common
27	<i>Strigula smaragdula</i>	<i>Strigulaceae</i>	Crustose	Leaves	Common
28	<i>Tricharia vainioi</i>	<i>Gomphillaceae</i>	Crustose	Leaves	Common
29	<i>Trichothelium annulatum</i>	<i>Trichotheliaceae</i>	Crustose	Leaves	Common
30	<i>Trypethelium eluteriae</i>	<i>Trypetheliaceae</i>	Crustose	Bark	Rare

Algae

Group	Genus
Cyanophyceae	a) Chroococcus,
	b) Oscillatoria,
	c) Phormidium,
	d) Lyngbya,
	e) Anabaena
	f) Microcoleus
	g) Pseudanabaena
Zygnematophyceae	a) Mesotaenium,
	b) Sprigya
Ulvophyceaea	a) Ulothrix
Chlorophyceae	a) Chlamydomonas,
	b) Chlorella,
	c) Haematococcus
	d) Oedogonium
	e) Gonium
Bacillariophyceae	a) Pinnularia,
	b) Navicula
Euglenoidea	a) Euglena

List of macrofungi recorded in Jeypure Reserved forest with uses and ecological relationship

Sl. No	Fungi	Family	Ecological relationship	Utilization
1	<i>Agaricus arvensis</i>	Agaricaceae	Saprophyte	Edible
2	<i>Lycoperdon pyriforme</i>	Agaricaceae	Mycorrhizal	Edible
3	<i>Coprinus disseminates</i>	Agaricaceae	Saprophyte	Non edible
4	<i>Amanita pantherina</i>	Amanitaceae	Mycorrhizal	Non edible
5	<i>Auricularia auricula-judae</i>	Auriculaceae	Dead wood	Edible, Medicinal
6	<i>Boletus badius</i>	Boletaceae	Mycorrhizal	Non edible
7	<i>Cantharellus lateritius</i>	Cantharellaceae	Saprophyte	Edible
8	<i>Craterellus sp.</i>	Cantharellaceae	Saprophyte, dead wood	Edible
9	<i>Clavaria sp.</i>	Clavariaceae	Saprophyte, dead & decaying wood	Non edible
10	<i>Ganoderma lucidum</i>	Ganodermataceae	Parasitic	Medicinal
11	<i>Ganoderma applanatum</i>	Ganodermataceae	Parasitic	Medicinal
12	<i>Ramaria sp.</i>	Gomphaceae	Saprophyte, dead wood	Edible
13	<i>Laccaria bicolor</i>	Hydnangiaceae	Mycorrhizal	Non edible

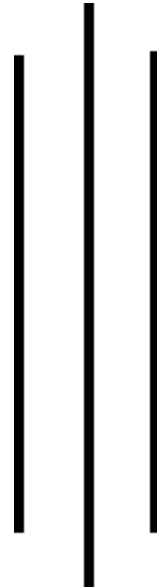
14	Phellinus gilvus	Hymenochaetaceae	Parasitic	Non edible
15	Marasmius androsaceus	Marasmiaceae	Saprophyte, plant debris	Non edible
16	Pleurotus sp.	Pleurotaceae	Dead wood	Edible
17	Panus fulvus	Polyporaceae	Dead and decaying wood	Edible
18	Earliella scabrosa	Polyporaceae	Dead wood	Non edible
19	Lentinus sp.	Polyporaceae	Dead wood stumps	Edible, medicinal
20	Microporus xanthopus	Polyporaceae	Dead wood	Medicinal
21	Pycnoporus sanguineus	Polyporaceae	Saprophyte, Dead wood	Non edible
22	Trametes versicolor	Polyporaceae	Wood decaying	Medicinal
23	Lactarius sshygrophoroides	Russulaceae	Mycorrhizal	Edible
24	Russulaamoena Mycorrhizal	Russulaceae		Edible
25	R. delica	Russulaceae	Mycorrhizal	Edible
26	R. pectinata	Russulaceae	Mycorrhizal	Edible
27	R. nobilis	Russulaceae	Mycorrhizal	Edible
28	Schizophyllum commune	Schizophyllaceae	Dead wood	Edible, medicinal
29	Scleroderma sp.	Sclerodermataceae	Mycorrhizal	Edible
30	Xylaria polymorpha	Xylariaceae	Dead wood	Non edible

List of mushroom species having medicinal uses

SI No.	Mushroom species	Utilization
1	Ganoderma lucidum	Promotes health and longevity, lowers the risk of cancer and heart disease and boosts the immune system.
2	Ganoderma applanatum	Antioxidant, hypoglycemic and antihypertension
3	Microporus xanthopus	To stop a child from breast feeding
4	Xylaria polymorpha	To stop a child from bed wetting
5	Schizophyllum commune	Anti-candida, anti-tumor and anti-viral properties, antitumor, anticancer and immunomodulating activities
6	Auricularia auricula-judae	anti-diabetic, antitumor, antihypertensive, anti-inflammatory, immunomodulatory and antibacterial agents
7	Trametes versicolor	immunomodulatory and anti-cancer effects
8	Pycnoporus sanguineus	Biodegrading textile dyes and lignosulphonates arthritis, gout, styptic, sore throats, ulcers, tooth aches, fevers, hemorrhages and antibacterial
9	Phellinus gilvus	Antiinflammatory, antitumor, antioxidant, antihepatotoxicity
10	Marasmius androsaceus	Tendon relaxation, pain alleviation and antihypertension
11	Lentinus sp.	Protect from cancer, environmental allergies, fungal infection, frequent flu and colds, bronchial inflammation, heart disease, hyperlipidemia, hypertension, infectious disease, diabetes, hepatitis and regulating urinary inconsistencies

VOLUME 1

PART I



SUMMARY OF FACTS ON WHICH PROPOSALS ARE MADE

CHAPTER 1

The Tract Dealt With

1.1 Name and situation: This Working Plan covers five RFs of Dibrugarh Division. The Division is situated between 27°43'4.06"N & 94°31'3.698"E to 27°3'54.949"N & 95°29'34.862"E coordinates. The Division is bound by Brahmaputra River in the North, Doom Dooma and Digboi Division and Arunachal Pradesh in the East, Sibsagar Division and Sibsagar District in the South and Sibsagar District in the West.

Dibrugarh Forest Division was created curving out erstwhile Lakhimpur Forest Division in the year 1960. Two new divisions viz. Dibrugarh Division and Digboi Division were created. Subsequently, Doomdooma Forest Division was constituted in 1974 cutting and reorganizing parts Dibrugarh and Digboi Division. On constitution of Dibru-Saikhowa Wildlife Sanctuary in 1986 another part of Dibrugarh forest division namely Dibru RF was transferred to newly constituted Tinsukia Wildlife Division in the year 1989. Subsequently, In the year 2001, Padumoni RF and Bherjan RF were transferred to Tinsukia Wildlife Division. Further, an area of 2,406.96 hectare of Jeypore RF. was notified as a part of Dehing-Patkai Wildlife Sanctuary in 2004. The sanctuary extends its area in both Dibrugarh and Digboi forest division. Accordingly, management of Dehing-Patkai Wildlife Sanctuary is shared by both Dibrugarh and Digboi forest division consequently, the sanctuary area which fall under Dibrugarh division is managed by Dibrugarh division. The Division covers not a major part of Dibrugarh Civil District but a major part of Tinsukia Civil District.

The administration of the Division is headed by the Divisional Forest Officer. Two posts of Assistant Conservator of Forests exist to assist the DFO in office and field works including supervision of all development works. Under the Division there are as many as five Ranges including Protection Squad Range, meant for protection of forest including combating illegal felling and all sort of illegal activities within the division jurisdiction. Administrative setup of the Dibrugarh Forest Division is cited in table 1.1

Table 1.1: Administrative setup of the Dibrugarh Forest Division (Ranges/Beats/Sub-beats and Camps)

Name of the Division	Name of the Range	Name of the Beat under the Range	Name of the Sub-beats and camps under the Range
1	2	3	4
Dibrugarh Division, Dibrugarh	Dibrugarh Range	Jokai Beat	
		Medela Beat	Telpani Sub Beat
	Tinsukia Range		Rupai Sub Beat
	Jeypore Range	Dilli Beat, Namrup	
		Naharkatia Beat	
		Hukanjuri Beat	Hukanjuri BOP Camp
		Kothalguri Beat	Kothalguri BOP Camp
	Khawang Range		
Protection Squad	-	-	

The Divisional Head Quarter is located at Dibrugarh Town while Range Offices are located at various places as shown in the table above. There are two Inspection Bungalows at Tinsukia and at Jeypur.

The maps prepared with geographical coordinates recorded at the site are maintained in the GIS Cell (REWP) Guwahati for reference purposes.

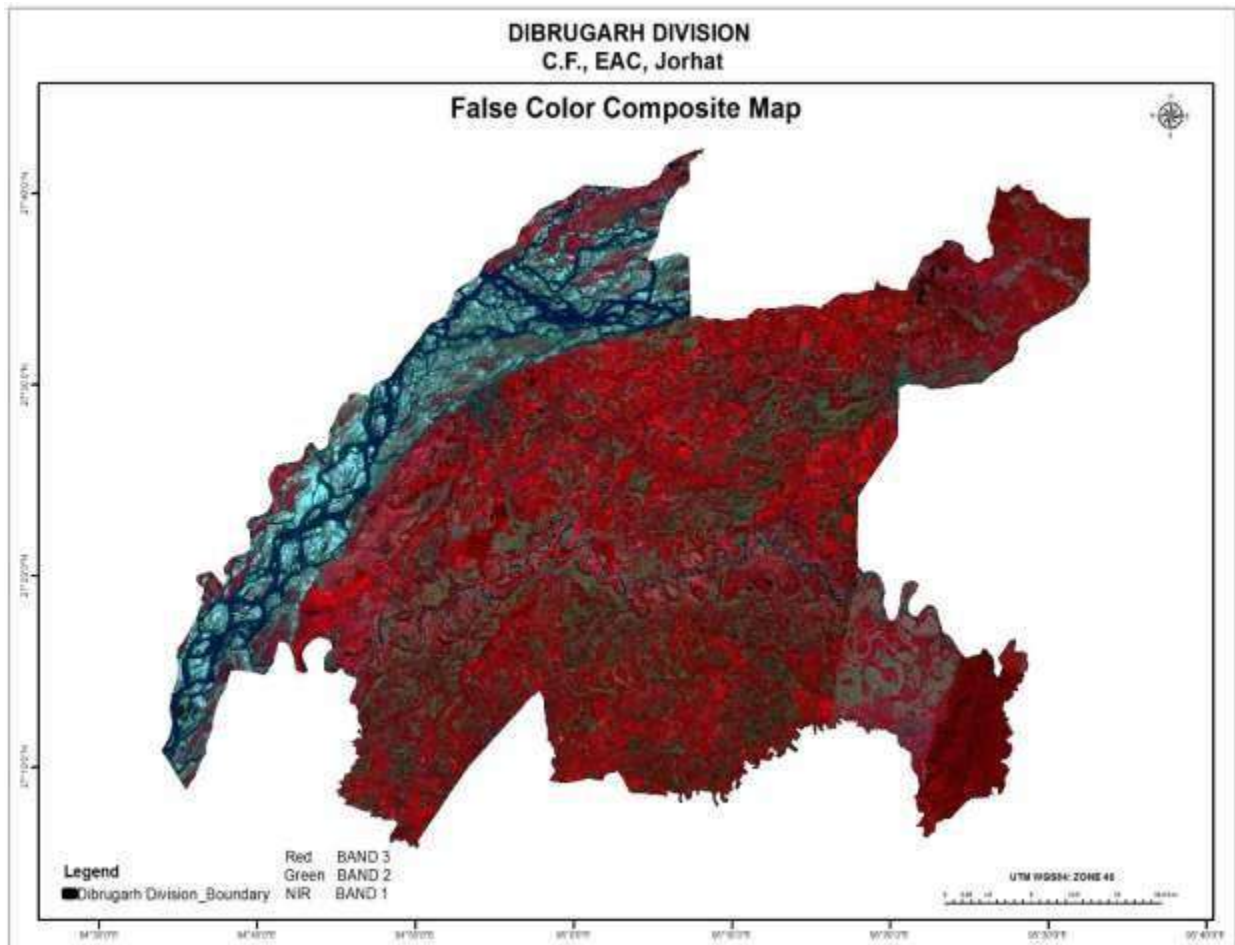


Figure 1.1: False Colour Composite Map of Dibrugarh division.

1.2 Configuration of the ground: The area under Dibrugarh Division is almost level and flood water inundates most of the RFs. The terrain is cut by numerous rivulets (nullas) and dotted with swamps and full of earthen mounds and hence a major position of the land in these RFs is Kurkani. The areas of RFs are traversed by the streams and swamps. The terrain of Jeypore RF comprises of low hills to medium hills and located along the foot hills of Tirap District of Arunachal Pradesh. This tract is drained by Buridihing, Namsang, Dilli and Brahmaputra river. Buridihing, a tributary of Brahmaputra, divides the district from east-to-west. Buridihing flows through Naharkatia and Khowang, and at a later stage in its course, Buridihing acts as a divider between Dibrugarh and Sivasagar districts. The region is flat with a gradual slope from the East Arunachal hills to the west. The altitude in the Division ranges from 94 msl near the North-Eastern corner of Dehingmukh RF to 480 msl at the highest point in the Jeypore RF.

1.3 Geology, rock and soil: The Division is characterized by sedimentary rock formations of different ages, ranging between Eocene and Pleistocene and are exposed mainly along the foot hills bordering the southern boundary of this Division. The eastern part of the Division and the valley of the Brahmaputra river are covered by thick alluvial deposits belonging to sub-Recent and Recent periods. The Brahmaputra valley in this district is of a nature of a “ramp valley” developed during the

simultaneous upheavals of the Himalayas on the north and northeast and the Patkai ranges on the south and southeast.

The thick sedimentary rocks of the Tertiary period have been buckled and over thrust due to the tectonic forces directed towards south from the Himalayas and to the northwest from the Shan-Burma Plateau region consequent on the upheavals. Eventually the tertiary rocks along the Patkai ranges were structurally disposed along several folded anticlines, often cut off by several parallel imbricating thrusts viz. Naga thrust, Haflong - Disang thrust and Margherita thrust.

Naga thrust passes along the northern edge of the Jaipur-Tipam-Digboi range of hills bordering the alluvial plains of Brahmaputra on the north. The next important one is the Haflong Disang thrust which runs East North East (E.N.E.), along the northern base of the Namsang -Barduria hills, south of Jaipur and continue further eastward along the southern boundary of the Makum coal-field. In between the above two, there is another thrust known as the Margherita thrust running along the northern boundary of the Makum coalfield. The thrust finally merges with Disang thrust near Dirak towards the west. The region forming the Jaipur Digboi region consists of Upper Tertiary rocks with Tipam sand stone stage, which is characterized by oil deposits.

Soils of the area are sandy to clayey loam type and grayish in color. They are acidic in reaction with PH ranges from 4.6 to 5.9. They are also characterized by low to medium phosphate and medium to high potash content. Based on pedogenic and pedological characters, soils of this area may be classified into following classes a) Recent riverine alluvial soils (Antisol) b) Old riverine alluvial soils (Inceptisol) c) Old mountain valley alluvial soils (Alfisol).

The soil formation in most of the tracts can be attributed to alluvial deposits brought down by the river Brahmaputra towards the north eastern portion and Buri Dihing river in the south western portion. The alluvial deposits of the Brahmaputra river are characterized by shallow surface layer of silty loam and grey colour with subsoil of coarse sand mixed with pebbles and boulders. The alluvial deposits of the Dihing river is characterized by its coarse nature reddish color and sandy clay. The soil is of considerable depth. The soil of the Brahmaputra alluvial is acidic the pH value being 5.5.

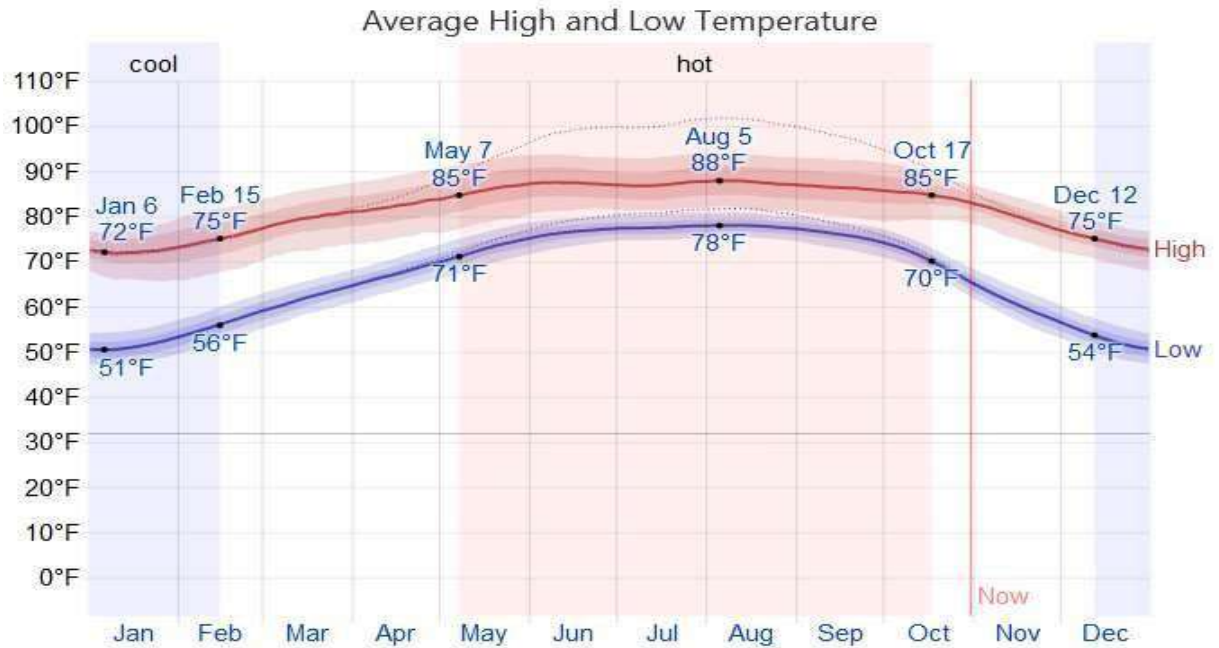
1.4 Climate: The Division experiences sub-tropical humid climate and falls under high humid zone. High humidity and high rainfall are the characteristic feature of the forests in this Division. Figure 1.4a represents the monthly min, max, and average temperature in the Division from 2009 and 2019. The hottest months are May, June, July and August and the coldest months are December and January. Details in Annexure 1a.

The Division is endowed with high rainfall. Maximum precipitation occurs between the months of April and September. Figure 1.4b shows the average monthly rainfall between 2009 and 2019.

Temperature

The *hot season* lasts for *5.3 months*, from *May 7* to *October 17*, with an average daily high temperature above *85°F*. The hottest day of the year is *August 5*, with an average high of *88°F* and low of *78°F*. The *cool season* lasts for *2.1 months*, from *December 12* to *February 15*, with an

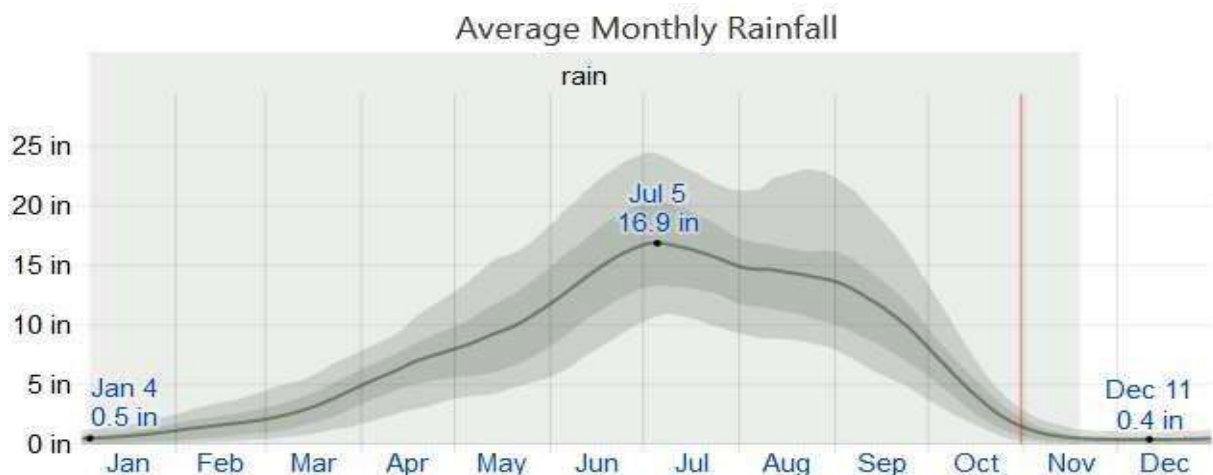
Average daily high temperature below 75°F. The coldest day of the year is *January 6*, with an average low of 51°F and high of 72°F.



The daily average high (red line) and low (blue line) temperature, with 25th to 75th and 10th to 90th percentile bands. The thin dotted lines are the corresponding average perceived temperatures.

Rainfall

To show variation within the months and not just the monthly totals, we show the rainfall accumulated over a sliding 31-day period centered around each day of the year. Dibrugarh experiences *extreme* seasonal variation in monthly rainfall. The *rainy* period of the year lasts for *10 months*, from *January 4* to *November 18*, with a sliding 31-day rainfall of at least *0.5 inches*. The *most rain* falls during the 31 days centered around *July 5*, with an average total accumulation of *16.9 inches*. The *rainless* period of the year lasts for *1.5 months*, from *November 18* to *January 4*. The *least rain* falls around *December 11*, with an average total accumulation of *0.4 inches*.



The average rainfall (solid line) accumulated over the course of a sliding 31-day period centered on the day in question, with 25th to 75th and 10th to 90th percentile bands. The thin dotted line is the corresponding average liquid-equivalent snowfall.

Humidity

Dibrugarh experiences *extreme* seasonal variation in the perceived humidity. The *muggier period* of the year lasts for *7.5 months*, from *March 28* to *November 11*, during which time the comfort level is *muggy*, *oppressive*, or *miserable* at least 25% of the time. The *muggiest day* of the year is *August 9*, with muggy conditions 100% of the time. The *least muggy day* of the year is *January 14*, when muggy conditions are essentially unheard of.



The percentage of time spent at various humidity comfort levels, categorized by dew point.

1.5 Demography: As per the 2011 India census, Dibrugarh city had a population of 154,019. Males constituted 54% of the population and females 46%. The sex ratio of Dibrugarh city was 961 per 1000 males. The average literacy rate of Dibrugarh is 89.5%, which is higher than the national average literacy rate. In Dibrugarh, 9% of the population is between 0 and 6 years of age, and the child ratio of girls is 940 per 1000 boys. Dibrugarh city area has a population of 154,019 according to a 2011 census.

Table 1.1.a: R.F wise distribution of Compartments and areas

Name of the Range	Name of the RF	Compartment (s)	Area as per Govt. notification (Ha)
Dibrugarh Range	Jokai RF	1, 2, 3, 4, 5, 6, 7, 8, 9, 10	1848.01
	Telpani RF	1	1332.288
	Dehingmukh RF	1, 2, 3*	5879.04
Khowang Range	Namdang RF	1	1858.63
Joypur Range	Joypur RF	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51	10876.68
TOTAL			21,794.648

* Compartment No 3 of Dihingmukh RF falls under Khowang Range.

CHAPTER 2

Maintenance/Increase in the extent of tree Cover

2.1 Area of forest under different legal classes:The Reserved Forests have been constituted under the relevant provisions of Assam Forest Regulation, 1891 and the Indian Forest Act, 1927. The total area under Reserved Forest of this Division, as per Working Plan survey, comprising five Reserved Forests and distribution of area into various Ranges along with the notification numbers and dates are presented in Table 2.1a.



Jeypur Reserved Forests

Table 2.1a: Legal position of Reserved Forests of Dibrugarh Division

Sl. No.	Name of RFs	Govt. Notification No.	Notification Date	Area (Ha.)
1.	Dihingmukh RF	No. 22 dt.	31 st March 1887	5747.20
	1 st addition to Dihingmukh RF	No. 4146R	12 th July 1905	71.84
	2 nd addition to Dihingmukh RF	No. FRS.257/83/3	26 th September 1983	60.00
2.	Jokai RF	No. 32	27 th May 1887	1848.01
3.	Joypur RF	No. 137	19 th October 1888	10,534.40
	1 st addition to Joypur RF	No. FOR SETT/277/57/28	24 th August 1959	198.20
	2 nd addition to Joypur RF	No. FOR/SETT/372/66/6	5 th May 1969	144.00
4.	Namdang RF	No. 8010F	3 rd November 1919	1858.63
5.	Telpani RF	No. 3084R	30 th August 1921	1332.288
TOTAL				21,794.648

Padumani RF notified vide No. 929R dated 20th March 1916 and Bherjan RF notified vide No. 2984R dated 29th August 1916 has been declared as Wildlife Sanctuary vide Govt. No. FRW.17/99/46 dt. 30/10/1999. The compartmentwise area perimeter under different RFs in Dibrugarh Division is shown in Annexure 1b.

2.1.1 Diversions: Out of the total forestland of 21,794.648 hectare, an area of 110.272 hectare of forestland has been diverted under FRA 2006 and 63.4916 hectare has been diverted for non-forestry purposes. Details provide in table 2.1.1a and 2.1.1b.

2.1.1a Forest Rights Act: Forest Rights as per the Scheduled Tribes and Other Forest Dwellers (Recognition of Forest Rights) Act, 2006 has been implemented under this Division. A total of 11 numbers of Tribal Forest Villages were taken for consideration. FRCs were constituted for the said 11 numbers of Forest villages. Already titles were issued for 3 numbers of Forest Villages, namely, 1) 20 Ghoria Kachari F.V. in Jokai RF, 2) 12 Ghoria Missing Forest Village, and 3) Naharoni Forest Village in Dihingmukh RF. Claims for other Forest Villages are in progress.

Title issued (Claim accepted): a) Naharani Forest Village and 12 Ghoria Jokai Tangia 29 (individual) and 9 (community).

Table 2.1.1a: Status of forestland diverted under Forests Rights Act 2006 in Dibrugarh Division

Claim submitted				Claim accepted				Claim pending				Claim rejected
Individual		Community		Individual		Community		Individual		Community		
No.	Area (Ha)	No	Area (Ha)	No	Area (Ha)	No	Area (Ha)	No	Area (Ha)	No	Area (Ha)	
733	778.2833	29	6.4125	103	108.562	9	1.710	620	669.7213	14	4.7025	10

2.1.1b: Diversion of Forests to non-forest purposes: Forestland under this Division have been diverted to non-forest purposes. The status of diversion of forestland to non-forest purposes is shown in Table 2.1.1b.

Table 2.1.1b: Status of forestland diverted for non-forest purpose in Dibrugarh Division, Assam

Sl. No.	Location	Name of User Agency	Area (in Ha)	Purpose	CA Area (Ha) allotted	Remarks
1	Joypur R.F.	Assam Power Project Development Company Ltd. (APPDCL)	22.1072	Construction of IMW Desang Hydro Power Project on Dilli River in Joypur R.F. (2010)		The Regional Office, Gol. MoEF&CC, Shillong has taken decision to close the diversion proposal and delete from the pending list for non-furnishing of essential information by User Agency.
2		M/s B.K. Enterprise, Lakhtokia, Guwahati -1	2.5	Lease permission for a period of 10 years for collection of stone from Dilli River of Joypur R.F.		Area handed over to User Agency. <i>(period already expired)</i>
3		Assam Power Generation Corporation Ltd. Namrup	0.069	Construction of a New Raw Water Intake Pump House at Dilli River	1.00	Area handed over the User Agency
4	Dihingmukh R.F.	N.F. Railway, Dibrugarh	4.38	Construction of Dyke for Bogibeel Bridge at Dibrugarh	9.00	Area handed over to the User Agency
5		M/s Brahmaputra Cracker & Polymer Ltd. Lepetkatta, Dibrugarh	0.678	Implementing the Mega Assam Gas Cracker Project at Lepetkatta, Dibrugarh	1.50	Area handed over to the User Agency
6		OIL, Duliajan	13.2574	Forest land required for Oil India Ltd. Drilling location DRB in Dehingmukh R.F.		Withdrawn by User Agency

7	Water Resource Division, Dibrugarh (WED Dibrugarh)	20.5	Extension of down stream Dyke on South Bank of Bogibeel Bridge, PH-IV from Chaulkhowa Gaon to Madhupur Deori Gaon at Bogibeel	20.50	Area handed over to the User Agency. An area of 20.5 Ha. are allotted for Compensatory Afforestation outside the Dehingmukh R.F. (Near Bogibeel Bridge)
TOTAL		63.4916		32	

2.2 Forest area under different working circle: Forest area under different working circle covered under the purview of this working plan is shown in table 2.2. The compartment wise area allocated under different working circles is elaborated under the individual working circles chapters mentioned in Part II of the working plan. Figure 2.2 shows allocation of different working circles in the Division.

Table 2.2: Statement of areas under various working circles (WC)

Divisional area Statement (Compartment-wise area distributed in various Working Circles) :

Range	Name of the RF	Compt No	Area (Ha)	Perimeter (m)	Sapling /Ha.	Growing Stock cu.m/Ha	JFMC WC	Plant WC	NTFP WC	Soil & Water WC
Dibrugarh	Jokai R F	1	82.058	4137.46	98	222.03	82.058	-	82.058	-
		2	120.491	4831.33	108	121.54	80.00	120.491	120.491	-
		3	211.545	7988.42	-	1.36	100.00	211.545	-	211.54
		4	251.463	8281.64	71	69.14	100.00	251.463	-	-
		5	160.036	6784.39	-	15.52	100.00	160.036	160.036	-
		6	181.152	7114.17	68	14.55	90.00	181.152	181.152	181.15
		7	178.475	6485.70	85	97.36	100.00	178.475	178.475	-
		8	167.731	5544.84	105	65.57	100.00	167.731	167.731	-
		9	254.951	8752.27	59	47.69	-	254.951	-	254.951
		10	240.108	7339.77	12	2.18	-	240.108	-	240.108
	Telpani R F	1	1332.288	27921.80	6	2.08	600.00	1332.288	1332.288	1332.288
Khowang	Dihingmukh	1	3614.282	35287.60	18	0.64	1800.00	3614.282	3614.282	3614.282
		2	1515.420	19976.60	12	0.03	-	1515.420	-	1515.420
		3	749.338	12713.40	-	2.17	-	749.338	-	749.338
Jeypore	Jeypore RF	1	205.291	6541.93	714	630.23	205.291	-	205.291	205.291
		2	267.467	6852.05	582	383.32	-	-	-	267.467
		3	143.238	6148.33	366	274.40	143.238	-	143.238	-
		4	217.355	6268.41	333	271.59	-	-	-	217.355
		5	187.846	6262.08	267	364.06	-	187.846	-	187.846
		6	142.204	5612.37	129	305.44	-	142.204	-	142.204
		7	164.969	6067.78	314	247.71	-	-	-	
		8	218.965	6489.36	117	63.24	-	-	-	218.965
		9	279.080	10211.60	299	175.68	279.080	-	279.080	279.080
		10	252.739	7900.24	310	331.50	-	-	-	-
		11	250.805	7669.94	402	419.17	-	-	-	-
		12	284.828	7754.04	316	478.06	-	-	-	284.83
		13	365.030	8179.57	232	392.09	365.030	-	365.030	365.03
		14	300.012	13469.30	236	485.01	-	-	-	-
		15	85.924	4267.16	-	388.54	-	85.924	-	-
		16	221.856	6540.32	254	190.91	-	221.856	-	-
		17	144.156	5181.13	-	368.37	-	-	-	144.156

18	163.099	6169.84	91	317.38	163.099	-	163.099	163.099		
19	192.350	5790.81	82	355.69	-	-	-	192.350		
20	220.986	6958.06	167	290.05	-	220.986	-	220.986		
21	180.564	6124.80	171	328.85	-	180.564	-	-		
22	186.514	6602.22	181	1688.00	-	-	-	-		
23	153.768	5444.84	451	168.68	-	-	-	-		
24	83.252	4212.65	-	372.82	-	-	-	-		
25	108.897	4356.67	-	322.03	-	-	-	108.90		
26	183.183	7530.59	132	429.15	-	-	183.183	183.18		
27	110.334	4901.26	189	1792.61	-	-	110.334	110.33		
28	363.133	11464.50	151	326.86	-	-	-	363.13		
29	310.331	8011.70	462	114.22	-	-	-	-		
30	365.142	8633.67	406	376.86	-	-	-	-		
31	188.489	7038.86	181	374.06	-	-	-	188.49		
32	198.200	6094.53	176	454.84	-	-	-	198.20		
33	114.682	4427.25	125	229.75	-	-	-	114.68		
34	265.278	6631.72	145	409.46	-	-	-	265.28		
35	144.712	7016.01	378	273.17	-	-	-	-		
36	231.194	6889.50	337	200.27	-	-	-	-		
37	158.819	7757.26	462	2.22	-	-	-	158.82		
38	176.738	5655.09	205	242.16	176.738	-	176.738	176.74		
39	226.502	7608.83	20	515.52	-	-	-	226.50		
40	128.028	5086.05	-	350.87	-	-	-	128.03		
41	102.171	4245.53	140	386.91	-	-	102.171	102.17		
42	140.074	5430.36	181	388.54	-	-	140.074	-		
43	231.781	6658.50	123	300.66	-	-	-	-		
44	113.414	4749.62	-	757.58	-	-	-	-		
45	141.806	4890.96	468	43.26	-	-	-	-		
46	137.845	5216.34	432	140.54	-	-	-	-		
47	335.695	10206.10	771	270.47	-	-	-	335.70		
48	301.131	7060.34	32	425.60	-	-	-	301.13		
49	431.198	9794.62	105	201.33	-	431.198	-	431.20		
50	298.279	7814.44	195	384.57	-	298.279	-	-		
51	115.047	4480.99	586	388.54	-	115.047	-	-		
	Jeypore 1 st add	198.20	5604.38	432	367.78	-	-	198.20	-	
	Jeypore 2 nd add	144.00	4811.98	336	345.77	-	-	144.00	-	
Khawang	Namdang	1	1858.63	29818.30	10	0.47	1200.00	1858.63	1000.00	1840.32
Total of the Division			21794.648				5684.534	12719.815	9046.951	16240.00

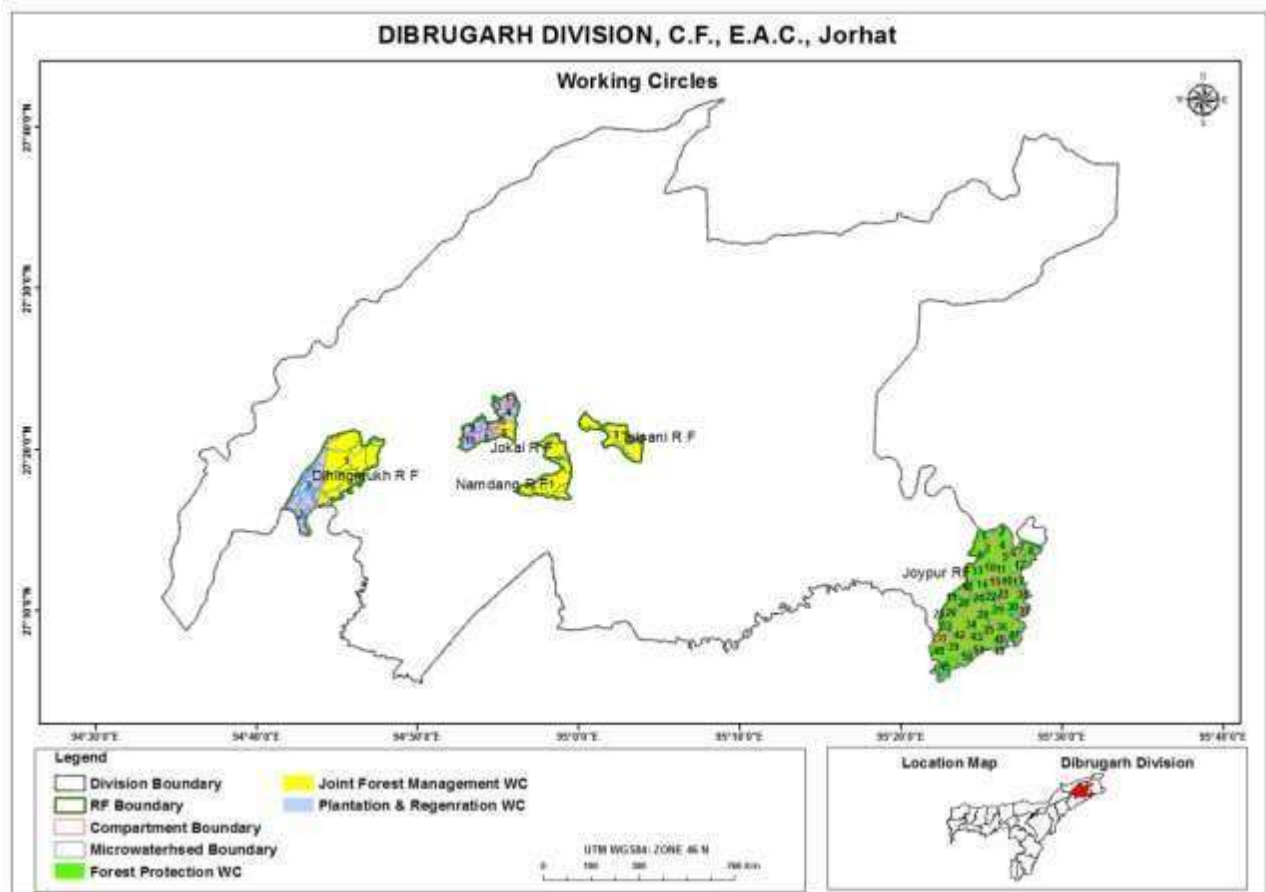


Fig. 2.2: Map showing Allocation of different working circles in Dibrugarh Division.

2.3 Percentage of forest with secured boundaries: The boundaries of the RFs are demarcated by artificial lines, roads, village paths and natural features like rivers, streams and edges of swamp area. The artificial lines are maintained by lines usually cleared of all shrub growth of width 8' to 12' and demarcated by earthen mounds or R.C.C. pillars. General state of artificial boundaries in the Division is not satisfactory in the case of some RFs surrounded by villages. The total length of the natural and artificial boundaries of the RF areas presented in Table 2.3.

Table 2.3: Total length of the natural and artificial boundaries of RFs in Dibrugarh Division

Sl. No.	Name of RF.	Artificial Boundaries (in Km)	Natural Boundaries (in Km)	Total Length (in Km)	Remarks
1.	Dehingmukh	03.04	27.20	30.24	
2.	Namdang	18.80	07.60	36.40	
3.	Telpani	12.62	10.40	23.02	
4.	Jokai	14.14	16.24	30.38	
5.	Jeypore	26.00	32.00	58.00	22 Km inner line
Total		74.60	93.44	168.04	

Estimates for proposed boundary pillar renovation is attached in Annexure.

2.4 Land use, land use change and forestry (LULUCF): The land use and land use change in forests was assessed and compared among two assessment base years of 2005-2006 and 2015-2016. The analysis of data reveals that the maximum Area are under Wetlands and natural

inlands also show massive reduction in their total land area, when assessed with respect to their base year i.e. 2005-2006. Due to increase in grazing activities, the area under grasslands and grazing lands has also reduced significantly. Owing to increase in population, urbanization and industrialization, there is an ever increasing demand of land to cater to the requirements. As a result, significant area under forest has been transformed to build up areas for both rural and urban settlements. Due to increase in agricultural practices, the area along the forest fringe has also witnessed major shift. Due to anthropogenic pressure, the areas under forests have also significantly deteriorated. RF wise LULUCF is shown in Annexure IX.

Table 2.4.a. Land use and land use change in forests of the division in 2005-2006 and 2015-2016

Land use, land use change and forestry (LULUCF)	2005-2006	2015-2016	Change in landuse (Ha)
Agriculture Cropland	1,05,129.2	1,03,195.3	-1933.8
Agriculture Plantation(Tea garden)	68,350.2	66,100.5	-2249.7
Built Up(Industrial/Mining)	42.4	587.1	544.7
Built Up Rural	11.6	1,516.3	1504.7
Built Up Urban	3,891.1	4,532.5	641.4
Forest Evergreen/Semi evergreen	14,919.5	14,998.2	78.7
Forest Scrub Forest	1,125.7	1,156.6	30.9
Forest Tree Clad Area	70,139.7	71,665.2	1525.5
Grassland & Grazing land	11,744.2	16,972.1	5227.9
Wasteland	0.0	432.1	432.1
Waterbodies Lake/Reservoir	9.0	474.4	465.4
Waterbodies River/Stream	58,462.3	52,714.7	-5747.5
Wetlands-Inland-Natural	5,830.9	5,310.6	-520.3
Total	3,39,655.7	3,39,655.7	

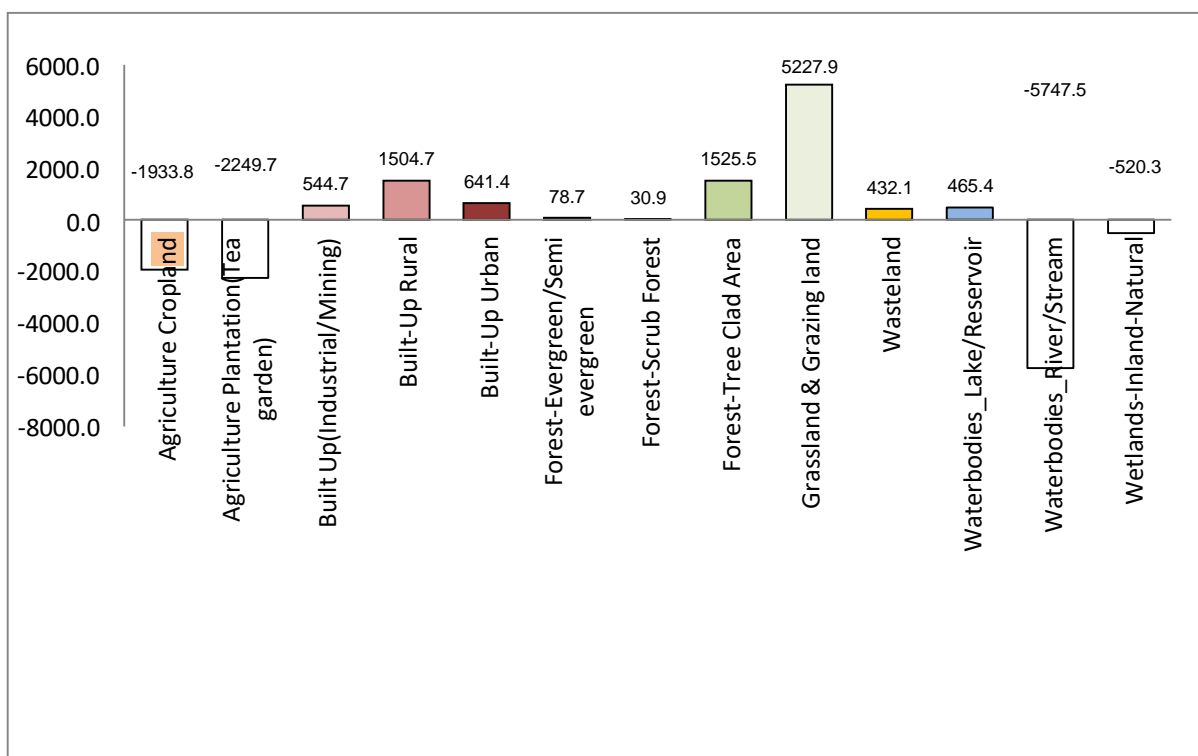


Figure 2.4.a: Graph showing extent of changes (Ha) in LULC detected between 2005-2006 and 2015-2016

Table 2.4b: LULUC matrix of Dibrugarh Division for two time points 2005-2006 and 2015-2016.

2005-2006 2015-2016	Agriculture Cropland	Agriculture Plantation Tea garden	Built Up Industrial /Mining	Built-Up Rural	Built-Up Urban	Forest- Evergreen/ Semi evergreen	Forest- Scrub Forest	Forest-Tree Clad Area	Grassland & Grazing land	Waste land	Waterbodie s/lakes/rese rvoirs	Waterbodie s/River/Stre am	Wetlands Inland- Natural	Grand Total
Agriculture Cropland	98838.30	1090.27	202.93	287.77	48.01	42.02	14.29	2862.26	502.79	311.20	3.90	264.94	660.47	105129.16
Agriculture Plantation, Tea garden	660.64	63472.20	221.79	352.11	22.47	2.97		3534.91	32.76	30.59	1.44	3.96	14.38	68350.22
Built Up- Industrial/Mining	0.90	0.35	40.17	--	0.95	--	--	--	--	--	--	--	--	42.37
Built Up Rural	--	--	--	11.27	--	0.03	--	--	--	--	--	0.29	--	11.59
Built Up Urban	12.70	12.11	0.72	0.18	3850.78	--	--	9.98	0.01	2.60	0.02	0.47	1.52	3891.10
Forest- Evergreen/Semi evergreen	24.09	3.03	0.04	0.42	--	14758.26	4.98	3.82	4.31		1.94	49.07	69.51	14919.48
Forest Scrub Forest	5.06	--	--	--	--	10.75	1100.41	0.09			0.66	2.65	6.08	1125.71
Forest Tree Clad Area	1887.61	1393.67	94.09	857.57	598.89	92.35	0.19	64949.76	28.46	2.24	1.00	134.98	98.88	70139.69
Grassland & Grazing land Temperate/Sub tropical	118.59	0.81	--	0.06	0.37	0.50	-	33.42	8010.34	13.35	--	3375.73	191.02	11744.18
Waterbodies Lake/Pond	0.31	--	--	--	0.04	--	--	0.53	--	--	8.13	--	--	9.01
Waterbodies- River/Stream	428.50	58.23	19.25	1.97	4.21	82.89	25.19	170.91	8158.43	20.46	456.02	48860.18	176.05	58462.29
Wetlands-Inland- Natural	1218.61	69.81	8.08	4.98	6.78	8.41	11.54	99.51	234.99	51.70	1.28	22.48	4092.73	5830.91
Grand Total	103195.32	66100.48	587.07	1516.33	4532.51	14998.18	1156.60	71665.21	16972.09	432.14	474.38	52714.75	5310.63	339655.70

Table 2.4c: Reserved forest wise LULUCF of Dibrugarh forest Division at two time points 2005-2006 and 2015-2016.

LULCF / Year	Dihingmukh RF		Jokai RF		Joypur RF		Namdang RF		Sengajan RF		Telpani RF	
	2005-2006	2015-2016	2005-2006	2015-2016	2005-2006	2015-2016	2005-2006	2015-2016	2005-2006	2015-2016	2005-2006	2015-2016
Agriculture cropland	1150	1130.28	550	555.79			995	1004.27			1224	911.37
Tea garden			19.5	20.35	8.8	8.54	23	23.08				
Builtup (Industrial/Mining)						68.75						
Builtup (Rural)					8.2	11.45						
Forest (Evergreen)	1893.1	1840.31	1132.8	1138.99	9420.2	9464.63	157.9	160.71	406.5			406.77
Forest (Scrub)	953.5	979.65					52.9	55.35				
Forest (Tree clad)	269	318.03	167	155.25			546.7	582.06	102.1			98.43
Grassland		68.92			6	10.81			1.9	0.01		2.14
River / Streams	415.7	35.25	1.8		108.3	65.22	0.5	0.35	159.9	0.02		154.64
Wetland (Manmade)		2.6										
Wetlands (Natural)	276.6	489.1	31.7	33.2			17.1	14.5	40.5			27.6

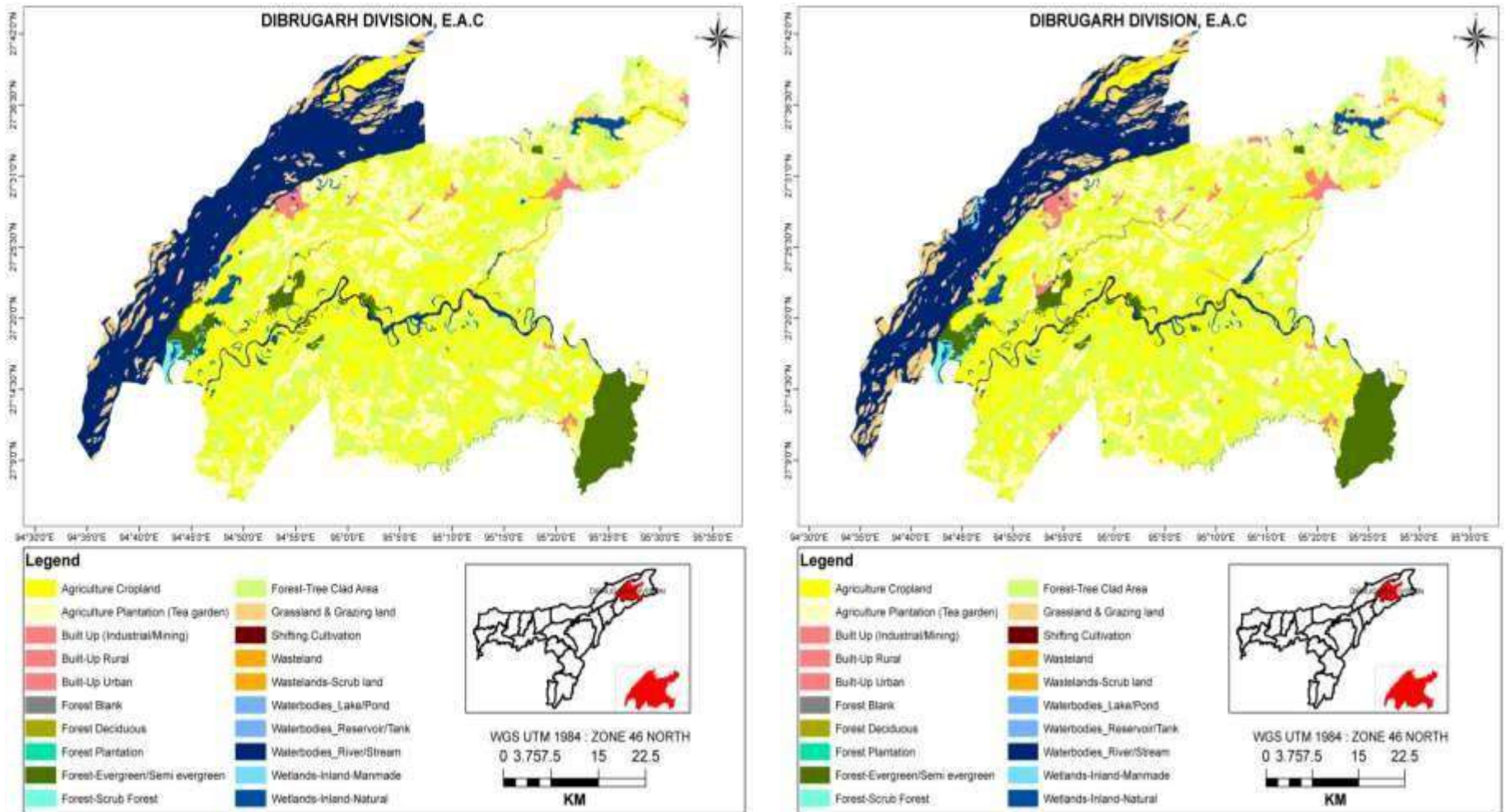


Figure 2.4b: Land Use Land Cover Map of Dibrugarh division in 2005-2006 and 2015-2016.

2.4.1 Status of encroachment: Almost all RFs of the Division are under encroachment. Encroachment is mostly along the agricultural fields, tea gardens, built up area and habitations in the Division. The forest area of the Division is under encroachments from tea gardens, habitations, etc. A total of 1,445.97 Hectare area of the RFs is encroached. RF wise encroached area statement is shown in table 2.4.1 and encroachment map for the division is shown in Figure 2.4.1. Through this working plan, precriptions has been proposed to recover the encroached area wherever possible and gradually utilize the encroached areas through people's participation for enhancing forest productivity.

Table 2.4.1: Statement showing RF-wise encroached area (Ha) under different landuse in Dibrugarh Division

SL/NO	Name of R.F.	Area (Ha.)	Encroachment (Ha.)		Area Evicted during 2002-2003 (Ha.)	Remarks
			Pre - 1980	Present Position		
01.	Jokai R.F.	1848.01	216.00	131.00	85.00	Human habitation & cultivation
02.	Telpani R.F.	1332.288	204.00	109.00	95.00	
03.	Dehingmukh R.F.	5879.04	586.97	504.97	82.00	
04.	Namdang R.F.	1858.63	900.00	700.00	200.00	
05.	Joypur R.F.	10876.68	1.00	0.00	0.00	Seasonal Cultivation by Arunachali
	Total	21,794.648	1907.97	1445.97		

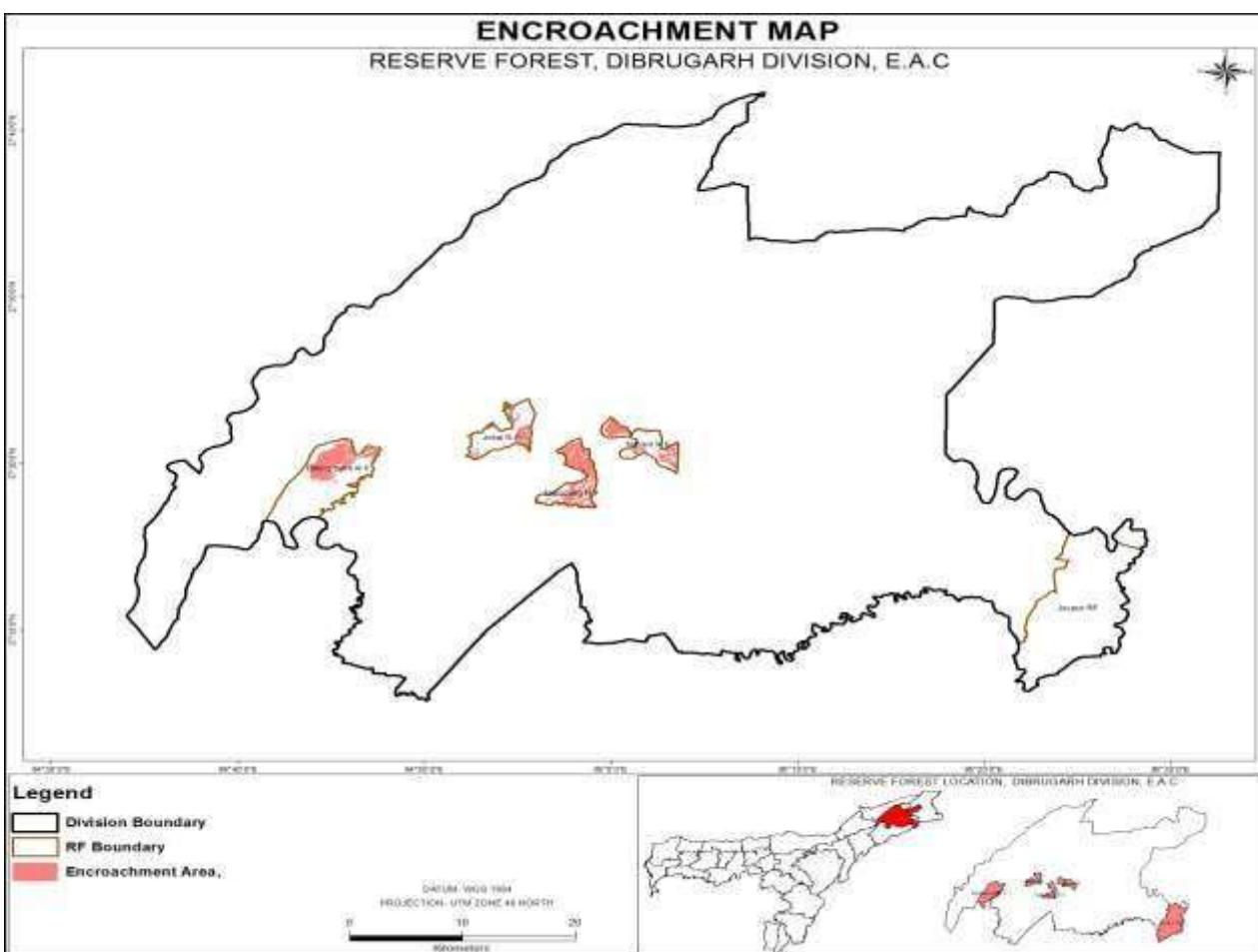


Fig. 2.4.1: Encroachment Map of Dibrugarh Division

2.5 Threats to the forests:

2.5.1 Encroachment: Almost all the Reserved Forests under this Division are surrounded by revenue villages and illegal removal of forest produces from these forests was a common occurrence in the past. As a result, the condition of the Reserved Forests got gradually worsened. However, the RFs are now showing improvement in terms of their growing stocks. Encroachment is the single largest cause of damage to the Reserved Forests. Constitution of Reserved Forests, subsequent additions, was allowed to be continued, resulting in difficulties in consolidation of the respective boundaries on the ground. As a result, the trend of encroachment inside Reserved Forests by the people of bordering villages is still widespread. Population in the villages has increased considerably and this has led to increased pressure on the Reserved forests. Almost the whole of Telpani RF and Jokai RF have been under the grip of encroachments. Hence, remedial measures like rehabilitation of these villages need to be taken up by granting suitable economic packages. Maximum damage of the forests may therefore be attributed to all these encroachments. Hence, to demarcate and consolidate the notified boundaries of the said RFs, immediate measures such as survey, demarcation, fixing of boundary pillars need to be taken up.

2.5.2 Deforestation: The other major factor that threatened the forest is deforestation. Upto late 1980s there have been extensive extraction of Nahor for meeting the heavy demand of railways sleepers. There have been extensive exploitation of Hollong, Mekai, Jutuli, etc. for plywood and other construction purposes like bridge etc. causing degradation of the forest. There have been a shift in the use of wooden sleepers towards concrete sleepers which have however stopped further extraction of the tree species. But, due to presence of very few number of mother trees in the RFs, regeneration of this species in the RFs except in Joypur is almost negligible. Similarly, extraction of medicinal plants has drastically reduced the population to an alarming stage.

2.5.3 Climber: *Mikania* is the main problem of these forests. They invade and cause damage to the seedlings. Their damage is heavy in open areas than in high forests. Other climbers also affect the healthy growth of the trees. The greatest damage to these forests, however, is caused by the climbers. When severe in intensity, climbers can, by sheer physical suffocation, kill trees outright. However, in general, if they are less insidious, the damage they cause inhibition of crown development to such an extent as to cause a considerable loss of increment in the standing crop.

2.5.4 Epiphytes and Parasites: Most of the epiphytes occurring in these forests are harmless in nature except *Ficus*. *Ficus* damage which result in the ultimate death of the trees, however it is negligible. Among parasites, a number of fungi are found in these forests, living on dead trees but mention can be made of root fungus that attacks and often causes the death of Hollong, young and old trees alike.

2.5.5 Weeds: Weed growth is heavy in the operated areas and their root competition is injurious to the regeneration and planted seedling. The invasion of weeds is very rapid with any opening in the forests and effects regeneration by swamping it out unless prompt and effective measures are taken. *Mikania micrantha* occupies the space and spreads rapidly to form a mat and all shrubs and seedlings of tree

species are covered and as a result, the seeds from the trees cannot reach the ground for further regeneration. On open patches at the boundary and adjacent to inspection paths *Lantana camara* is also observed. The wetlands are full with *Eicchornia* spp. and *Ipomea* spp. covers the adjacent areas.

2.5.6 Insects:Borer attack on Hollong logs is massive in this Division. In some places, borer causes damage to all the portions of a Hollong log even within a month. *Weevils* do a lot of damage to Hollong fruits. Sam and Hollong (*Dipterocarpus retusus*)seedlings are attacked by twig borer.Hollong fruits are attacked by a weevil, *Alcides cressers* and these accounts for the low percentage of germination of the otherwise plentiful seeds. But on the whole, the forests are immune from any large scale danger from any source as they have the security of a mixed crop which provides a very efficient check on large scale damage by the insects.

2.5.7 Animals:Elephants cause damage to plantations and nurseries. Deer cause damage to miscellaneous plantations eating up their shoots. Nahor (*Mesua Ferrea*) seeds are eaten by pigs.Birds such as parrot eat the seeds of Hollong and Mekai but its damage is negligible as most of the the half-broken seeds falls on the ground.

2.5.8 Human:Illegal removal of trees, encroachment, felling of trees for firewood are some of the anthropogenic activities affect adversely on forests of the Division.

2.5.9 Storm:Storm damage is caused mainly in the areas where the trees become solitary due to operation.

2.5.10 Erosion and Flood damage:Flood damage to the forests especially in Dihingmukh Reserved forest is of annual feature. Vast tract of forests in this reserved forests are eroded by the Brahmaputra river. Flood water entering Telpani reserve remains there for a considerable time. It lead to low germination of seeds and low survival of planted seedlings.

2.5.11 Grazing:Grazing causes damage to the forests near the human habitation by eating the tips of the seedlings and by trampling them and hardening the soil. Hollong(*Dipterocarpus retusus*) leaves are normally not eaten by cattle.

2.6 Distribution of different forest types:

The forests occurring in this Division are of two types, viz. Evergreen Forests and Mixed Deciduous Forests with evergreen patches. Figure 2.6.a shows the distribution of different forest types in Dibrugarh Division., while Fig. 2.6.b. shows the map of forest density of the Division.

2.6.1 Assam Valley Tropical Wet Evergreen Forests (Dipterocarpus) (Type 1B/C₁):

The Jeypore Reserved Forests of the Division fall under this forest type. These forests are characterized as multi-storeyed, with dominant species Hollong, reaching a height of 50 meters and girth upto 7 meters. It associate Mekai (*Shorea assamica*) occupy the top canopy along with Hollong over some

localities, especially on slightly higher elevations with good drainage. The other areas are mainly occupied by Hollong-Nahor formations. Species that are also found in the top canopy sporadically are, Sopas, Dhuna, Sam, Jutuli, Amari, Barpat etc. Hollong prefers well drained soil and its best expressions are found in old alluvium of Dihing River. The middle storey is dominated by Nahor and Morhal. Other species found in this canopy are Hilikha, Jamuk, Selleng, Bandordima, Bhomora etc. Sometimes, there occurs a third story which is occupied by species such as *Dendrocalamus hamiltonii*, *Bambusa pallida*, *Pseudostachyum polymorphum* and *Livingstonia jenkinsiana* etc. The undergrowth is composed of woody shrubs, like Gochbhedeli, Kasidoria, Osbeckia spp., Sorat etc. Scitamineous shrubs like Kaupat, Bogitora etc., palms such as Geruga tamul, Tokopat etc. and Canes such as Jengu, Raidang, Haukabet, Lejaiare also common.

Numeorus climbers are observed in these forests. Common among them are *Mikania scandens*, *Thunbergia grandiflora*, *Tapiria hirsuta*, *Entada scandens*, *Mezoneurum cucullatum*, *Derris oblomga* and *Bauhinia vahlii* among others. Wherever there is a clearance, Mikenia occupies the space and spreads rapidly to form a mat and all shrubs and seedlings of tree species are covered and as a result, the seeds from the trees cannot reach the ground for further regeneration.

Regeneration of Hollong, Mekai and Nahor are found to be encouraging in these forests, but the height growth of Mekai being slow, established regenerated areas of Mekai are very few. Among other important species, regeneration of Dhuna is common.

2.6.2 Mixed deciduous forests with Evergreen patches (Type No. 3/132):

These forests are found to occur in the Jokai, Telpani, Namdang and Dehingmukh RFs. The general quality of the forests is poor. Significant portions of this region are characterized by open forests. The Nahor type occurs on well drained highland that does not get inundated during the rainy season except in years of exceptional floods. The associates of Nahor in these forests mentioned in order of incidence are Uriam, Jutuli, Outenga, Ajhar, Jobahingori etc. Outenga occurs to larger extent in the Dihingmukh reserve, this reserve being the most low-lying among the four reserves mentioned above. These areas are subject to inundation during the rains and remain submerged during the rainy season. Outenga is the predominant species in the crop and its associates in order of incidence are Uriam, Morhal, Ajhar, Jamuk, Moj, Hilika, etc. The areas in the above four reserves carry a very poor stocking of trees. These areas which cover about half the area of these forests can be subdivided into open and swampy areas. The former areas appear to be vestiges of past cultivation whilst in the later water stagnates for long periods during the year.

The swampy areas are covered by grasses and reeds with isolated trees occurring therein. Amongst the trees that occur in the swampy areas are Ajhar, Amisa, Bhe, Outenga, etc. most of them being stunted in growth except the Bhe which occurs in well grown gregarious patches. The typical undergrowth in these forests consists of Bon-madhuriam, Dhoptita, Dighloti, Gochbhedeli, Bonposola, Sorat, Phutuka, Patidoi, Kaupat, Bogitora, Geregua Tamul, Lejaibet, Jatibet, Kako and Betibah. In well stocked areas in the Nahor type the common undergrowth is Lejaibet, Gochbhedeli and sometimes Kaupat with Geregua Tamul, confined to the edges of depressions. Patidoi is the most common undergrowth in the Outenga type while

Sorat, Dighlota are characteristic of open areas. The swamps and edges of streams are covered by Jatibet and grass nearer the big rivers whilst Lejaibet takes the place of Jatibet in such areas away from big rivers.

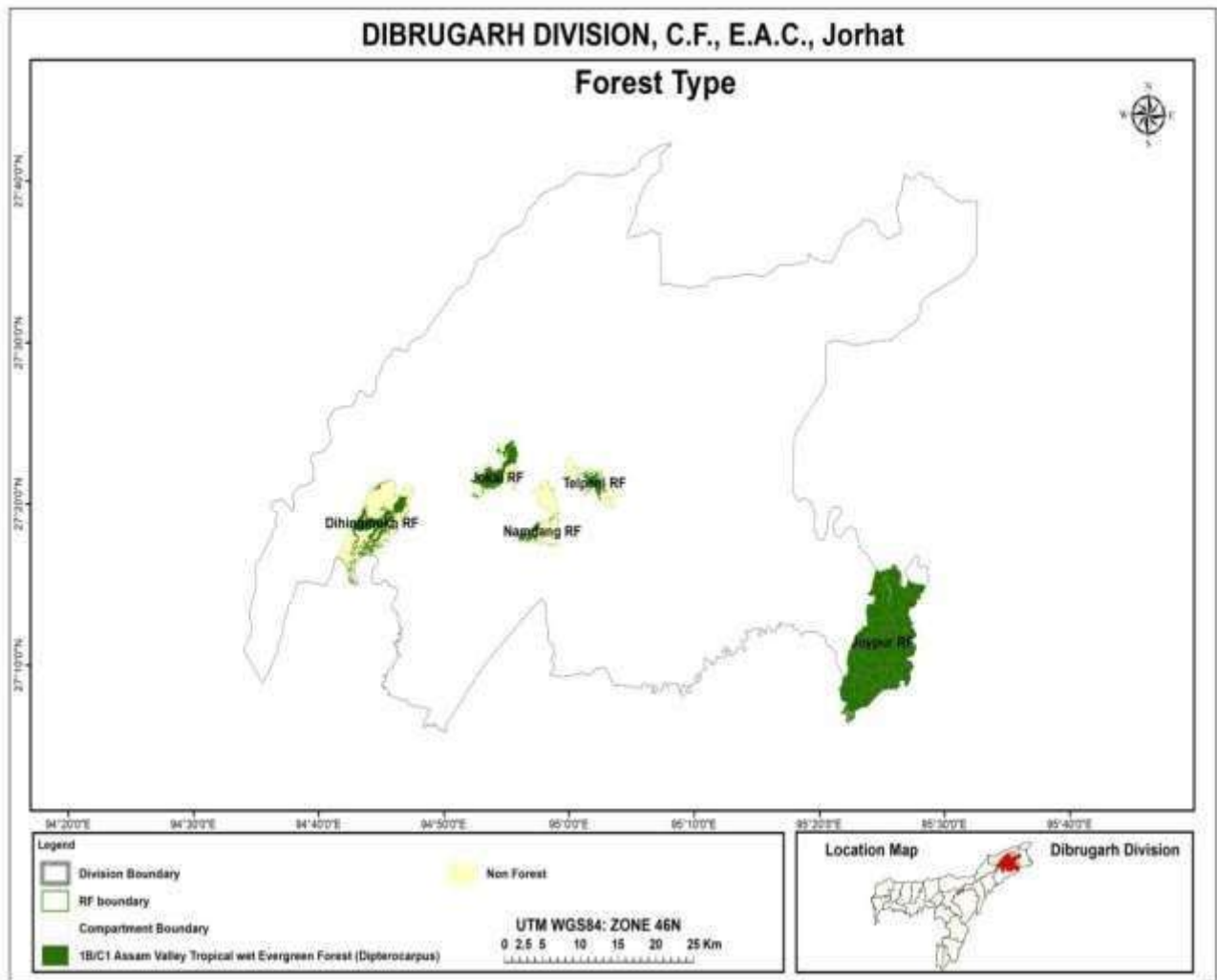


Fig. 2.6.a. Forest Type Map of Dibrugarh Division.

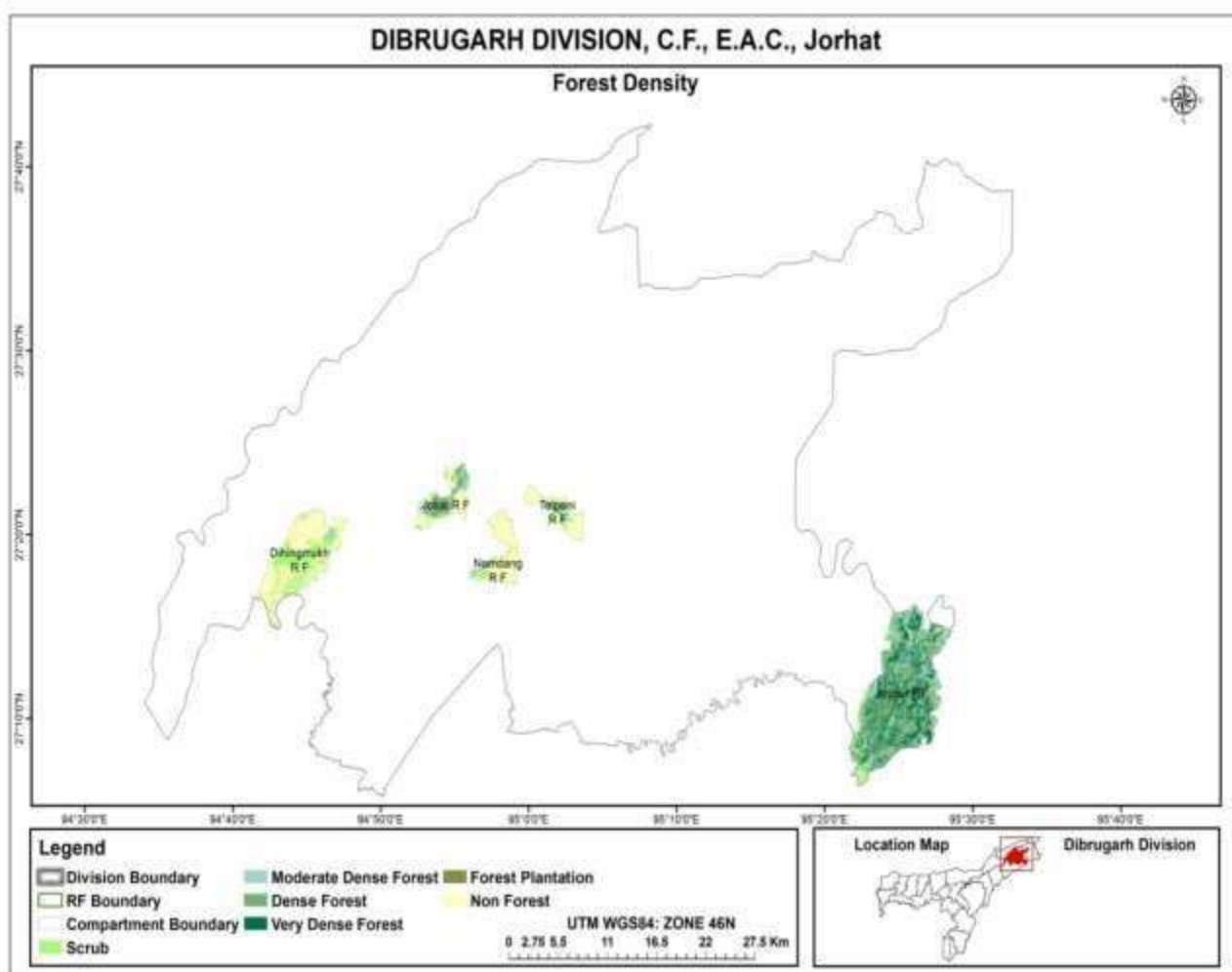


Fig. 2.6b. Canopy Cover Map of Dibrugarh Division

2.7 Tree cover outside forest area: Though most of the forest area is concentrated inside the notified areas of Dibrugarh Forest Division, a sizable number of trees are observed outside these forest areas. There are large number of home grown species found in the revenue areas of these District. These are grown by people in rural areas over their land as habitual socio-cultural practices by planting fruit bearing trees like Mango (*Mangifera indica*), Jamun (*Syzygiumcumini*), Jackfruit (*Artocarpus spp*), Jalpai (*Elaeocarpus serratus*), Amlakhi (*Phyllanthus emblica*), Silikha (*Terminalia chebula*), etc. along with patches of Bamboos. Trees outside forest (TOF) are include all the trees growing outside recorded forest area in the Division. A large part of the demand of the people in terms of timber, fuelwood, and resources is being met from outside forest areas and therefore assessment of TOF becomes imperative in this working plan. IRS P-6 LISS IV (5.8m) satellite images were geometrically rectified with the help of Survey of India toposheets on 1:50,000 scale. Mapping of TOF areas was carried out by digitizing the greenwash area by taking them as proxy forest areas and masking them out. Map showing the tree outside forest areas of Dibrugarh Division is shown in the figure 2.7.1. The total area of tree outside forest in the Division is 35,543.98 hectare. Details of TOF areas with the coordinates is provided in Annexure VI.

The methodology adopted by Forest Survey of India (FSI) is adopted for mapping ToF areas. The multispectral data of Sentinel 2 with spatial resolution of 10m and swath of 290 km has been used for classification of the selected grids. The sentinel satellite data is downloaded and geo-rectified with the help of Survey of India (SOI) open series map topo-sheets on 1:50,000 scale. The image is then classified into settlement, waterbodies, tree patches, agriculture and other land cover cases. This classification enables the interpreter to distinguish between tree patches and other classes. The classified image is visually analysed for editing and refinement. Since the minimum mapable area is 0.1 Ha, pixels are clumped and cluster of pixels having area less than 0.1 Ha are eliminated. After editing the classified image, the final classified map is generated having all TOF areas.

2.7.1 Tree cover outside forest area: There are homegrown species found in the revenue areas outside the Reserved forest in this division. Major part of the demand of the people in terms of small timber, fuelwood, and NTFP is being met from trees growing outside forest areas. Trees are grown by people in rural areas as habitual socio-cultural practices. Though, most of the forest area is concentrated inside the notified areas of Dibrugarh Division, a sizable number of trees are observed outside these forest areas. There are large number of home grown species found in the revenue areas of these districts. These are grown by people in rural areas over their land as habitual socio-cultural practices by planting fruit bearing trees like Mango (*Mangifera indica*), Jamun (*Syzygiumcumini*), Jackfruit (*Artocarpus spp*), Jalpai (*Elaeocarpus serratus*), Amlakhi (*Phyllanthus emblica*), Silikha (*Terminalia chebula*) etc. along with patches of Bamboos mainly Jati, Bholuka, Bijuli and Ura or Sepa.

Further, these can be noticed on road - sides, planted by the Forest department. Also, Dibrugarh District being the highest exporter of tea, has a number of tea gardens with considerable number of tree species. In addition to this, S.F. Division Dibrugarh has taken up plantations within the Dibrugarh Division since its inception.

Table 2.7.1a: Statement on number of ToF patches under different area classes.

S.No.	Area class (ha)	Number of patches	Commonly found ToF species
1	0 - 50	494	<i>Mangifera indica, Terminalia chebula, Terminalia boohera, Emblica officinalis, Artocarpus heterophyllus, Dellinea indica, Sysygium indica, Musa spp., Areca catechu, Elaeocarpus serratus, Flacourtia jangomas, Citrus spp., Bambusa tulda, Dendrocalamus spp., Saraca ashoka, Cassia fistula, Morus alba, Delonix regia, Azadirechta indica, Melia azadirechta, Bombax ceiba, Livistona jenkinsiana, etc.</i>
2	50 - 100	58	
3	100 - 150	13	
4	150 - 200	5	
5	200 - 250	3	
6	250 - 300	1	
7	300 - 350	1	
8	350 - 400	1	
9	550 - 600	1	
		577	

Details on number of trees in tree gardens and plantations are presented in Table 2.7.1c.

Table 2.7.1b: Number of trees observed in plantations and tea gardens in Dibrugarh Division, Assam

SI. No.	Plantation	Area (Ha)	Number of Trees (Approx.)
1	S.F. Plantation	100	1,11,100
2	Tea Garden	2,100	3,25,000
TOTAL			4,36,100

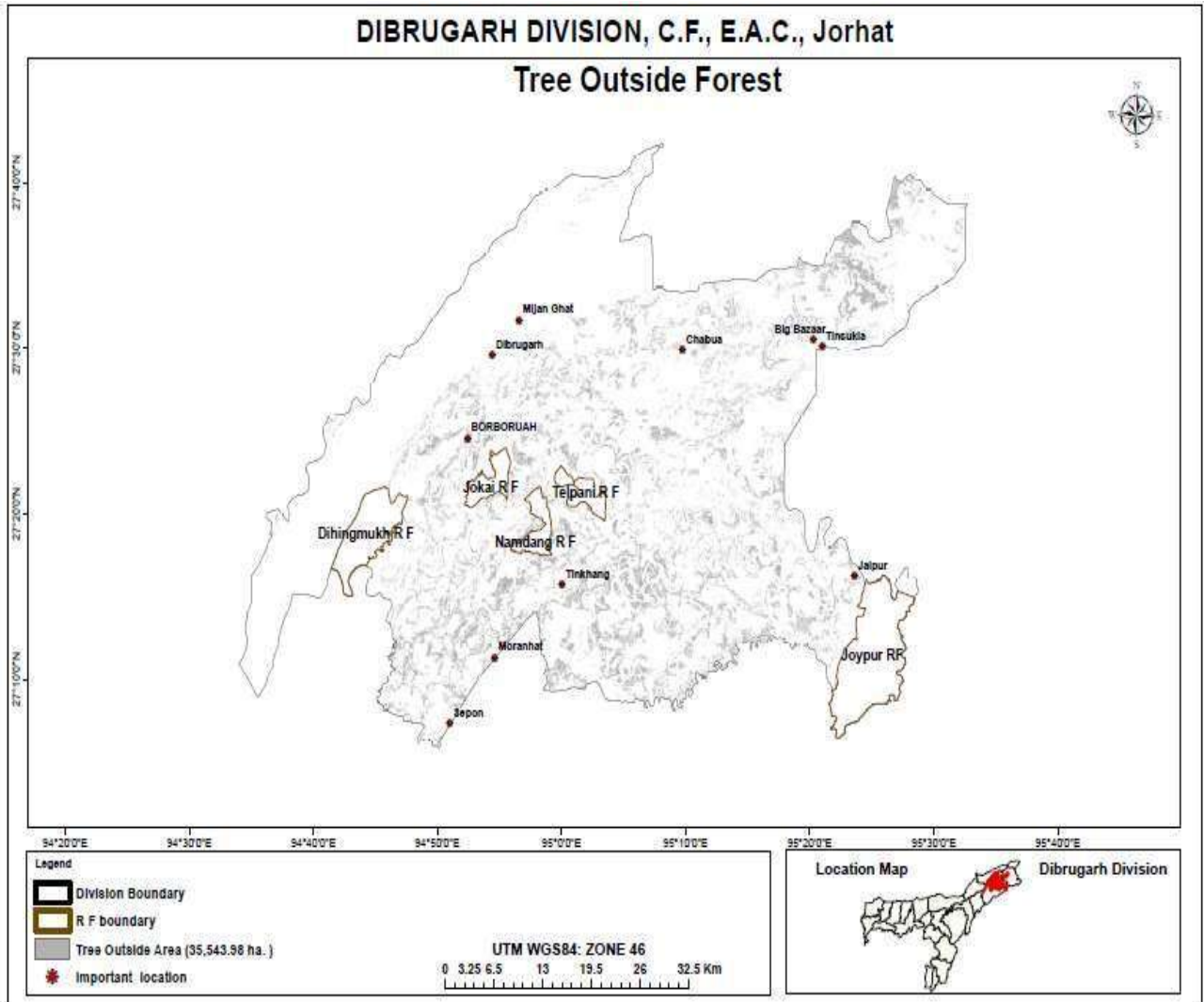


Fig.2.7.1: Tree outside forest map of Dibrugarh Division

2.7.2 Unclassified State Forest (USF): USF areas are those patches other than Reserved Forests in the jurisdiction of the Forest Division, that are above 10 hectares in area. There are 33 patches in this Division. These were delineated and mapped (see Figure 2.7.2). Detail area of each USF patch and coordinates is shown in Annexure 3. Distribution of USF patches under different area classes with commonly occurring species is shown in table 2.7.2.

Table 2.7.2: Statement on number of USF patches under different area classes

S.No.	Area class (ha)	Number of patches	Commonly found ToF species
1	10-60	18	<i>Ficus religiosa</i> , <i>Ficus bengalensis</i> , <i>Dipterocarpus</i> spp., <i>Mangifera indica</i> , <i>Terminalia chebula</i> , <i>Terminalia boohera</i> , <i>Embllica officinalis</i> , <i>Artocarpus heterophyllus</i> , <i>Dellinea indica</i> , <i>Syzygium indica</i> , <i>Musa</i> spp., <i>Areca catechu</i> , <i>Elaeocarpus</i> <i>serratus</i> , <i>Flacourtia jangomas</i> , <i>Citrus</i> spp., <i>Bambusa tulda</i> , <i>Dendrocalamus</i> spp., <i>Saraca ashoka</i> , <i>Cassia fistula</i> , <i>Morus</i> <i>alba</i> , <i>Delonix regia</i> , <i>Azadirachta indica</i> , <i>Melia azadirachta</i> , <i>Bombax ceiba</i> , <i>Livistona jenkinsiana</i> , etc.
2	60-110	7	
3	110-160	1	
4	160-210	2	
5	260-310	1	
6	360-410	1	
7	460-510	1	
8	510-560	1	
9	660-710	1	
		33	

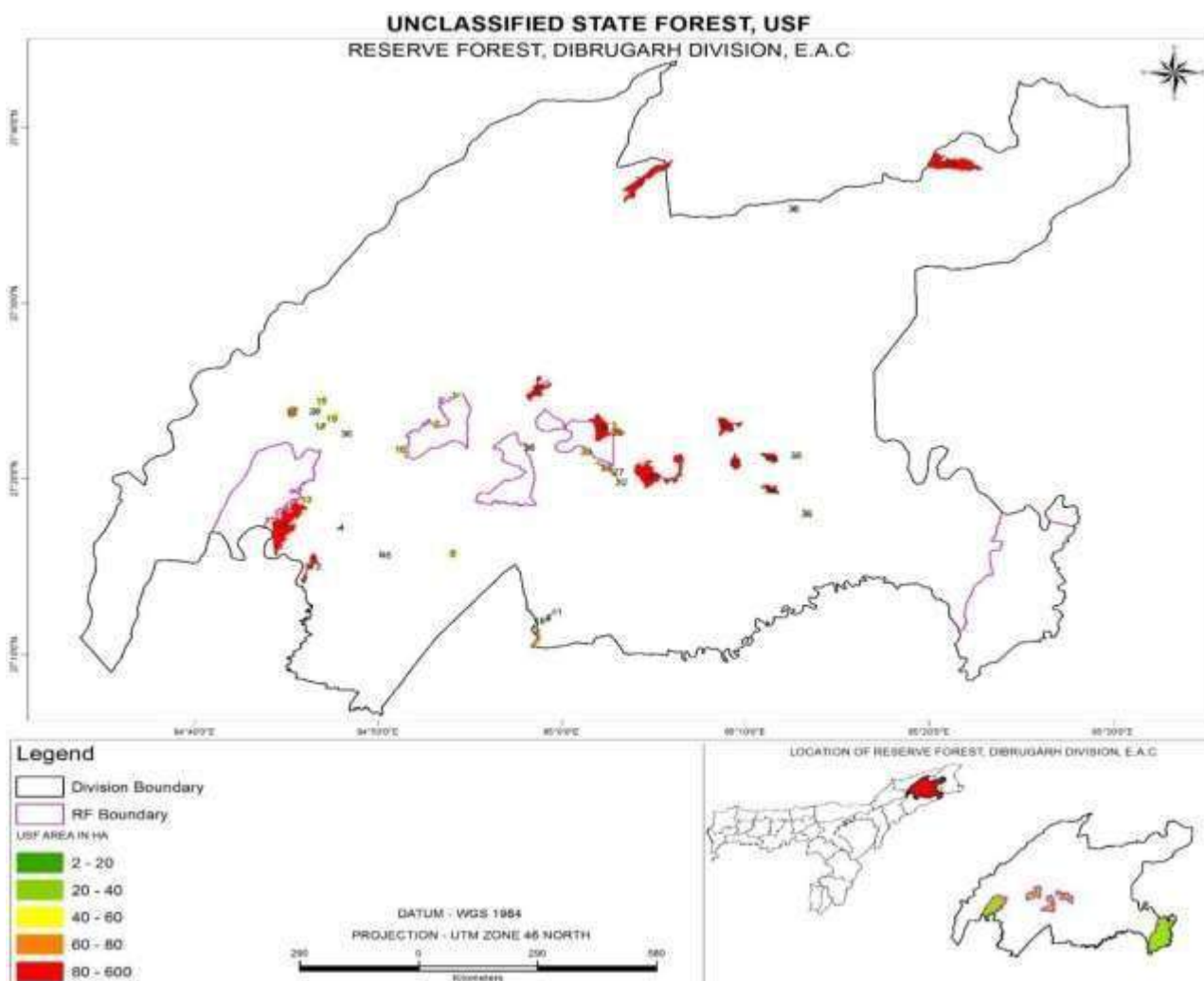


Fig 2.7.2: Unclassified state of forest map in Dibrugarh division

2.8 Shifting cultivation (Jhumming): Though Shifting cultivation is practiced in many parts of the State, it is not practiced in Dibrugarh Division. As such it is not posing as a threat to the forest of this Division. However, on increase of human population and on rising demand for cultivable land, chances of adoption of Jhum like cultivation in the long run, cannot be denied. Therefore, precautionary measures need to be taken to thwart any such attempt of the land hungerers.

CHAPTER 3

Maintenance, Conservation and Enhancement of Biodiversity

3.1 Forest composition and distribution: The forests occurring in this Division are mainly of two types, viz. Evergreen Forests and Mixed Deciduous Forests with evergreen patches.

3.1.1 Assam Valley Tropical Wet Evergreen Forests (Dipterocarpus) (Type 1B/C1):

The Joypur Reserved Forests of the Division fall under this forest type. These forests are multi-storeyed with dominant species as Hollong reaching a height of 50 meters and girth upto 7 meters. Another dipterocarp, Mekai (*Shorea assamica*) also occupy the top canopy along with Hollong on some localities, especially on slightly higher elevations with good drainage. This Reserved Forest is mainly occupied by Hollong-Nahor formations. Other species which are found to occur in the top canopy sporadically are, Sopas, Dhuna, Sam, Jutuli, Amari, Barpat etc. Hollong prefers well drained soil and its best expressions are found in old alluvium of Dihing river. The middle storey is dominated by Nahor and Morhal. Other species found in this canopy are Hilikha, Jamuk, Selleng, Bandordima, Bhomora etc. Sometimes, these occurs in a third storey which is occupied by *Dendrocalamus hamiltonii*, *Bambusa pallida*, *Pseudostachyum polymorphum*, *Livistonia jenkinsiana*, etc. The undergrowth is composed of woody shrubs, like Gochbhedeli, Kasidoria, *Osbeckia* spp., Sorat, etc. Scitamineous shrubs like Kaupat, Bogitora, etc., palms such as Gerugatamul, Tokopat, etc. and Canes such as Jengu, Raidang, Haukabet, Lejai.

Climbers are numerous and occur profusely in these forests. Common among them are *Mikania scandens*, *Thunbergia grandiflora*, *Tapiria hirsuta*, *Entada scandens*, *Mezoneurum cucullatum*, *Derris oblonga*, *Bauhinia vahlii*, etc. Wherever there is a clearance, *Mikania micrantha* occupies the space and spreads rapidly to form a mat over shrubs and seedlings as a result, the seeds from the trees are restricted to reach the ground for quick germination. Regeneration of Hollong (*Dipterocarpus retusus*), Mekai (*Shorea assamica*) and Nahor (*Mesua ferrea*) are found to be encouraging in these forests, but the height and growth of Mekai being slow, established regenerated areas of Mekai are very few. Among other important species, regeneration of Dhuna (*Canarium* spp.) is common.

3.1.2 Mixed deciduous forests with Evergreen patches (Type No. 3/132):

These forests are found to occur in the Jokai, Telpani, Namdang and Dihingmukh Reserves. General quality of the forests is poor on the whole. These forests, particularly in the Dihingmukh Reserve, show remnants of the past human habitation which extended probably up to the beginning of the last century. About half the area under this type carries on it tree forest to some extent, the other half consisting of open area. The two types of trees which can be distinguished are the Nahor type and the Outenga type, the former covering only a small portion of the area and being characteristic of the better drained areas. The Nahor type occurs on well drained high land that does not get inundated during the rainy season except in years of exceptional floods and is characterized by incidence of Nahor in the crop. The

associates of Nahor in these forests mentioned in order of incidence are Uriam, Jutuli, Outenga, Ajhar, Jobahingori etc. Outenga, occurs to larger extent in the Dihingmukh reserve, this reserve being the most low-lying among the four reserves mentioned above.

The Outenga (*Delina indica*) type better drained among the low-lying areas and the banks of the numerous small streams that are found in these forests. These areas are subject to inundation during the rains and remains submerged for some length of time during the rainy season. Outenga is the predominant species in the crop and its associates in order of incidence are Uriam, Morhal, Ajhar, Jamuk, Moj, Hilika, etc. The potential value of this type is, however, low at present. The rest of the area in the Reserved forests carry a very poor stocking of trees. Open areas and swampy areas cover about half the area of these forests. The former areas appear to be vestiges of past cultivation whilst in the later water stagnates for long periods during the year. The swampy areas are covered by grasses and reeds with isolated trees occurring therein. Amongst, the trees that occur in the swampy areas are Ajhar, Amisa, Bhe, Outenga, etc. most of them being stunted in growth except the Bhe which occurs in well grown gregarious patches.

The typical undergrowth in these forests consists of Bonmadhuriam, Dhoptita, Dighloti, Gochbhedeli, Bonposola, Sorat, Phutuka, Patidoi, Kaupat, Bogitora, Geregua Tamul, Lejaibet, Jatibet, Kako and Betibans. In well stocked areas in the Nahor type the common undergrowth is Lejaibet, Gochbhedeli and sometimes Kaupat with Geregua Tamul, confined to the edges of depressions. Patidoi is the most common undergrowth in the Outenga type while *Sorat*, *dighloti* are characteristic of open areas. The swamps and edges of streams are covered by Jatibet and grass nearer the big rivers whilst Lejaibet takes the place of Jatibet in such areas away from big rivers.

3.2 Plant species diversity: The climatic condition and wide variety of physical features have resulted in the diversity of ecological habitats such as forests, grasslands, wetlands which harbor and sustain wide ranging floral and faunal species. In the "Revised Survey of Forest Types of India", Champion and Seth (1968) categorized the forest types/ Sub-types as – Tropical Wet Evergreen Forest, Tropical Semi Evergreen Forest, and Tropical Moist Deciduous Forest.

Orchids show all the habits and growth form found orchidaceous taxa. Mostly they are epiphytes. *Goodyera procera* and *Spiranthes sinensis* are adapted to aquatic habitat. Whereas, *Vanillapilifera*, *Galeola altissima* are climbers. Species belonging to genera *Acanthe pippium* spp., *Anoectochilus* spp., *Apostasia* spp., *Agrostophyllum* spp., *Coelogyne* spp., *Cymbidium* spp., *Dendrodium* spp., *Eria* spp., *Oberonia* spp., *Calanthe* spp., *Eulophia* spp., *Geodorum* spp., *Habenaria* spp., *Malaxis* spp., *Nephelaphyllum* spp., *Vanilla* spp., *Zeuxine* spp., *Didymoplexis* spp., *Galeola* spp., *Bulbophyllum* spp., *Camarotis* spp. are the commonly found orchids.

Fourteen species of cane grow in cane breaks and the species are mainly, *Calamus flagellum*, *Calamus floribundus*, *Calamus latifolius*, etc. A good number of plants having medicinal uses in Ayurvedic, Unani, Homeopathic and even modern medical practices etc. like *Curcuma aromatica* (Bon Haladhi), *Phyllanthus emblica* (Amlakhi), *Aeglemarmelos* (Bel), *Terminalia chebula* (Hilikha), *Terminalia bellirica* (Bahera),

Syzygium cumini (Jamun), *Garcinia* spp. (Thekera spp), *Holarrhena antidysenterica* (Dudkhuri), *Litsea cubeba* (Mejankuri), *Ocimum* spp. (Tulsi), *Phlogocanthus thyrsoiflorus* (Titaful), *Piper longum* (Pipoli), *Saraca asoka* (Ashoka), *Zinziber officinale* (Ada) are found among other medicinal species in the forests of Dibrugarh Division. Dibrugarh has some fresh water wetlands along with marshy depression and swamp as well as perennial water bodies of various shape and size which are locally called beels, doloni, pitoni etc. which harbor numerous aquatic species, categorized as follows –

- Free floating hydrophytes: *Eichhornia crassipes*, *Pistia stratiotes*, *Lemna minor*, etc.
- Suspended submersed hydrophytes: *Ceratophyllum demersum*, *Utricularia gibba*, etc.
- Anchored submersed hydrophytes: *Hydrilla* spp., *Potamogeton* spp., *Vallisneria* spp.,
- Anchored hydrophytes with floating leaves: *Nelumbo* spp., *Euryles* spp., etc.
- Anchored hydrophytes with floating shoots: *Ludwigia* spp., *Ipomea* spp., etc.
- Emergent amphibious hydrophytes: *Sagittaria* spp., *Scirpus* spp.
- Wetland hydrophytes: *Cyperus* spp., *Hygophylla* spp., etc. Species diversity details is provided in Annexure III.

Species diversity details is provided in Annexure 4. The data reveals that the Division is rich in biodiversity. There are 126 species of trees recorded in the division with an average density of 186.5 trees/ha. The area is rich with NTFP and medicinal plant species. Graph showing the importance value index is shown in Figure 3.2. It reveals that *Dipterocarpus retusus* is the dominant species with maximum Importance Value Index (IVI: 55.5) followed by *Mesua ferrea* (IVI: 32.6) and *Shorea assamica* (IVI: 28.4) as co-dominant species. Other associate species in this forest area are: *Castanopsis indica*, *Aglaiia spectabilis*, *A. hiernii*, *Artocarpus lakoocha*, *Albizia lebbeck*, *Cassia fistula*, *Bauhinia variegata*, *Carota urens*, *Magnolia champaca*, *M.baillonii*, *Cinnamomum bejolghota*, *Cinnamomum tamala*, *Pterocarpus* spp, *Mallotus* spp, *Chukrasia tabularis*, *Terminalia chebula*, *T. bellirica*, *Toona ciliate*, *Ziziphus* spp. etc.

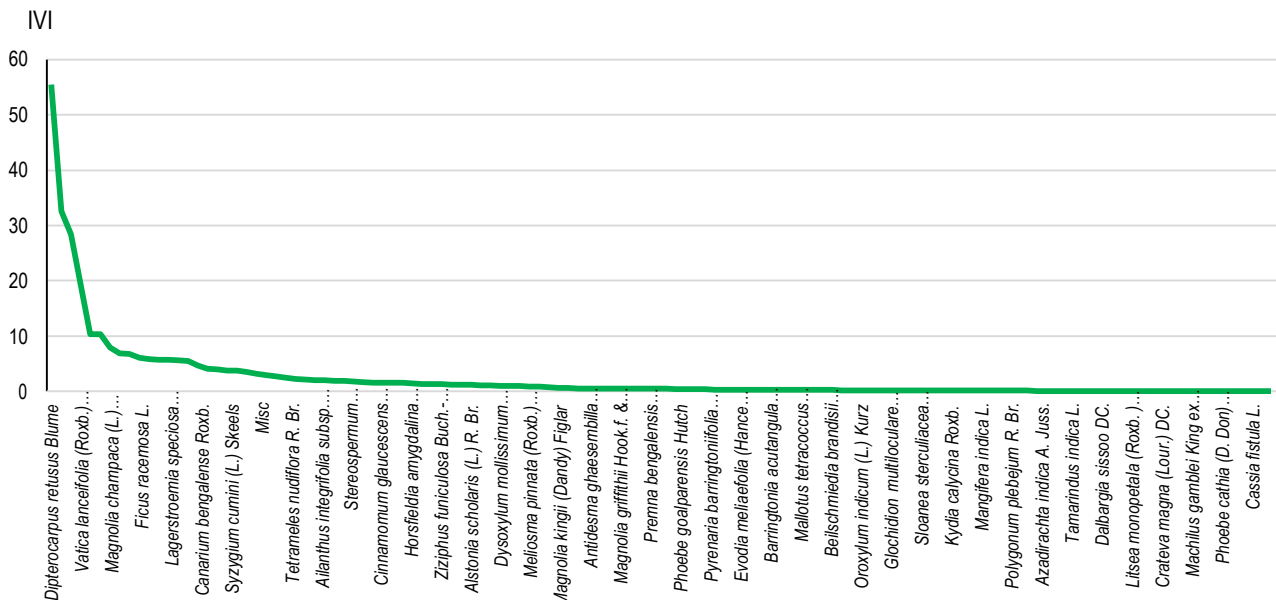


Figure 3.2: Graph showing the IVI of different species in Dibrugarh division

3.3 Status of biodiversity conservation in forests: The rain forest of this division, popularly known as Amazon of the east has a very rich biodiversity in as much as 60 mammal species, 270 plus bird species, 47 snake species, 25 amphibian species, 71 fish species, 300 plus butterfly species live in these forest. The wild animals noticed in the tract include The Asian elephant, Tiger, The clouded leopard, Field mouse, Fruit bat, Wood rat, The jungle cat, The Rhesus monkey, Pangolin, Sloth bear, Indian civet, Sambar, Bamboo rat, Mole, Tree shrew, Himalayan Black Bear, Small civet, The leopard, The common langur, Giant squirrel, Hare, The slow loris, The Assamese macaque, The fishing cat, Muntjac, Hog deer, The mongoose, The Goral, Porcupine, The jackal, Wild boar, Common Otter. Different species of birds namely Drongos, pheasants, Jacanas, Orioles, Eagles, Hornbills, Owl, Minivets are found in the waterholes, waterbodies located inside the Division.

The biodiversity of forests is declining rapidly due to land use change, climate change, invasive species, overexploitation, and pollution. These are due to the adverse affects from various drivers. Encroachment, illegal felling and clearing of forests for cultivable land have posed threat to the forest flora as well as faunal biodiversity. Apart from Assam Forest Regulation 1891 (Amendment Act 1995), the State has several rules and regulations such as Biological Diversity Act 2002, Assam Biodiversity Rules 2010, State Forest Policy 2004, National Forest Policy 1988, Draft Assam Bamboo and Rattan Policy 2003, National Biodiversity Action Plan 2008, Assam State Action Plan on Climate Change 2015-30, etc. for conservation of biodiversity. The strategies include –

- a) protection and making efforts to restore original ecosystem and halt habitat fragmentation, degradation, loss, and shrinking of genetic diversity,
- b) promotion of indigenous tree species in degraded areas,
- c) improving canopy density in the existing forests,
- d) promotion of natural regeneration, protection and preservation of bamboo and rattan,
- e) preparation of comprehensive flora and fauna species lists,
- f) management of funds for biodiversity conservation and enhancement related work, and
- g) involvement of local communities and their livelihood development.

Except for Joypur RF, all other RFs is affected by encroachment and illicit felling, which also affects the natural habitat of the flora and fauna. The western hillock gibbon in found in Bherjan-Borjan and Padumoni Wildlife Sanctuary. The Eastern hoolock gibbon flourish in Joypur division. In other RFs these were worst affected by unabated encroachment and conversion of forests and wetlands in to agriculture and human habitation. If forest protection measures are not strictly observed in these natural abode, the endemic gibbons will disappear permanently and will lead to extinction of the Eastern Hollock from Assam. The list of RET species and species under Schedule List of WPA, 1972 is provided in table 3.3.

Table 3.3: List of RET species and those under Schedule list of WPA, 1972

S.No.	Common Name	Scientific Name	RET Category
1	Mekai	<i>Shorea assamica</i>	Critically endangered
2	Morhal	<i>Vatica lanceaefolia</i>	Critically Endangered
3	Tezpat	<i>Cinnamomum tamala</i> (Buch-Ham.) T. Nees&Eberm	Near Threatened
4	Holong	<i>Dipterocarpus retusus</i> Blume	Endangered

5	DooleeChampa	<i>Magnolia pterocarpa</i> Roxb.	DD (Data deficient)
6	Orchid	<i>Gastrochilus calceolaris</i>	Critically endangered
MAMMALS			
1	Pangolin	<i>Manis crassicaudata</i>	Schedule I
2	Fishing Cat	<i>Felis viverrina</i>	Schedule I
3	Gangetic Dolphin	<i>Platanista gangetica</i>	Schedule I
4	Hoolock Gibbon (Eastern)	<i>Dinopithecus leuconedys</i>	Schedule I
5	Hoolock Gibbon (Western)	<i>Dinopithecus hoolock hoolock</i>	Schedule I
6	Indian Elephant	<i>Elephas maximus</i>	Schedule I
7	Leopard	<i>Panthera pardus</i>	Schedule I
8	Leopard Cat	<i>Felis bengalensis</i>	Schedule I
9	Slow Loris	<i>Nycticebus caucang</i>	Schedule I
10	Sloth Bear	<i>Melursus ursinus</i>	Schedule I
11	Spotted Linsang	<i>Prionodon pardicolor</i>	Schedule I
12	Tiger	<i>Panthera tigris</i>	Schedule I
13	Wild Buffalo	<i>Bubalus bubalis</i>	Schedule I
14	Capped Langur	<i>Presbytis pileatus</i>	Schedule I
15	Clouded Leopard	<i>Neofelis nebulosa</i>	Schedule I
16	Assamese Macaque	<i>Macaca assamensis</i>	Schedule II
17	Rhesus Macaque	<i>Macaca mulatta</i>	Schedule II
18	Bengal Porcupine	<i>Atherurus mecrourus assamensis</i>	Schedule II
19	Large Indian civet	<i>Viverra zibetha</i>	Schedule II
20	Small India civet	<i>Viverricula indica</i>	Schedule II
21	Jackal	<i>Canis aureus</i>	Schedule II
22	Flying Squirrel	<i>Petaurista phillippensis</i>	Schedule II
23	Giant Squirrel	<i>Ratufa indica</i>	Schedule II
24	Jungle Cat	<i>Felis chaus</i>	Schedule II
25	Otter	<i>Lutra lutra</i>	Schedule II
26	Barking Deer	<i>Muntiacus muntjak</i>	Schedule III
27	Sambar	<i>Cervus unicolor</i>	Schedule III
28	Wild Pig	<i>Sus scrofa</i>	Schedule III
29	Hare	<i>Lepus timidus</i>	Schedule III
30	Fruit Bat	<i>Pteropus mariannus</i>	Schedule V
31	Mice	<i>Mus musculus</i>	Schedule V
32	Rat	<i>Rattus rattus</i>	Schedule V
REPTILES AND AMPHIBIANS			
1	Pit Viper,	<i>Trimeresurus medoensis</i>	Schedule-II (Part-II)
2	Indian Python	<i>Python molurus</i>	Schedule-I (Part-II)
3	King Cobra	<i>Ophiophagus hannah</i>	Schedule-II (Part-II)
4	Indian Cobra	<i>Najanaja</i>	Schedule-II (Part-II)
5	Asian Leaf Turtle	<i>Cyclemys oldhamii</i>	Schedule-I (Part-II)
6	Water Monitor Lizard	<i>Varanus salvator</i>	Schedule-I (Part-II)
7	Rat Snake	<i>Zamenis longissimus</i>	Schedule-I (Part-II)
8	Banded Krait	<i>Bungarus fasciatus</i>	Schedule IV
9	Black Krait	<i>Bungarus niger</i>	Schedule IV
10	Mountain Pit Viper	<i>Ovophis monticola</i>	Schedule IV
11	Fresh Water Frog	<i>Rana temporaria</i>	Schedule IV
ENDANGERED BIRDS			
1	Bengal Florican	<i>Eupodotis bengalensis</i>	Schedule I
2	Forest Spotted Owlet	<i>Athene blewitti</i>	Schedule I
3	Great Indian Hornbill	<i>Buceros bicornis</i>	Schedule I

4	Greater Adjutant Stork	<i>Leptoptilos dubious</i>	Schedule I
5	Lesser Pied Hornbill	<i>Anthracoseros albirostris</i>	Schedule I
6	Fish Eating Eagle	<i>Pandion haliaetus</i>	Schedule I
7	White Winged Wood Duck	<i>Cairinascutulata</i>	Schedule I
8	Hill Myna	<i>Gracula religiosa</i>	Schedule I
9	Long Billed Vulture	<i>Gyps indicus</i>	Schedule I
BUTTERFLIES			
1	Common gem	<i>Poritia hewitsoni</i>	Schedule II
2	Yam fly	<i>Loxura atymnus</i>	Schedule II
3	Sullied sailor	<i>Neptis soma soma</i>	Schedule I
4	Peablu	<i>Lampides boeticus</i>	Schedule 1

Due to absence of approved Working Plan in the Division, no specific efforts have been taken for Biodiversity Conservation other than the enforcement of Assam Forest Regulation, 1891 and Wildlife Protection Act, 1972. The Assam State Biodiversity Board was constituted in 2010 as an autonomous and statutory body to exercise the power conferred under sub-section (1) of Section 22 of Biological Diversity Act, 2002. It aims to promote Biodiversity Conservation, sustainable use of its component and equitable sharing of benefits arising out of commercial use of biological resources or associated traditional knowledge. Dibrugarh Division has taken initiative for *in-situ* and *ex-situ* conservation efforts for sensitive/RET/IUCN red listed species. At Jokai Reserved Forest a botanical garden cum germ plasm centre has been set up for *ex-situ* conservation of medicinal, aromatic, orchid, rainforest species among which a considerable number of species are RET (Rare Endangered threatened) in an effort towards in-situ conservation of Jokai Reserved Forest endowed with medicinal trees, aromatic plants and fruit trees.

3.4 Status of species prone to over exploitation:Upto late 1980s there have been over exploitation of Nahor for meeting the heavy demand of railways sleepers. There have been also been extensive extraction of Hollong, Mekai, Jutuli, etc. for bridge and other construction purposes, this led to exploitation. Shifting toward concrete sleepers have stopped further extraction of the tree species. However, due to very few number of mother trees in the RFs, regeneration of this species in all the RFs expect in Joypur is almost negligible. Similarly, extraction of medicinal plants have drastically reduced the population to an alarming stage. Mostly all the Reserved forests are having trees, below the commercially exploitable girth. So the commercial exploitation of these trees is not advisable. The local villagers most often cut the trees illegally to meet their domestic needs as firewood. In this situation all the tree species under the Divisions are very much prone to over exploitation.

3.5 Conservation of genetic resources:The biodiversity of forests is declining rapidly due to land use change, climate change, invasive species, overexploitation, and pollution. These are due to the adverse affects from various drivers. Encroachment, illegal felling for cultivable land has posed threat to the forest flora as well as faunal biodiversity. The state has several rules and regulations such as Biological Diversity Act, 2002, Assam Biodiversity Rules 2010, State Forest Policy 2004, National Forest Policy 1988, Draft Assam Bamboo and Rattan Policy 2003, National Biodiversity Action Plan 2008, Assam State Action Plan on Climate Change 2015-2030, etc for conservation of biodiversity. The strategies

include protection and making efforts to restore original ecosystem and halt habitat fragmentation, degradation and loss and shrinking of genetic diversity, promotion of indigenous tree species, improving canopy density in the existing forests, promotion of natural regeneration, promotion, protection and preservation of bamboo and rattan, preparation of comprehensive flora and fauna species lists, management of funds for biodiversity conservation and enhancement related work, involvement of local communities and their livelihood development, etc. However, on ground implementation of some of the later mentioned activities required to be strengthened. There are no identified genetic plots in the RFs of the Division. However, one orchid House at Kathalguri under Joypur Range and one medicinal plantation at Jokai under Dibrugarh Range is established for genetic purpose.

3.5.1 Preservation plots: Under Dibrugarh Forest Division there are 2 (two) Plots, one for Preservation and another one for Sample Plots exist in Jeypore Range jurisdiction raised by Jeypore Silviculture Range to monitor their growth and other silvicultural aspect of different indigenous species of Assam.

Table 3.5.1 : Preservation plot and sample plot

Sl. No.	Plot 1		Sl. No.	Plot 2	
1	Name of the Plot	Preservation Plot	1	Name of the Plot	Sample Plot
2	Location	Mohan Singh Ali (Tipam)	2	Location	Jeypur RF
3	Name of RF	Jeypur RF	3	Name of RF	Jeypur RF
4	Year of Creation	1975	4	Year of Creation	1980
5	Area	4.2 Hect	5	Area	0.20 hect.
6	Date of Measurement	27-11-2017	6	Date of Measurement	2018
7	Species	Hollong, PhulGamari, M/Sal, Pan Sopa	7	Species	Hollong
8	Total No. of trees planted	170 nos of trees	8	Total No. of trees planted	40 nos of trees

3.6 Fauna and their habitats: The forests of this Division were originally very rich in wildlife including migratory birds. Currently, wild animals are only observed in Joypur RF. This RF harbours a rich variety of wildlife such as Elephant, Tiger, Leopard, Black Deer, Slow Panther, Clouded Leopard, Chinese Ponglin, Sloth Bear, Eastern Hollock Gibbon, Western Hollock Gibbon, India Bison, Sambar, Barking Deer, Slow Loris, Capped langur, Hollock Gibbon, Flying squirrel and different types of reptiles. The RF is very rich in Avifauna. Some of the important species of birds are Drongos, Pheasants, Orioles, Jacanns, Wood Ducks, Eagles, Owl, Horn bills, Minivets etc. Number of migratory water birds visits the water bodies of Dehingmukh, Namdang, Telepani and Jokai RF. especially during the winter season. Habitats of fauna is given in Table 3.6.2

The first tea garden was established in Chabua in 1837 and there are sprawl of many tea gardens in the Division. The landscape itself is picturesque lying at the foothills of the mighty Himalayas. The rivers are fast flowing that carry huge volume of boulder, sand, clay and debris of eroded materials, roots and trunks

of tree etc. The turbid rivers turn bluish during winter and provide shelter to large flock of migratory birds. The rivers are full of fishes like Mohaseer, Rohu, Bahu, Borali, Chitol, etc. The Brahmaputra River is an excellent habitat of Gangetic Dolphin (Hihu), a critically endangered mammalian species whose world population is only 2200. There is a great potential to constitute a Dolphin Sanctuary on the eastern and western boundary of the Dibru Saikhowa National Park about 30 kms on each side to secure the survival of this critically endangered mammal. Navigation on the Brahmaputra River can be regulated once this stretch is declared as a Dolphin Protected Area. Further, sporadic incidences like poisoning, blasting, electrocution, netting, etc. to catch fish can be legally dealt with. The existing Fish Mahals can be gradually withdrawn considering the immense value of the River Eco System. There is potential to generate employment to several hundred people along with promotion of ecotourism. Motivating the fishing community and otherwise providing engagement to the boatmen and their families will be of great help in nature conservation. Navigation (Regulated) itself is a means of surveillance and an item like “Dolphin show” can be introduced which will be the first/one of its kind in the State.

The Division possesses an excellent habitat of Hoolock Gibbon, Eastern Hoolock (*Binopithecus leuconedes*) and Western Hoolock (*Binopithecus hoolock hoolock*). This primate requires habitat with tall trees. Fragmented forests makes this species vulnerable. Heavy biotic pressure such as non-availability of tall trees and food bearing species, encroachment, felling of trees, cultivation, grazing, poaching, fishing, etc. will possibly lead this already rare and endemic species to become locally extinct. India is a signatory to the SDG 2030-an UN Convention which was adopted during 2015 and the Goal no.17 envisages protection of terrestrial ecosystems, wetlands, biodiversity and constitution of Sanctuary, Conservation/Community Reserve will ensure in achieving this goal. Thus it becomes our primary duty to bring the RFs under the Wildlife Management (overlapping) Working Circle, declare important habitats as Conservation Reserve and link different RFs constituting Community Reserve through the villages lying in between so that transfer of genetic materials can take place by pairing. Research in this regard is absolutely necessary by inviting Research Scholars from Universities or from Research Institutes.

3.6.1 DehingPatkai Elephant Reserve: The Dehing Patkai Elephant Reserve was notified on 17.04.2003 with an area of 937 sq. km covering Dibrugarh, Tinsukia and Sivasagar Districts of Assam. The Forest Divisions involved are Dibrugarh, Doomdooma, Digboi, Sivasagar and Jorhat. The Elephant Reserve extends up to Aruanchal Pradesh border. The Reserved Forests that fall under the Elephant Reserve are Kakojan, Tokawani, Nalani, Torani, Philobari, Duarmora and Buridihing. The elephant habitat over these areas is highly fragmented. The isolated Reserved Forests surrounded by tea gardens and paddy fields facilitate movement of the pachyderms. The Kakojan Reserved Forests has excellent forests and uninterrupted movement of elephants has been taking place through Upper Dehing RF (East Block) from centuries. Illegal felling and cultivation has cropped up gradually in these RFs except Kakojan. The RFs need to be reclaimed immediately and adequate protection measures must be provided to the elephants and their habitat. There is a small water body inside the Kakojan RF developed due to excavation of earth for establishing a mining well by Oil India Limited. The elephants are observed

enjoying their bath for a considerable period in this water body which is to be enlarged by artificial means for giving a natural look. The mining well is not under operation.

3.6.2 Distribution of wildlife:The forest of this Division harbours significant levels of bio-diversity and is rich in wildlife including migratory birds. Diverse migratory birds visit the water bodies located along the river Brahmaputra during winter season. The Joypur Reserved Forests are known world wide as the habitat for Deoanh "White-winged Wood Duck", an endangered avifauna declared as the "State bird of Assam". White-winged Wood Duck is a Critically Endangered Species whose population in the world is around 1000. Leopards often observed in this tract. There are some resident leopards in the large tea gardens situated near the Reserved Forests. Among other mammals, elephant is often sighted particularly in Dihingmukh, Joypur RFs throughout the year. However, during the winter season, herds of wild elephant raid crops, destroy other property and even cause death to human life. Tiger sighting is rare. Hoolock gibbon commonly found in Joypur RF. Similarly, sightings of Slow Loris are also common. During patrolling, the officers and staff of Dibrugarh Division have recorded more than 100 elephants on the northern side of Brahmaputra River and 200 over these Reserved Forests of the ER. Big-Cat census was conducted under this Division during March 2000 & estimated that 1 female tiger, 6 male Leopards, 8 female leopards and 3 cubs are present in the RFs. Statement showing fauna and their habitats/microhabitats in Dibrugarh Division is shown in Table 3.6.2.

Table 3.6.2: Statement showing fauna and their habitats in Dibrugarh, Assam

S.No.	Name of the species	Habitat / microhabitat	Area (km ²)	Remarks
1	Deoanh (White winged Wood Duck)	Joypur RF	100	It is extremely important to bring these areas under the Wildlife Management (overlapping) Working Circle with an aim to upgrade it into Sanctuary, Conservation and Community Reserve.
2	Leopard (<i>Panthera pardus</i>)	All the RFs of the division	300	
3	Elephant (<i>Elephas maximus</i>)	Dihingmukh RF, Joypur RF	-	
4	Hoolock Gibbon	Eastern and Western Population Joypur RF.	-	
5	Gangetic Dolphin	Brahmaputra River	300	

The Wild Elephants Population/Estimation was carried out during 2017 under Dibrugarh Division. One hundred seventy seven numbers of wild elephant recorded/seen during the said estimation.

3.7 Threats and challenges to wildlife:The flagship species of the Dibrugarh Division is the highly endangered White Winged Wood Duck (*Cairina scutulata*), both the Western and Eastern Hoolock gibbon (*Binopithecus hoolock hoolock* and *Binopithecus leuconedes*), the only Western Ape found in India. Both are Schedule-I species of the Indian Wild Life (Protection) Act 1972 and listed in the Appendix-1 of Endangered Species under CITES 1973. The White Winged Wood Duck is the 'State Bird of Assam' whose worldwide population is only 1,200. The Hoolock Gibbon is considered as an endangered animal based on the criteria A2ac, C2a (i) (Recent). The population of the Gibbons came down to mere 5000 which was One Lakh 50 years before. This is also the prime habitat of Asiatic Elephant and part of Dihing Patkai Elephant Reserve. Elephant estimation carried out during February 2011 recorded 204 nos. of elephants. Big herds totaling 100-150 and few loners visit the RFs especially Dihingmukh.

Deforestation and degradation of forests especially the riparian forests are posing as a severe threat to white winged wood duck population. The resultant small, fragmented populations are vulnerable to extinction due to loss of genetic variability, disturbance, hunting and collection of eggs and chicks for food or pets. More local threats to the bird include inappropriate forest management, and pollution.

The endangered birds are the long-billed vulture (Critically endangered), White Winged Wood Duck and Greater Adjutant Stork. The Globally critically endangered tree *Vatica lanceaefolia* (Morhal) is among the plants of conservation importance. Some of the common birds found in the forests are the Great White Billed Heron, Lesser Adjutant Stork, Slender Billed Vulture, etc. Moreover, it is a breeding ground of different species of reptiles and invertebrates.

There are a number of threats to the wildlife of Dibrugarh Forest Division such as encroachment, extraction of minor minerals, electrocution, poisoning, roads/ railways lines running through elephant movement path. Pollution, navigation in Brahmaputra, encroachment in river Chapori also poses threat to the wildlife. In addition, burning/ trampling/collection of eggs of Bengal Florican, poaching, loss of habitat, grazing, practicing agriculture in the natural Florican habitat, removal of fodder of elephants, bank erosion, high flood, fishing in wetland inside the RFs pose threat to the wildlife.

Butterflies and moths were found to be the easy victims during oil mining. The Mining Contract Areas for mining Minor Minerals outside the RFs are not monitored. The Tea Gardens become possible threats after sometime as elephants die due to consumption of chemicals stored in the Gardens. Electrocution case was recorded in Dibrugarh Division and such accident may reoccur due to sagging of high voltage electric wires. If such wires are not insulated, hoolock gibbons may also die as they are fond of swinging. Poisoning, blasting and electrocution by generator are the major causes of death of dolphins, fishes, reptiles, amphibians, mammals and migratory/resident birds. Navigation in the Brahmaputra River was a hazard for the survival of the Dolphin population. Navigation by mechanized boats considerably pollutes the Brahmaputra River. Encroachment in river chapories is also a major threat to wildlife. These areas need to be brought under EDC. Similarly, Govt. approved Fisheries are to be gradually reduced and phased out. Burning of grasslands for agriculture in areas has seriously depleted the habitats of Bengal florican and shelters of elephants. Trampling of the florican habitat and collection of eggs have affected the population of the highly endangered floricans. Sporadic poaching of wild animals for bush meat, trapping of birds, accidental poisoning of vultures, felling of nesting trees are recorded. Illegal grazing inside forests also disturbs the wildlife and reduces their fodder. Reduction of food and fodder of elephants has caused increased man-elephant conflict. Continuous bank erosion, particularly by River Brahmaputra is a major threat for reducing prime habitats of wild life. High flood also sometimes leads to destruction of habitat and wildlife mortality. Illegally felled/wind fallen trees, grazing by cattle along with fishing incidences in wetlands inside the RFs have disturbed the White Winged Wood Duck and gibbon population considerably. This will make the gibbons disappear permanently and will lead to extinction of the Eastern Hoolock from Assam. Elephant mortalities due to various reasons is shown in Table 3.7.

Table 3.7: Elephant mortalities due to various reasons recorded in Dibrugarh division

Sl.No	Number	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
1	Elephant killed by accidental electrocution	01	-	-	01	-	-	3
2	Elephant killed by deliberate electrocution	-	-	-	-	01	-	-
3	Elephant dying of natural reasons	Chronic illness. Injured by big elephant	-	-	1. Injured by adult one. 2. Excessive cold.	1. Liver fluke infection .	-	-

3.8 Protection and management of fauna: There was no specific management plan for wildlife in the Division. For better management of wildlife, Dibru RF has been declared as Wildlife sanctuary and subsequently it has been upgraded to National Park. Two other RFs of the Division, namely Padumani RF and Bharjan RF were declared, as Wildlife sanctuaries vide Govt. Letter No. FRW.17/99/46 dt. 13th October, 1999. Under the Centrally Sponsored Scheme - "Project Elephant", fodder species have been raised within the Reserved Forests that fall under Elephant Reserves. Further, Table 3.8a presents details of areas in the Division kept reserved as Wildlife preservation areas for migratory birds and animals.

Table 3.8a: Wildlife preservation areas for migratory birds and animals

Sl. No.	Name of the RFs	Compartment Number	Area (Ha)
1	Dehingmukh RF	1,2, 3	1,000.4
2	Telpani RF	1	248.00

Intensive patrolling and protection measures have been undertaken with the available resources in the division to protect the wildlife and their habitat. Mobile Protection squad involving villagers of adjoining Reserved Forests have been constituted to assist the departmental staff in containing wildlife depredation as well as to provide protection to the wildlife. Such protection squad & the Joint Forest Management Committees are also entrusted to look into the movement of wild animals through the animal corridors connecting the different Reserved Forests. Recently, provisions have been made to pay the members of the Mobile Anti Depredation Squad and has been found to be very effective. Generation of data will be done through Camera Trapping method with the help of high resolution digital camera which will be placed at suitable locations. In addition, the Beat Officers concerned were directed to monitor and record the movement of wildlife, their nesting/breeding ground, depredation etc. Development of salt licks, waterholes, fodder development, plantation of fruit bearing species, grassland management, and preservation of snag and den trees will be ensured at least in 15 different locations during the Plan period.

Major depredation is caused by the elephants in the neighbouring villages of forests by damaging paddy crop and destroying dwelling houses during the period from October to February each year. Herds of elephants come out of the forests in search of food and enter the crop fields and homestead of villages.

Sometimes loss of human life is also caused by rogue elephants. Cattle lifting by tiger and leopard in the vicinity of forests are also reported from time to time. In the process, human encounters with tiger and leopard also takes place, and loss of human life was also reported. To bring awareness of general public towards wildlife conservation and to motivate the affected people in this regard, there is scheme to provide compensation for loss of human life and causing permanent disability due to wildlife depredation. The compensation amount is being enhanced from time to time. Information on *Ex-gratia*/Compensation paid due to death, injury and damage of property by wild animals other than wild elephant during the last 10 Years is provided in table 3.8b.

Table 3.8b: Table on Ex gratia / Compensation paid in the division

Year	Ex-gratia/ Compensation paid to the victims/ next kin due to			Remarks
	Human death (Rs.)	Human injury (Rs.)	Total (Rs.)	
2010-2011	-	-	-	-
2011-2012	-	-	-	-
2012-2013	-	-	-	-
2013-2014	-	-	-	-
2014-2015	-	-	-	-
2015-2016	-	-	-	-
2016-2017	2,00,000.00	1,17,480.00	3,17,480.00	-
2017-2018	4,00,000.00	20,000.00	4,20,000.00	-
2018-2019	-	-	-	-
2019 to 01/01/2020	4,00,000.00	60,760.00	4,60,760.00	-
TOTAL	10,00,000.00	1,98,240.00	11,98,240.00	-

CHAPTER 4

Maintenance and enhancement of Forest Health and Vitality

4.1 Status of regeneration: Natural regeneration in Joypur RF is adequate but in other RFs the status of regeneration is very poor. Map showing the regeneration of species in different RFs is shown in Figure 4.1. Reserved forest wise status of regeneration is provided in Figure 4.1a to Figure 4.1e.

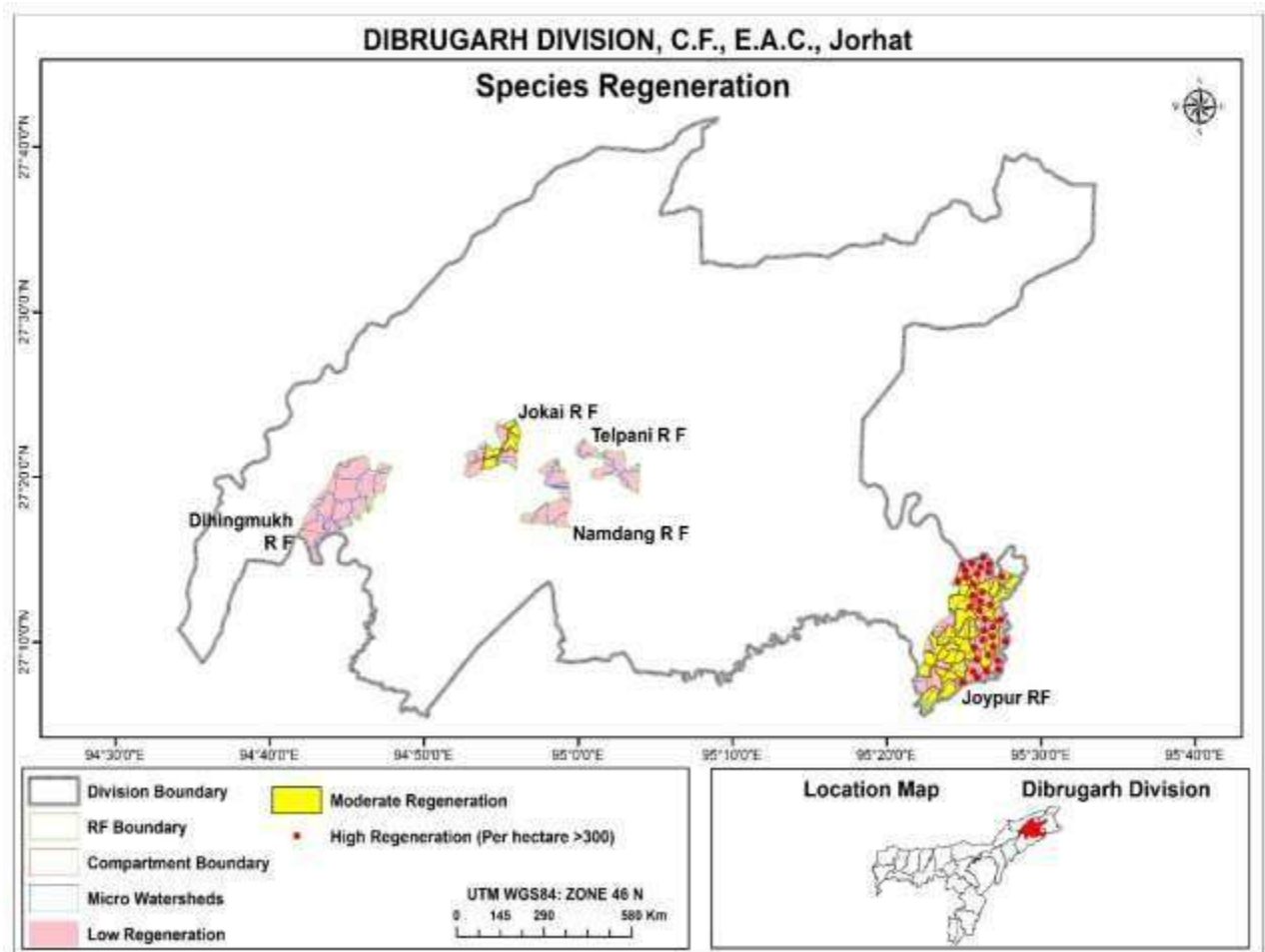


Figure 4.1a: Species regeneration map of Dibrugarh division

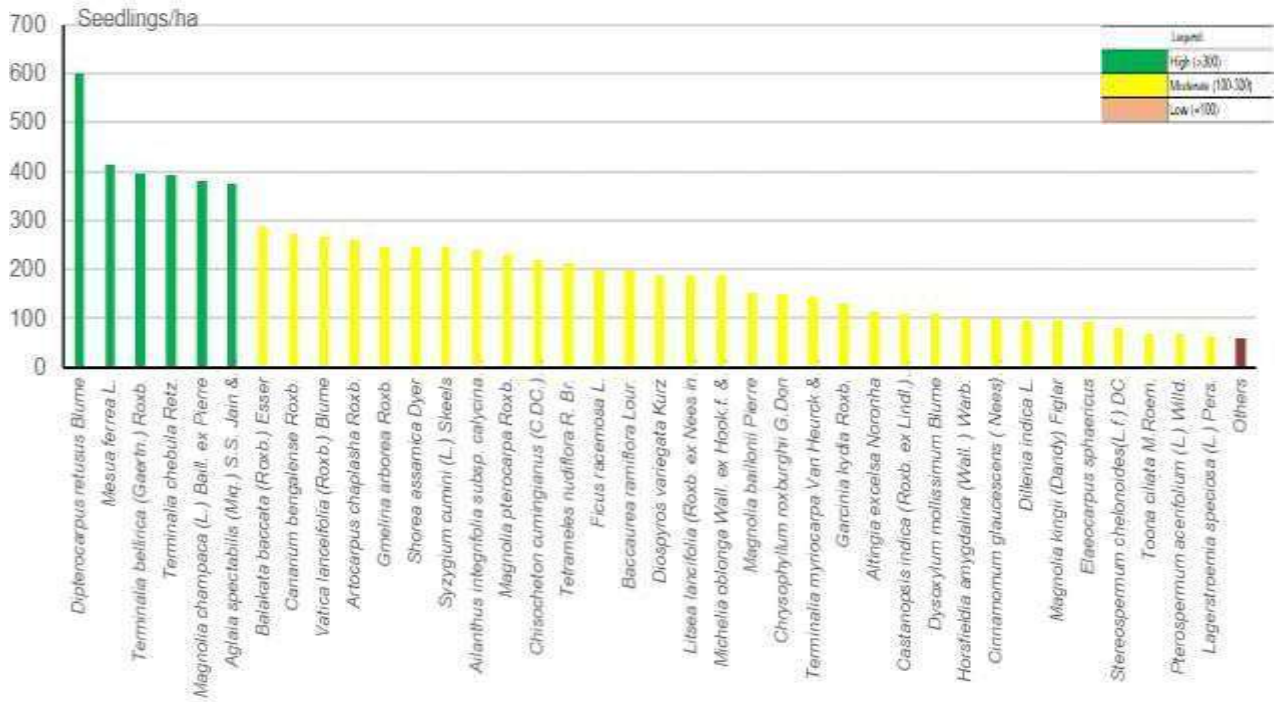


Figure 4.1b: Status of species regeneration in Joypur RF map of Dibrugarh division

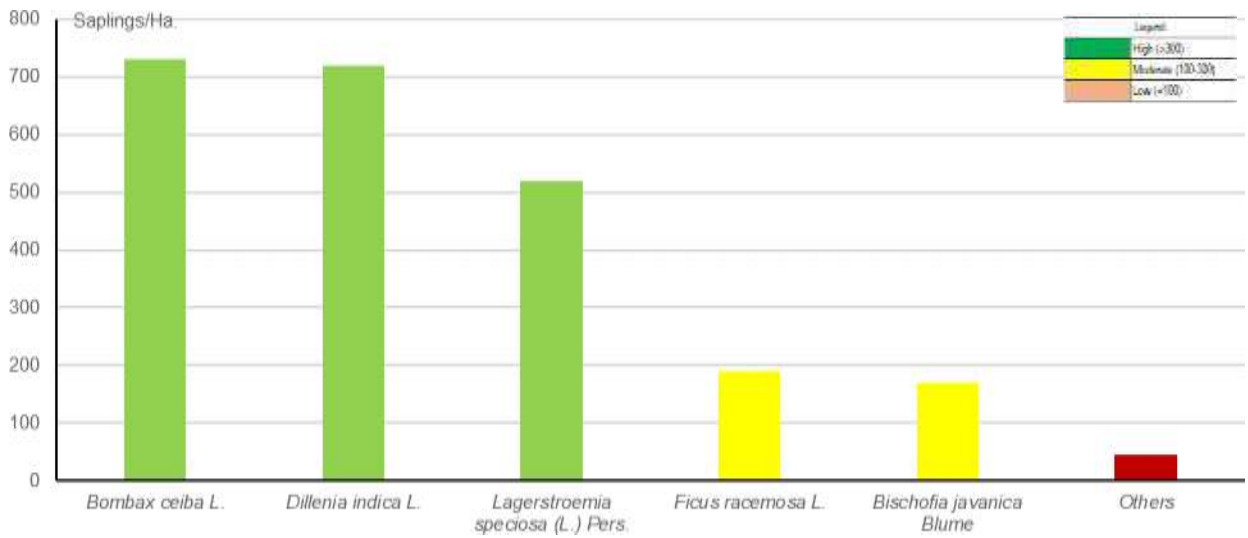


Figure 4.1c: Status of species regeneration in Dehingmukh RF map of Dibrugarh division

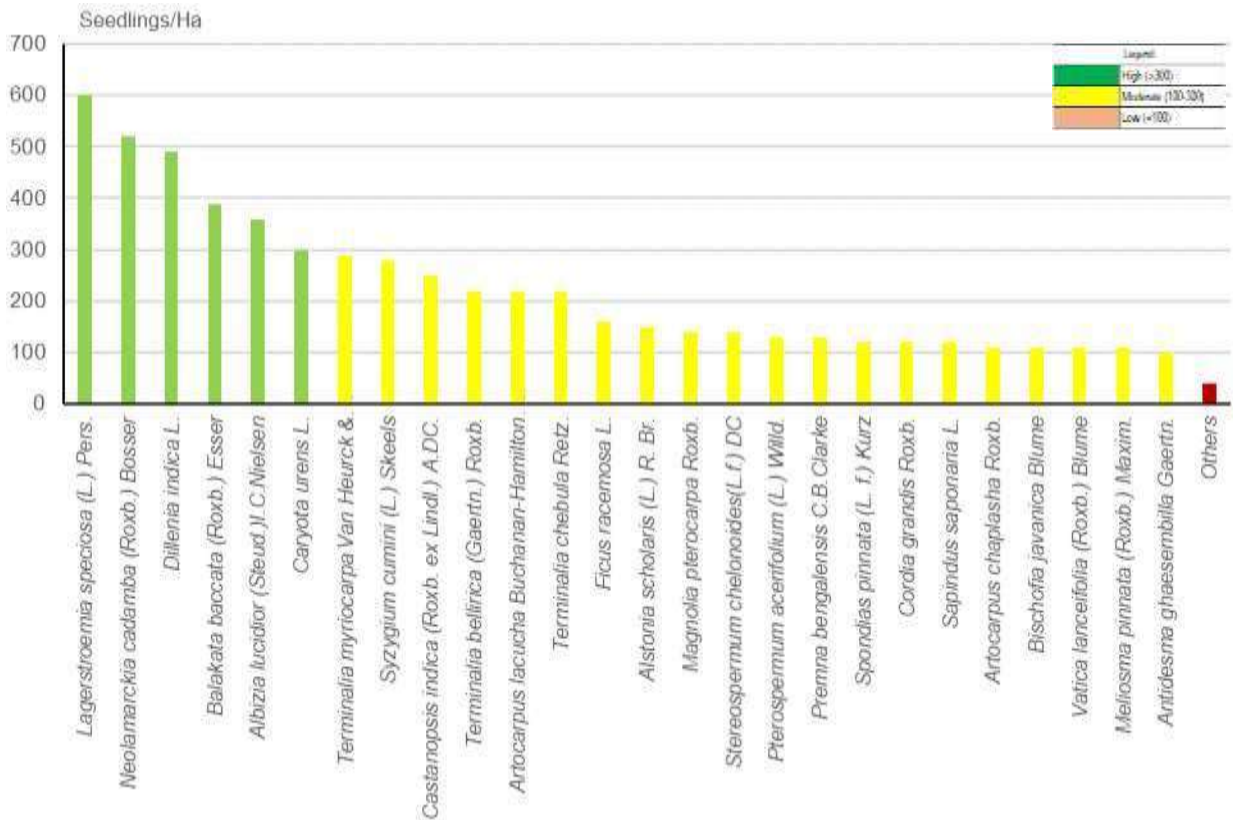


Figure 4.1d: Status of species regeneration in Jokai RF map of Dibrugarh division

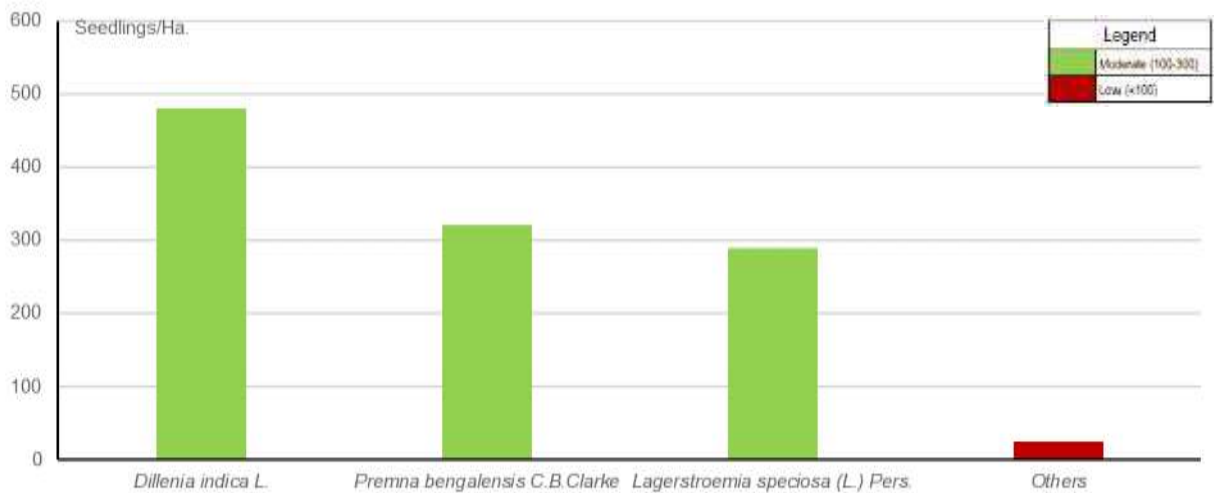


Figure 4.1e: Status of species regeneration in Namdang RF map of Dibrugarh division

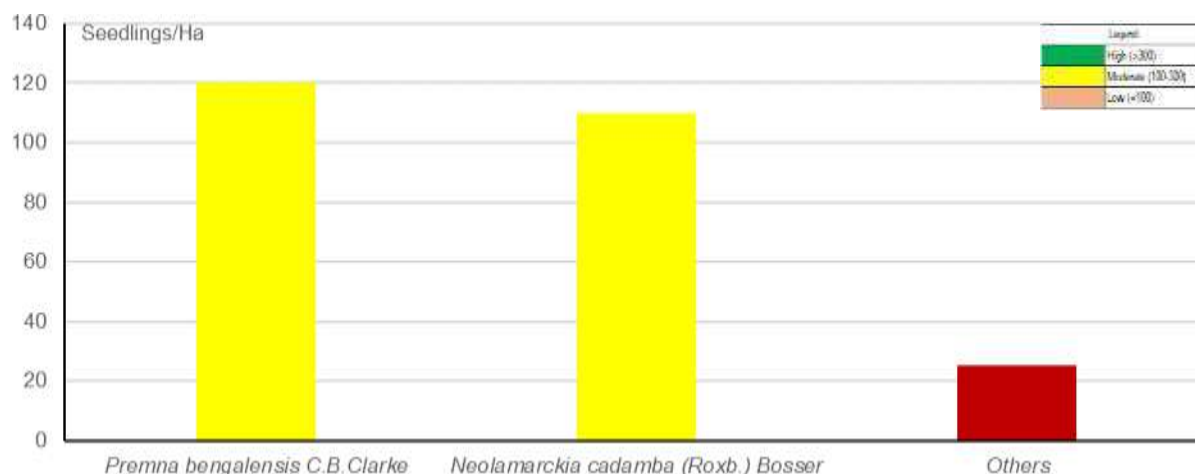


Figure 4.1f: Status of species regeneration in Telpani RF map of Dibrugarh division

Natural regeneration of Hollong, Nahor, Bhomora, Silikha, Titasopa and Lali is high in Joypur RF. Regeneration of Mekai is low in all the RFs. Lack of mother trees of the main species namely, Hollong, Mekai and Nahor resulted in low regeneration of these species in the other RFs.

Regeneration of Simul, Outenga and Ajar was is high in Dihingmukh RF. In Jokai RF, high regeneration is recorded for Ajar, Kadam, Outenga, Seleng, Moj and Sewa. High regeneration of Outenga, Gohera, and Ajar recorded in Namdang RF whereas, in Telpani RF moderate regeneration recorded for Gohera and Kadam, and all other species exhibited low regeneration. Regeneration success is reduced by pre and post dispersal pest attack and explicit microsite requirements for germination and growth. Weevils especially *Alcides craessus* attack fruits reducing germination percentage especially of Hollong species. Scanty mother trees of the main species namely Hollong, Mekai and Nahor resulted in low regeneration of these species in the other RFs. namely in other RFs of Wild boars, barking deers, hog deer, sambar, and mongoose damage seeds a great deal. In addition, unabated encroachment in each Reserved Forests reduced the area under Hollong and natural germination. Hollong seeds loose viability after dispersal exhibiting low germination. Hence, only selected seeds of bigger size and more weight are to be put to polybags for maximising germination and vigorous growth of seedlings. The weight matters more in germination success and early seedling growth. Systematic tending operations will be beneficial.

4.2 Area affected by forest fire:MODIS fire data revealed two fire incidences inside the RFs, namely Jokai and Joypur RF. Other fire incidences are outside the RF. Figure 4.2 shows fires incidences in Dibrugarh division.

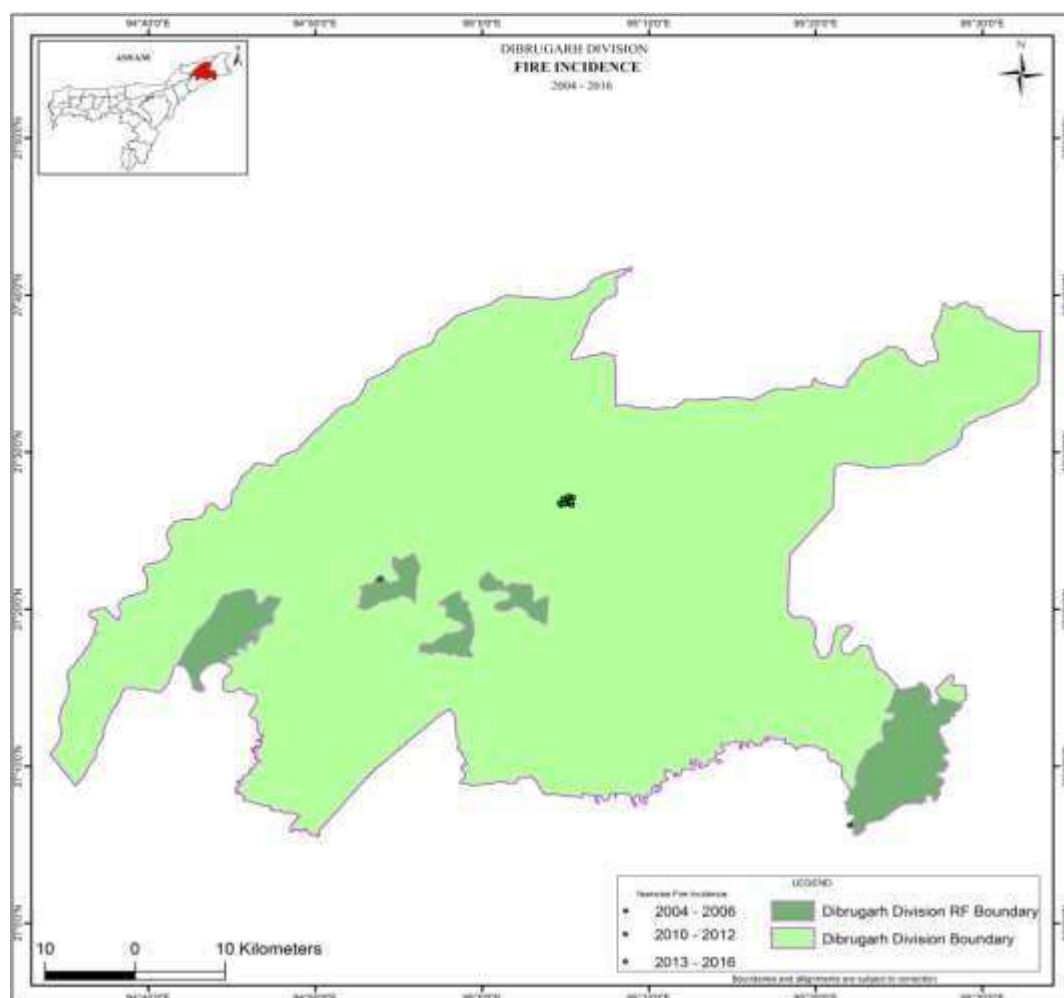


Fig 4.2: Map showing fire incidences in Dibrugarh division

4.3 Area damaged by natural calamities: There is occurrence of erosion on the banks of river Brahmaputra, Burhidihing and Sessa in Dehingmukh RF during floods. There is negligible erosion in other RFs of the Division. Damage of trees caused due to storm occurs in rainy season. Table 4.3 provides an overview of area damaged by natural calamities in the Division.

Table 4.3: Statement showing area damaged by natural calamities in Dibrugarh Division, Assam

Location	Natural calamities	Area Damaged (Ha)
Tinsukia Modhupur FV, Parologuri FV, No 2 Madhupur Deori FV, Thekerapukhuri FV	Flood damage & Erosion	60
Medela Madhupur Nahoroni FV, No.1 Madhupur FV	Flood damage	15
Bamboo plantation under NBM and other plantation under NAP in Dehingmukh RF.	Flood damage	180
Plantation area in Dehingmukh & Telpani RF.	Flood damage by Brahmaputra and Buridihing Rivers & Elephant Depredation	Damaged 90% of the Area. Approx.
Medicinal plantation in Dihingmukh RF.	Flood damage	100

4.4 Area protected from grazing:No grazing is allowed in the RFs of the Division.However,there are occurrences of cattle from fringe villages damaging seedlings in the RFs.

4.5 Lopping practices:There are no lopping practices in the RFs of the Division. However, climber cutting is done as a silvicultural operation. The women of the nearby villages generally collect the branches of young trees for meeting their needs of firewood.

4.6 Area infested by invasive weed species in forests:The RFs in the division are infested with Michenia, sDal Ghah, Arali, Longbon, Dubori, Alpenia etc. Various species of Ficus spp. also occur as epiphytes on various trees.

Table 4.6: Total area infested by weeds in Dibrugarh division

Assessment Year	Name of the RF	Species	Area (Ha.)	Type of forest	Treated forest area (Ha.)
2013-2014	Jokai RF	<i>Mikania micrantha</i>	3	Wet evergreen forest and Semi-evergreen forest	29.5
		<i>Lantana camara</i>	1		
		<i>Mimosa pudica</i>	0.5		
		<i>Ipomea spp.</i>	1		
2014-2015	Telpani RF	<i>Mikania micrantha</i>	1		
		<i>Lantana camara</i>	1		
		<i>Mimosa pudica</i>	-		
		<i>Ipomea spp.</i>	1.5		
2015-2016	Dehingmukh RF	<i>Mikania micrantha</i>	3		
		<i>Lantana camara</i>	1		
		<i>Mimosa pudica</i>	3		
		<i>Ipomea spp.</i>	4		
2016-2017	Namdang RF	<i>Mikania micrantha</i>	1.5		
		<i>Lantana camara</i>	0.5		
		<i>Mimosa pudica</i>	-		
		<i>Ipomea spp.</i>	2		
2017-2018	Joypur RF	<i>Mikania micrantha</i>	3		
		<i>Lantana camara</i>	1		
		<i>Mimosa pudica</i>	1		
		<i>Ipomea spp.</i>	0.5		
Total			29.5		

4.7 Incidences of pest and diseases:Top dying,White blochas,Twig cutter and other unknown diseases are observed in the RFs of the Division.

4.8 Forest degradation and its drivers: An overview of the various drivers of forest degradation in the Division is shown in Table 4.8.

Table 4.8: Overview of drivers of degradation in Dibrugarh Division, Assam

Sl. No.	Drivers of degradation	Name the area where visible	Area (indicativesq. km)
1	Grazing	Abhoypur F.V. under Dihingmukh RF.	100
2	Landslides	Dihingmukh RF.	50
3	Illegal felling	Joypur & Jokai RF.	9.386 Cum
4	Frequent flood	Dihingmukh RF.	10,000
5	Encroachment	Dihingmukh, Jokai, Namdung & Joypur RF.	34.7987
6	Weed infestation	Barren and open patches in RFs	3,000
7	Boundary conflicts	Nagfan area in Joypur RF.	10,000
8	Diversion of forest land	Jokai, Dihingmukh & Joypur RF.	75,580
9	Man animal conflicts	Dihingmukh RF.	5,000

4.8.1 Encroachment: Encroachment is the biggest driver of forest degradation. Out of total 21,794.648 hectare of forest land 1445.97 hectare have been encroached by the encroachers. Maximum of the area is used for agriculture and built up i.e., construction dwelling houses. Factors responsible for these encroachments are (i) Population increase leading to requirement of land for settlement and agriculture, (ii) Insurgent problem sequential by laxity from the department, (iii) Lack of plan, programme, and infrastructures. Ejection of these encroachments will be an uphill task and recovery of these encroached lands will be very difficult. Following is the Reserved Forest wise area under encroachment.

Table 4.8.1: Statement showing RF-wise encroached area (Ha) under different landuse in Dibrugarh Division

SL/NO	Name of R.F.	Area (Ha.)	Encroachment (Ha.)		Area Evicted during 2002-2003 (Ha.)	Remarks
			Pre - 1980	Present Position		
01.	Jokai R.F.	1848.01	216.00	131.00	85.00	Human habitation & cultivation
02.	Telpani R.F.	1332.288	204.00	109.00	95.00	
03.	Dehingmukh R.F.	5879.04	586.97	504.97	82.00	
04.	Namdang R.F.	1858.63	900.00	700.00	200.00	
05.	Joypur R.F.	10876.68	1.00	0.00	0.00	Seasonal Cultivation by Arunachali
	Total	21,794.648	1907.97	1445.97		

4.8.2 Illegal felling: Illegal felling of trees is one of the noticeable factors for forest degradation. Human populations living in and around Reserved Forests of the Division are involved in illegal felling of trees.

4.8.3 Forest Offences: Detection of Forest offences is always a tip of iceberg. Reserved Forests, the open treasury devoid of any barrier or any kind of protection measure except a few forest staffs, are always being exploited by the surrounding human population. Illegal removal of minor minerals (sand, stone), timber, firewood, grazing, lopping are very common in all the Reserved Forests. The staffs could detect illegalities and register offences.

4.9 Pollution control and protection of environment: Pollution of forests and environment caused due to destruction of forests by way of encroachment, jhumming, illegal felling of trees and setting fire to forests and other biotic interferences.

CHAPTER 5

Conservation and maintenance of soil and Water resources

5.0 Soils: The soils of the area are basically the products of the fluvial processes of the Brahmaputra and its tributaries and composed of sand and clay in varying proportion. The high grounds of this zone composed mostly of lateritic soils and are covered by tea gardens and dense forests. The plains are composed of alluvium which may be classified as new and old. The new alluvium varies mostly from clayey to sandy loam in texture and is slightly acidic in reaction, deficient in phosphoric acid, nitrogen and humus, but rich in lime and potash. It is found in the vast plain of the district along the river valleys, especially in their lower courses. The old alluvium on the other hand occurs in the upper and middle parts of the valleys in the form of terrace deposits. These deposits contain alternating beds of pebbles, gravel or boulder with loose sand and clays. In certain parts, both the old and new alluvium are so combined that it is difficult to distinguish them. The old alluvium has relatively high percentage of acid and soluble magnesium accompanied by calcium in general, its hydrochloric acid soluble material contents are lower and the percentage of MgO is higher. The pH value ranges between 4.2 and 5.5 with very low quantity of exchangeable calcium which varies from 0.1 to 5.0 mg per 100 gm of soil. The new alluvium is less acidic as compared to the old alluvium. Its pH value varies from 5.5 to 9.0. These soils are rich in PO₄, K and Ca (6 to 21mg per 100 gms of soil), but its nitrogen content is somewhat low, being 0.1 percent. Tea is abundantly grown in the old alluvium as it has high percentage of acid. The tea estates are located over relatively high lands covering mainly the mouzas of Chubwa, Bogdung, Rahmaria, Tengakhat, Tipling, Kheremia, Gharbandi, Lahoal, Moderkhat, Mancotta, Jamira, Joypur and Tipling with discernible slopes containing both old and new alluvium. Heavy clays, with high percentage of nitrogen are suitable for rice cultivation. The silty river banks lying in Lengri, Khowang, Mancotta and Larua are favourable for pulses and vegetables.

Soils of the area are sandy to clayey loam type and grayish is color. They are acidic in reaction with PH ranges from 4.6 to 5.9. They are also characterized by low to medium phosphate and medium to high potash content. Based on pedogenic and pedological characters, soils of this area may be classified into following classes a) Recent riverine alluvial soils (Antisol) b) Old riverine alluvial soils (Inceptisol) c) Old mountain valley alluvial soils (Alfisol).

The soil formation in most of the tracts can be attributed to alluvial deposits brought down by the river Brahmaputra towards the north eastern portion and Buri Dihing river in the south western portion. The alluvial deposits of the Brahmaputra river are characterized by shallow surface layer of silty loam and grey colour with subsoil of coarse sand mixed with pebbles and boulders. The alluvial deposits of the Dihing river is characterized by its coarse nature reddish color and sandy clay. The soil is of considerable depth. The soil of the Brahmaputra alluvial is acidic the pH value being 5.5.

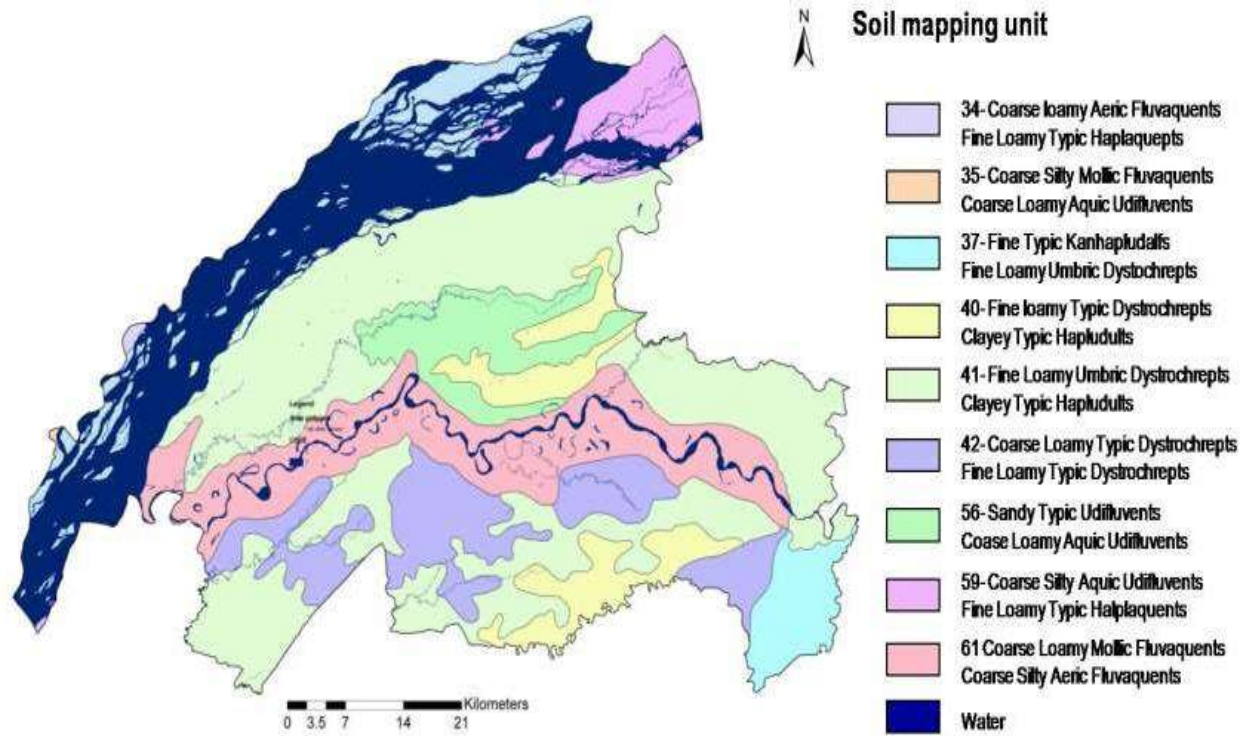


Figure 5.0a: Soil taxonomic map of Dibrugarh district.
(Source: NBSS and LUP Soil map of 1:250,000 scale)

Soil Map (Figure 5.0b) of Assam from Joint Research Centre, European Soil Data Centre (ESDAC)
<https://esdac.jrc.ec.europa.eu/documentspublications>



Hydrology plays an important role

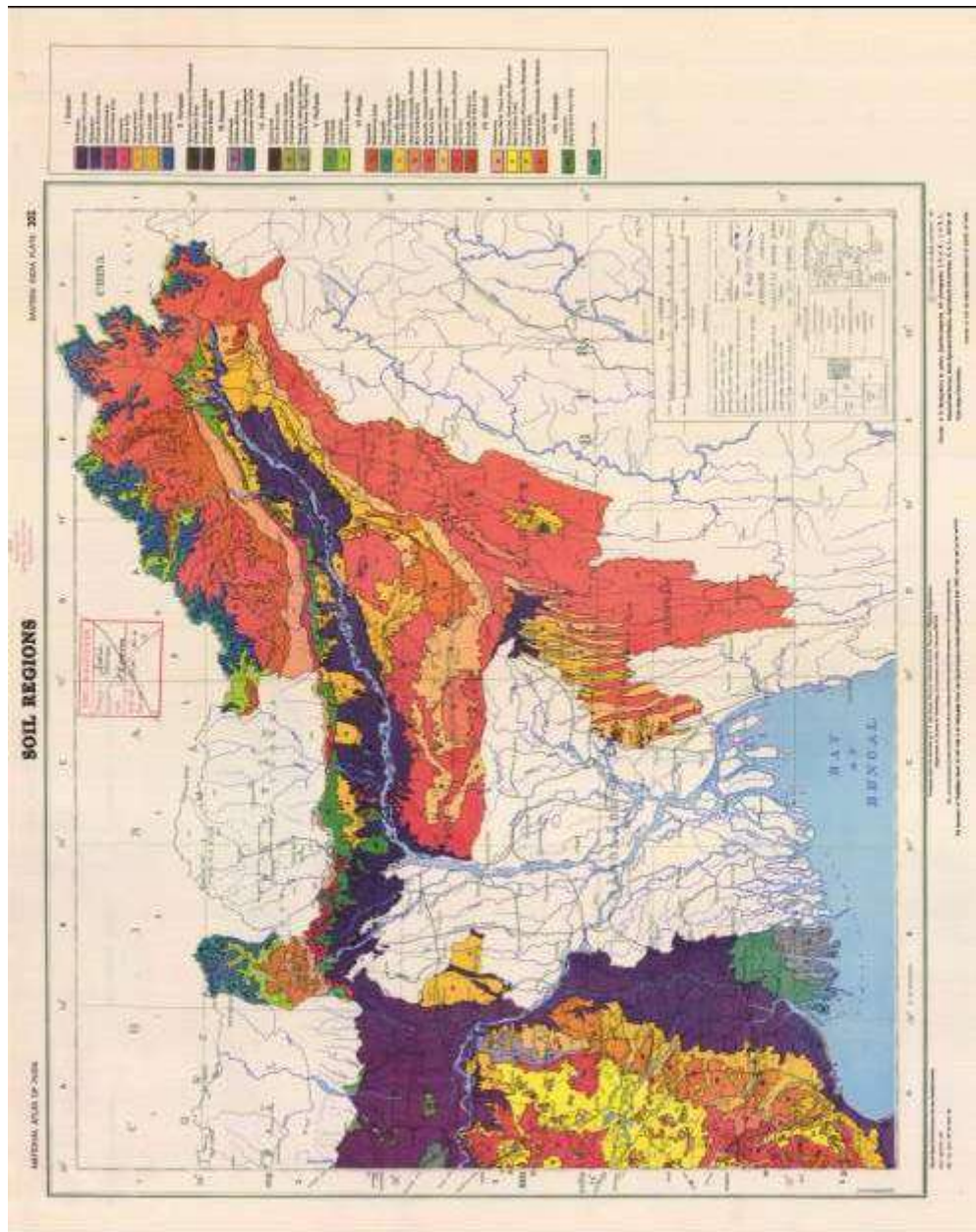


Figure 5.0b: Soil map of North East India

5.1 Area treated under soil and water conservation measures:No soil and water conservation measure has been adopted so far in any part of the Division. Appropriate measure of soil and water in the forest area and their systematic documentation will be taken up during the tenure of this Working Plan. Microwatershed map of the Division is shown in Figure 5.1. This is done to recast the compartment based on microwatersheds. Microwatershed details attached in Annexure 5.

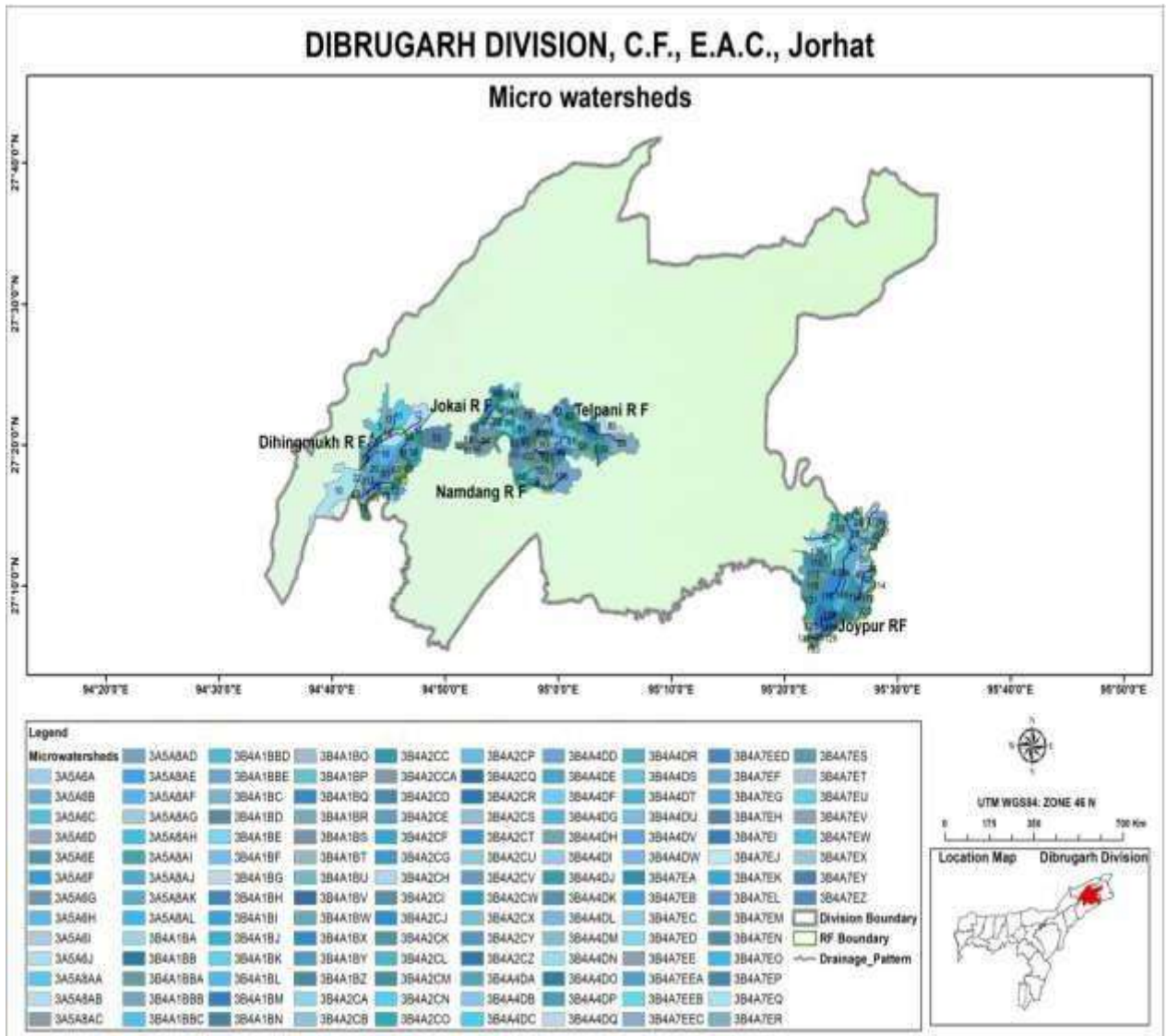


Fig. 5.1 Microwatershed map of Dibrugarh Division.

5.2 Duration of water flow in the selected seasonal streams:The total area covered by rivers/streams in the Division is 5,808.75ha of which 1,122.43 hectares falls inside the RFs. River/stream map of the Division is shown in Figure 5.2.a. Daily water level for 2019-2020 is shown in Annexure 7. There is extensive soil erosion and loss of vegetative cover due to anthropogenic interferences. As a result, surface runoff in the Division is increasing, in turn increasing flood intensity in the rainy season. However, periodic monitoring of river flow pattern with reference to annual rainfall/duration of flow

Would be taken up in the tenure of this Working Plan. Figure 5.2.b. shows the status of stream and riverflow in litres per minute in the division.

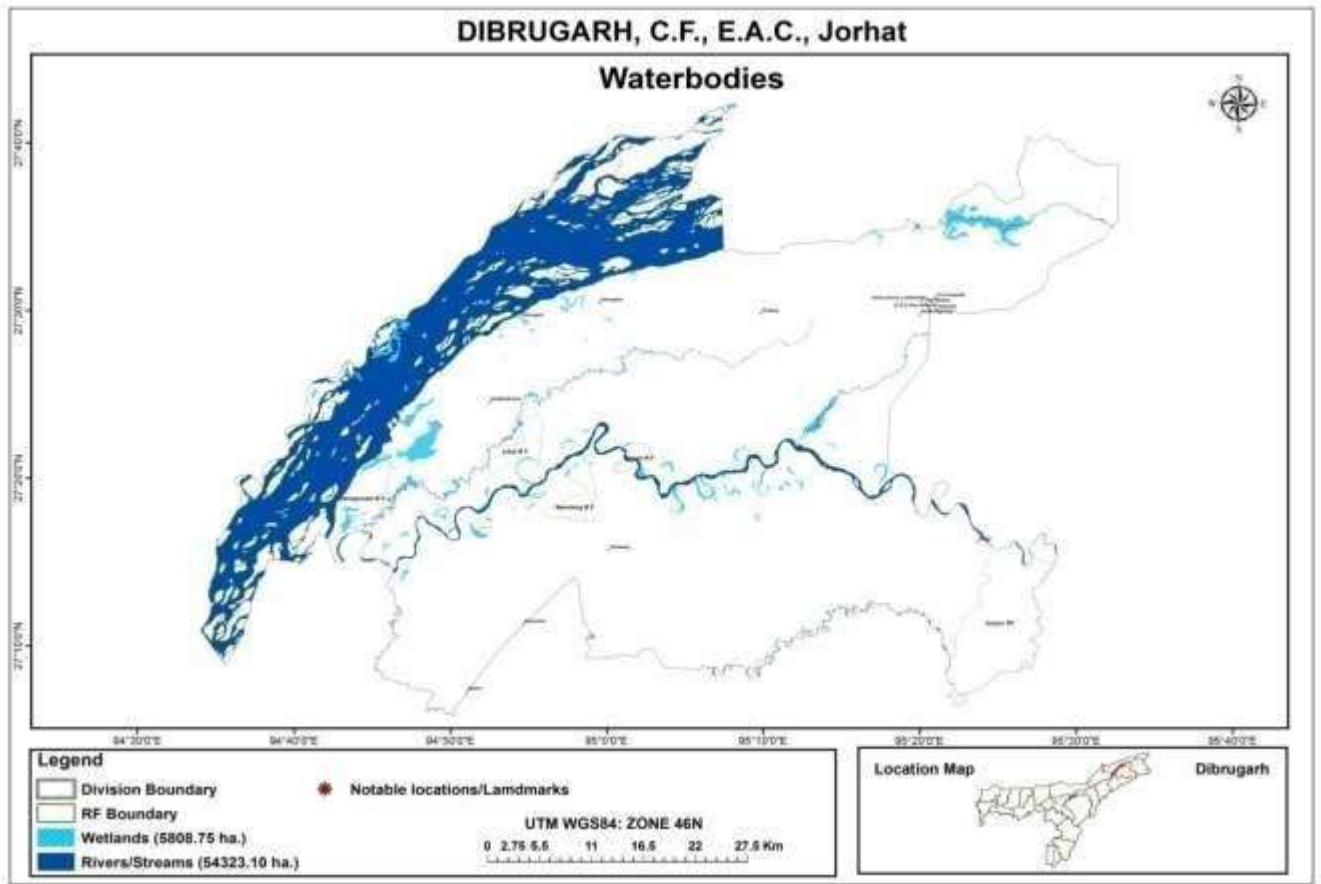


Fig. 5.2.a. Map showing waterbodies in Dibrugarh Division

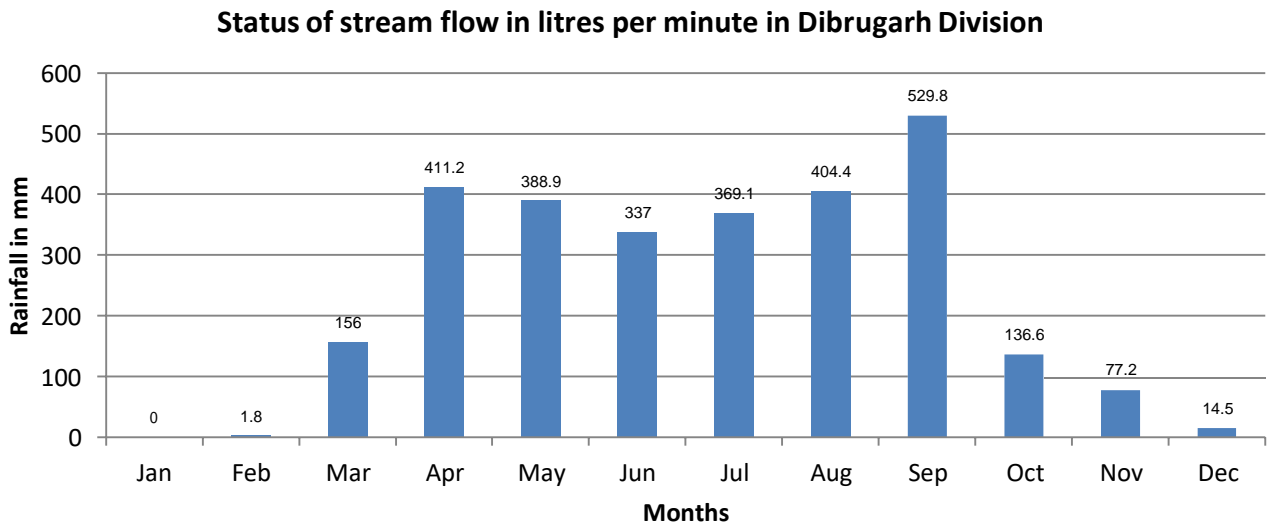


Fig. 5.2. b. Status of stream flow in litres per minute due to rainfall in Dibrugarh division

Table 5.2: Stream flows at major places in Dibrugarh division.

Place	Min	Max	Areas
Khowang	0.67 to 1.78	1.24 to 2.80	Burhi Dihing River: Flowing in the Northern boundary of the block (flowing in NE to SW direction)
Borboruah	0.90 to 1.79	1.27 to 2.20	Brahmaputra River: Flowing in the extreme North (flowing from NE to SW)
			Sessa River: Flowing through the central part of the block, flowing from NE to SW
			Burhi Dihing River: Flowing in the southern boundary of the block, flowing from NE to SW
Lahoal	0.30 to 0.86	1.06 to 2.64	Brahmaputra River: Flowing in the extreme Northern part of the block
			Mai Jan River: Flowing in the northern part of the block (flowing from East to West)
			Dibru River: Flowing from NE to SW and meets with Brahmaputra River in the West.
Tengakhat	0.16 to 1.66	0.14 to 2.90	Sessa River: Flowing in the extreme Northern part of the block, (flowing from East to West)
			Burhi Dihing River: Flowing in the Southern boundary of the block (flowing from SW to NE and then at the middle of southern boundary, from NE to SW)
Panitola	0.82 to 0.86	2.47 to 4.34	Brahmaputra River: Flowing in the extreme Northern part of the block (flowing from NE to SW)
			Dibru River: Flowing through central part of the block from East to West block from East to West
			Sessa River: Flowing in the Southern part of the block from East to West
Joypur	0.42 to 4.23	0.92 to 5.693	Disang or Dilli River: (Flowing from South to North and then NE to SW)
			Burhi Dihing River: Flowing from ESE to WSW
Tingkhong	1.24 to 1.73	3.11 to 3.79	Disang or Dilli River: Northern Boundary of the block and flowing from NE to SW direction).

5.3 Wetlands in forest areas: There are numerous wetlands in the RFs of the Division. Some of the major wetlands of the Division are Singimari Beel of Telpani RF, Erasuti of Jokai RF, Namdang of Namdang RF and Maguri Beel, Missimi Beel and Barkur Beel of Dihingmukh RF. Fishery mahals have been created in Telpani RF, Namdang RF and Dihingmukh RF. The RFs consists of 19.32% of the wetlands that exists in the entire division (Table 5.3). Wetland map of the division is shown in Figure 5.3.

Table 5.3 Area under wetlands in Dibrugarh Division

Wetland classes	Wetlands area (Ha) in division	Wetlands area (Ha) in RFs
Water bodies-Canal/Drain	485.29	-
Water bodies-Lakes/Ponds-Permanent	38.88587	-
Water bodies-Lakes/Ponds-Seasonal	3.556605	2.59
Water bodies-Reservoir/Tank-Permanent	4.734827	-
Wetlands-Inland-Natural	5,276.286	1,119.84
Total area	5,808.75	1,122.43

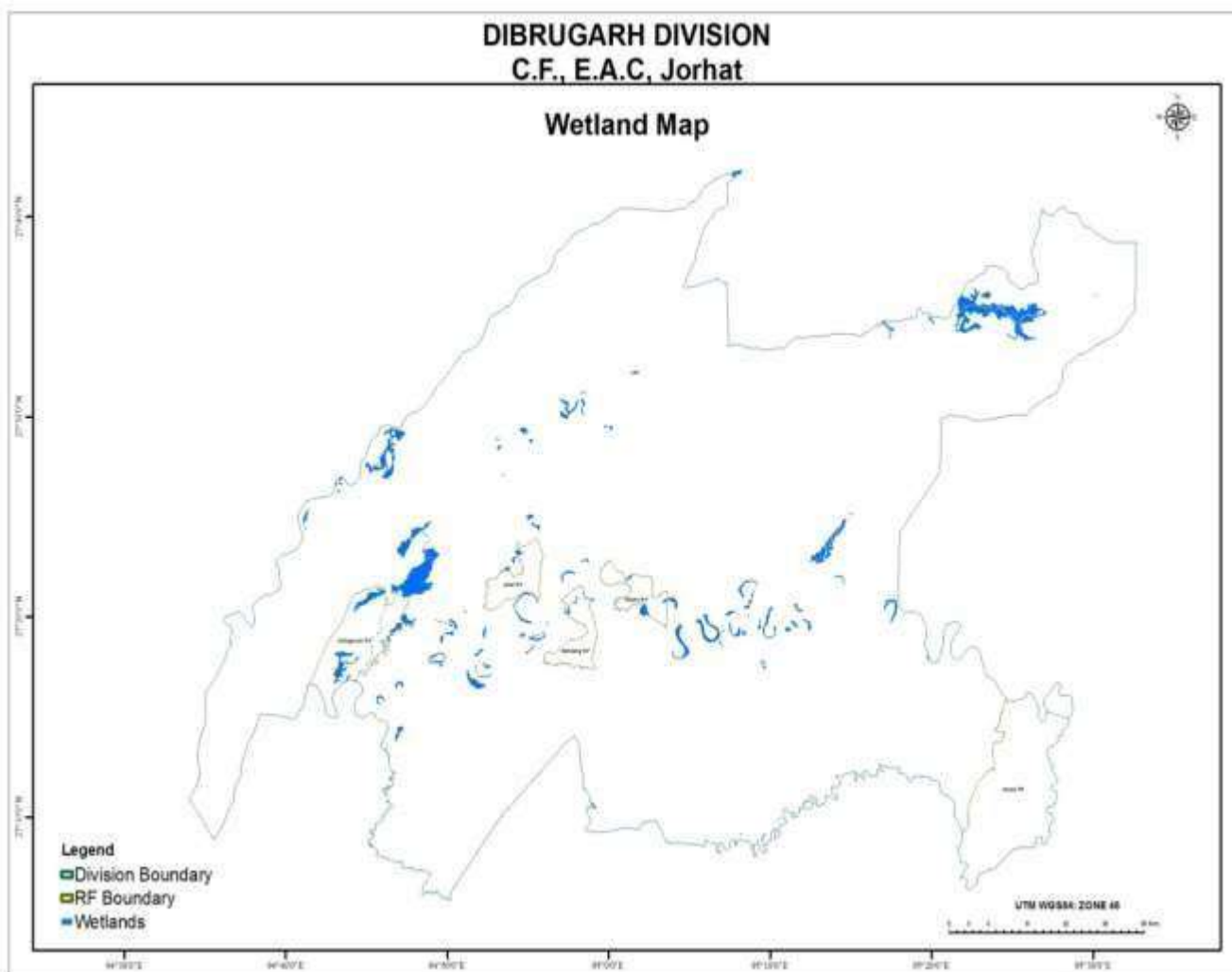


Fig. 5.3 Map showing wetland in Dibrugarh Division.

5.4 Water level in the wells in the vicinity (upto 5 km.) of forest area: Due to its geographical location and quantum of the rainfall the major source of drinking and irrigation water is the surface water. In the village area the pond is the main source of water facility. Also, as per experts and local people opinion there is no such downfall in the ground water level of this Division. Depth to water level data shows that in most part of the district it is 2-4 m bgl (below ground level) while in some parts it is 4-6 m bgl (below ground level). As the water level (DTW) is within 6 m bgl(below ground level) therefore, artificial recharge is not required for this district. High iron problem, specifically in hand pumps and water logged areas with water borne diseases during rainy days suggest to choose roof top rain water harvesting in specific areas but ground water recharging is not required for the district.

On the basis of ground water exploration data of the Central Ground Water Board it can be inferred that in the northern part it is mainly a single aquifer system while in the southern part there is multi-aquifer system where individual aquifers are separated by thick clay layers. Thickness of aquifer increases from east to west.

The water table contour ranges in elevation from 97 m above msl (mean sea level) in western part to 113m above msl (mean sea level) in the eastern part. The gradient varies between 0.30 to 0.55 m/km. Seasonal fluctuation in most part of the district is within 1 to 2 m. But, along the Burhi-Dihing river and Brahmaputra river, the fluctuation is less than 1m. In semi-consolidated Tertiary formation, water level fluctuation is 2 to 4 m. The piezometric surface rests between 1.25 and 4 m bgl. A number of shallow bamboo tubewells constructed in this district down to a depth of 36 m by tabbing 12 to 15 m of saturated medium to coarse grained sand zone. Yield of these wells varies from 27 to 31.5 m³/ hour. Deep tube wells constructed down to 253 m bgl yield around 82-164 m³/ hour for a nominal drawdown of 2-3 m. Transmissivity in the area ranges from 6,500 to 10,350 m²/day. Storage coefficient ranges from 2.57 X10⁻³ while specific capacity ranges from 798 to 915.

Table 5.4: Table showing depth (m) of water level in wells in Dibrugarh district

Place	Pre-monsoon depth to water at wells (meters below ground level)	Post-monsoon depth to water at wells (meters below ground level)
Khowang	1.23	2.02
Borboruah	1.35	1.74
Lahoal	0.58	1.85
Tangakhat	0.91	1.52
Panitola	0.84	3.41
Joyour	2.33	3.31
Tingkhong	1.49	3.45

Source: Central Ground Water Board, Dibrugarh district information booklet 2019

5.5 Status of aquifers: A single system of aquifer (granular zone) below a thin clay cover on top is present mainly in the southern part of the district. In the northern part, this single aquifer system is separated into a multiple aquifer system by thick clay partings. Thickness of aquifer increases from east to west. Ground water in shallow aquifer group exists in unconfined to semi confined condition. Depth of tube wells varies from 35 to 45 m. The tube wells tap 12 to 24 m of saturated sands generally between the depth of 24 and 36 m or even down to 45 m and yields 27 to 45 m³ /hour. Pre-monsoon depth to water level in southern part and in limited areas of northern part is in between 2 to 4 m bgl. Deepest water level in few pockets recorded upto 9.4 m bgl. The piezometric surface rests between 1.25 and 4 m bgl. Seasonal fluctuation in most part of the district is 1to2 m. Deep tubewells constructed from >50 m to 215 m bgl yield around 82-164 m³/hour for a drawdown of 2 to 3 m. Transmissivity in the area ranges from 6500 to 10,350 m²/day. Storage coefficient in this area is 2.57 X 10⁻³ while specific capacity ranges from 798 to 915. As the district is covered by alluvial formation, rotary rig is recommended for this area.

Ground water of the district is found to be colorless, odor-less and free from turbidity. Other chemical constituents are also found well within permissible limit and thus, the area possesses potable water for domestic use except in some parts of Tengakhat area where higher concentration of iron has been recorded. Iron removal plant should be there with each PWSS. Local people can themselves prepare low cost iron removal structure in there own houses to mitigate this problem. Goiter has been reported in some of the villages like Kalakhowa, Lejai and Sessa area which is due to deficiency of iodine in ground

water. People of the villages are advised to use iodized salt to mitigate the problem. Presence of TDS within 150 to 1000 ppm, SAR within 0.30 to 1.97, RSC value within 0.01 to 1.01 meq/ Lt and Fe content below 5 ppm in ground water indicates that the area is safe in all respect for utilizing ground water for irrigation purpose also. Depth to water level data shows that in most part of the district it is 2-4 m bgl while in some parts it is 4-6 m bgl. As the water level (DTW) is within 6 m bgl and seasonal fluctuation in most part of the district is within 1to2 m therefore, artificial recharge need not required for this district. High iron problem, specifically in hand pumps and water logged areas with water borne diseases during rainy days in some parts of the district suggest to choose roof top rain water harvesting in selected localities. Net available ground water resource of the district is 1406.96 mcm. Gross draft of the district is 167.66 mcm. Net 1235.59 mcm ground water will be available for future irrigation use after allocating 31.08 mcm, ground water for domestic and industrial purpose upto 2025. Single cropping pattern persists in this district because of non-availability of assured irrigation (Only 3.9%) facility. Out of 1, 35,806 ha sown area, net irrigated area is only 13,019 ha. For double cropping and for cultivation during winter (Ravi crops) shortage of surface water is the main bottleneck. Moreover, comparatively resourceful farmers are only uses shallow tube wells for irrigation. So to boost up the agricultural growth and thereby economic growth of the district, irrigation practice by utilizing ground water need to be raised.

There are few aquifers in the Division. In the shallow aquifer, groundwater exists in unconfined and semi-confined condition. Thickness of aquifers increases from east to west. Tube well depth varies from 35m to 45 m. The water quality is fit for drinking purposes. Detailed monitoring of aquifers in the Division will be carried out and their sustainability will be assessed during the tenure of this Working Plan. The water table contour ranges in elevation from 97 m above msl in western part to 113 m above msl in the eastern part. The water table contour ranges in elevation from 97 m above msl in western part to 113 m above msl in the eastern part. The gradient varies between 0.30 to 0.55 m/km. Seasonal fluctuation in most part of the district is within 1 to 2 m. But along the Burhidihing River and Brahmaputra River, the fluctuation is less than 1m. In semi-consolidated tertiary formation, water level fluctuation is 2 to 4 m. The piezometric surface rests between 1.25 and 4 m bgl. Deep tube wells constructed down to 253 m bgl yield around 82 - 164 m³/hour for a nominal drawdown of 2-3 m. Transmissivity in the area ranges from 6,500 to 10,350 m² /day. Storage coefficient ranges from 2.57 X 10⁻³ while specific capacity ranges from 798 to 915.

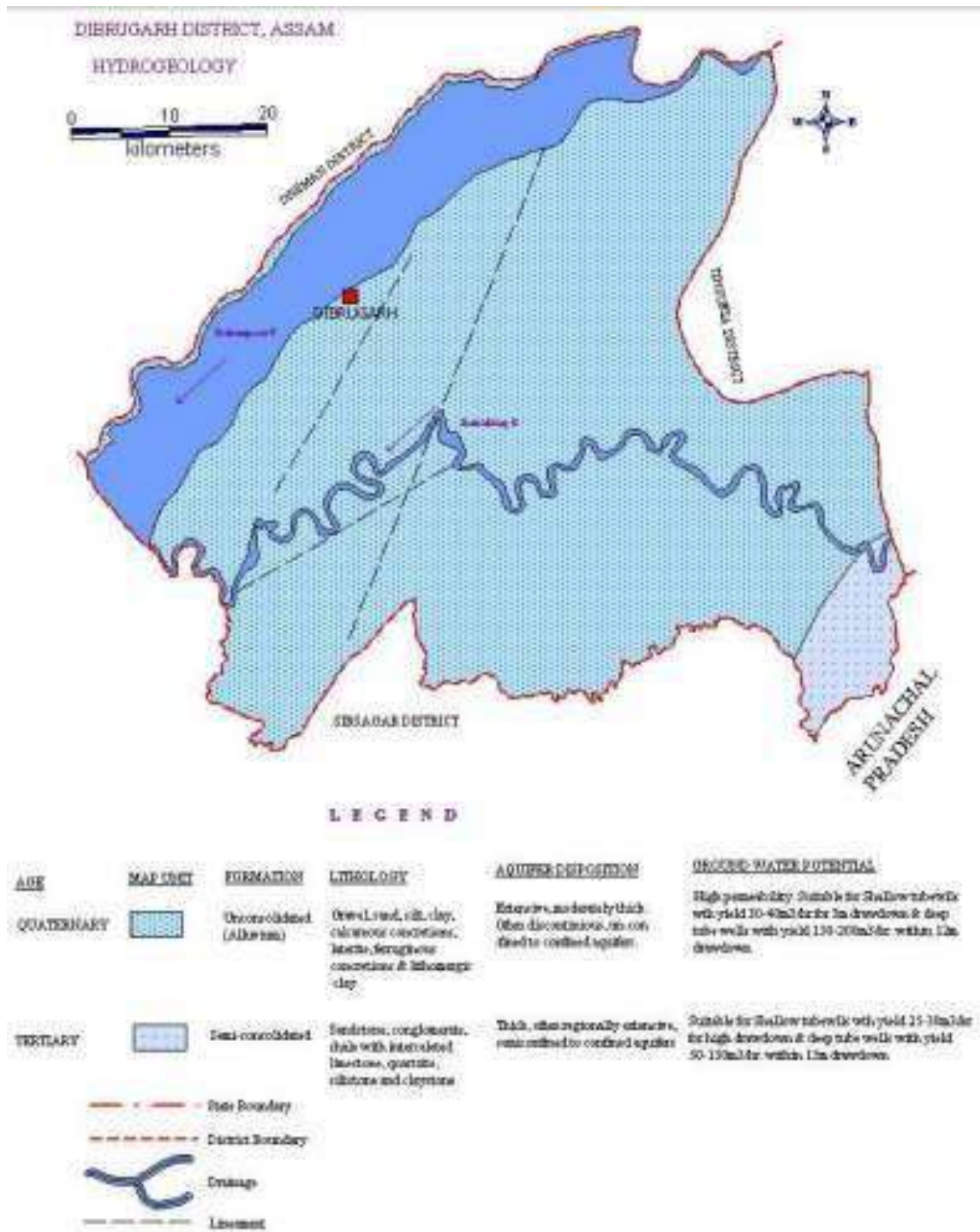


Figure 5.5: Hydrogeological map of Dibrugarh division
 Source: Groundwater information booklet of Dibrugarh division, CGWB

CHAPTER 6

Maintenance and Enhancement of Forest Resource Productivity

6.1 Growing stock of wood: Forest inventory and analysis of growing stock is necessary to quantify tree growth and its sustainable utilization. Growing stock analysis is essential to calculate harvestable yield in the working plan. Mean annual increment is an important parameter for sustainable management of forest. Growing stock analysis is necessary to ensure sustain flow of income and ecosystem services to local communities considering conservation and ecological security. The forest resource assessment methodology prescribed in the National Working Plan Code-2014 was followed to conduct assessment of the total growing stock of trees and biomass. Grid based Systematic Stratified Random Sampling was carried out. Map of the sample plots is provided in Figure 6.1b. Sample plots were laid out and observational assessment of site quality, tree species, composition, its health, density and crop age etc. were recorded in Plot Approach Form I. Blanks, important scattered trees, plantations raised were noted. Information on drivers of forest degradation, NTFP species, intensity of invasive species, faunal sights/ traces, microhabitats of wildlife were recorded.

In accordance with the guidelines and methodology stipulated in National Working Plan Code 2014, North East Space Application Center (NESAC) derived the location of Sample Plots. Plot locations are shown through figure 6.1b. After navigating to each sample plots using a hand held GPS, a square plot of 0.1 ha was laid measuring 22.36 m horizontal distance i.e. half of the diagonal in all the four directions. After checking the dimensions of the plot, latitude, longitude and altitude were recorded using the handheld GPS device. The main plot was used for recording the trees and bamboo stocking. The enumeration of trees was done by measuring the girth of each tree above 30 cm girth found in the sample plot. In case of bamboo, each clump was enumerated by taking its height, number of first, second and third year old culms, dried, congested culms and overall condition of the culms.

Information on regeneration status of forest species, injury to forest species, grazing incidence, fire incidence, soil type, gradient of slope etc. were gathered through visible evidences and recorded. Data of shrubs, climbers and regeneration status were recorded from all quadrats of 3m×3m laid out at a distance of 30 metres from the centre of the main plot of 0.1ha at SE and NW directions. Data of herbs from all nested quadrats of 1m×1m laid within each quadrat of 3m×3m was collected and recorded in the plot enumeration form. Growing stock analysis is a representation of 127 different tree species recorded in the sample plots. The most predominant species in terms of number of individuals are *Dipterocarpus retusus* Blume, *Mesua ferrea* L., *Shorea assamica* Dyer and *Vatica lanceifolia* (Roxb.) Blume. The other dominant species in the Division are *Aglaia spectabilis* (Miq.) S.S. Jain & S.S.R. Bennet and *Castanopsis indica* (Roxb. ex Lindl.) A.DC.

A detailed enumeration of trees for the distribution of trees into diameter classes of different species has been limited to the measurement of standing biomass of trees having diameter at breast height above 30 cm. All woody litter below 5 cm diameter is enumerated from the four nested quadrats of size 3 m x 3 m and from the same plot, all shrubs and climbers are uprooted and weighed for the estimates of biomass and carbon. Estimate for the herbs, grasses and leaf litter and data on humus and soil carbon of the forest floor is obtained from the nested quadrats of 1 m x 1 m plots of NE and SW corners and a pit of size 30 cm x 30 cm x 30 cm is dug within these plots to collect composite samples of soil for the estimate of soil organic carbon. The schematic diagram of field enumeration plots is shown in Figure 6.1a

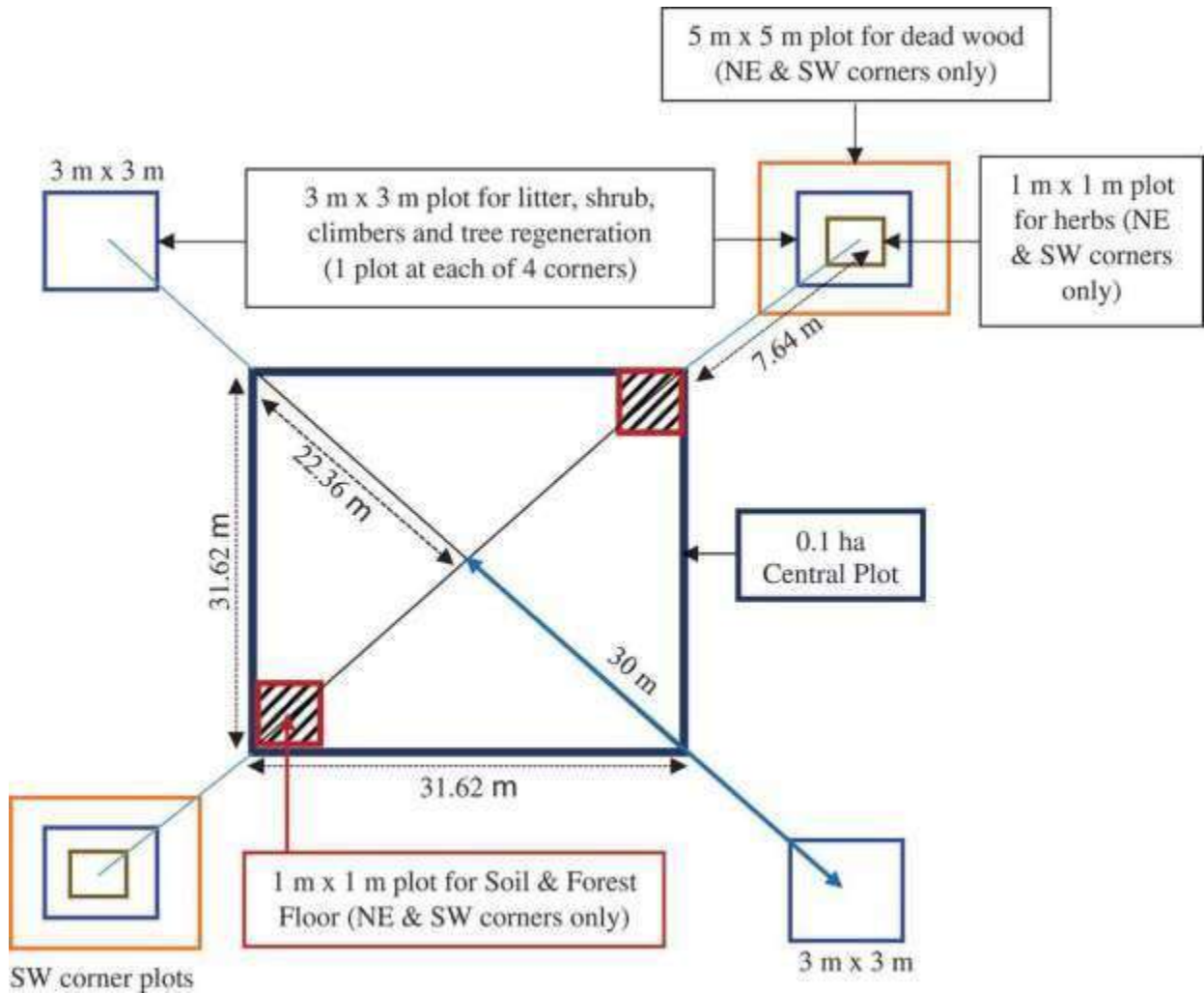


Figure 6.1a Schematic representation of field enumeration plots (NE: North East, SW: South West)

DIBRUGARH DIVISION
C.F, E.A.C, Jorhat

Systematic Grid Design

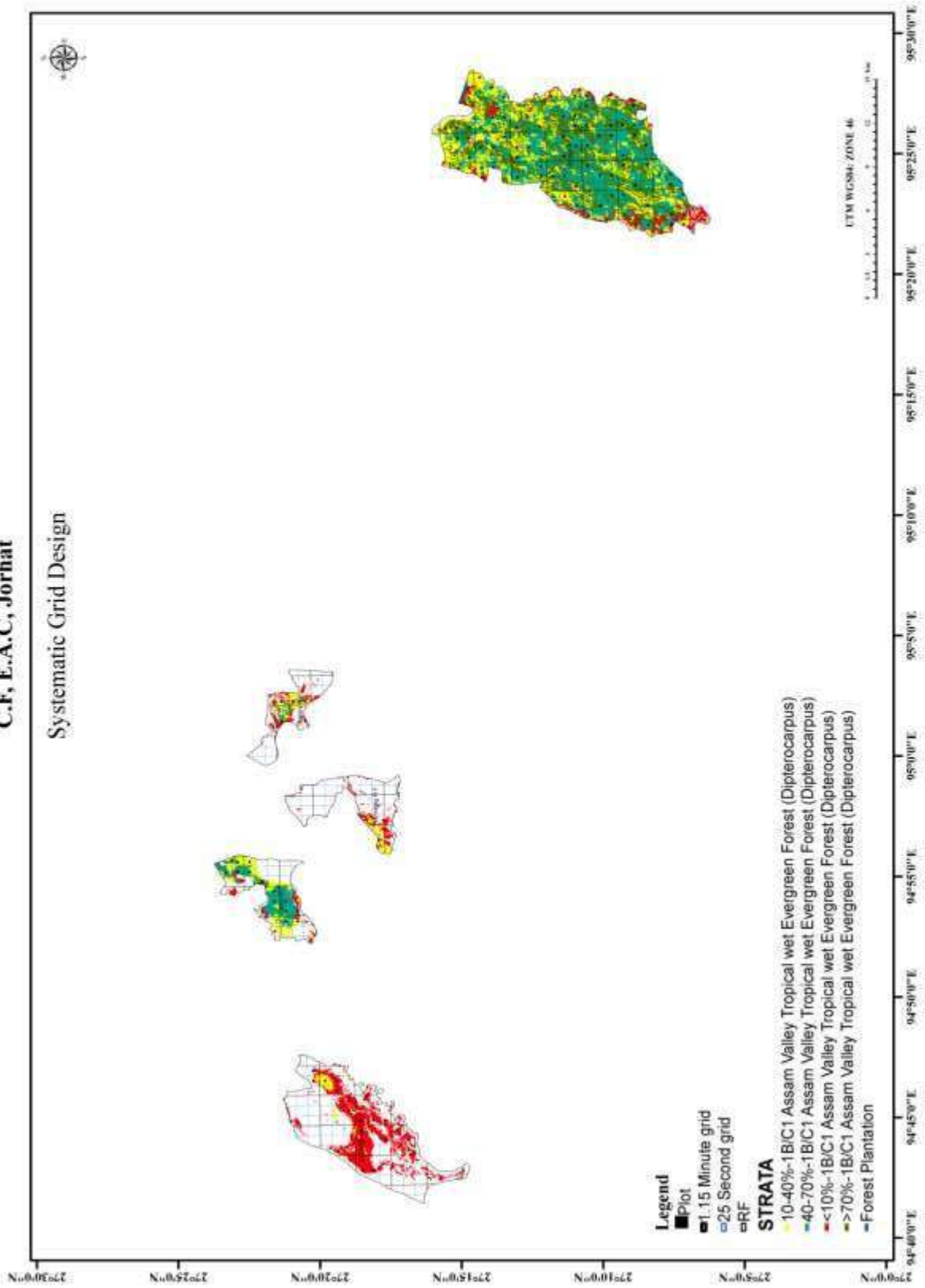


Figure 6.1b: Map showing location of sample plot in Dibrugarh as per systematic grid design

The forest resource assessment methodology prescribed in the National Working Plan Code - 2014 was followed to conduct assessment of the total growing stock of trees and biomass. Grid based 'Systematic Stratified Random Sampling' was carried out. Sample plots were laid out and observational assessment of site quality, tree species, composition, health, density, crop age etc. were recorded in Plot Approach Form I as given in NWPC – 2014. The sampling size was estimated as per the following formula prescribed in the National Working Plan Code 2014. Sampling size for Dibrugarh Division estimated as per given formula in NWPC 2014.

$$n = \frac{t_v^2 \left(\frac{CV}{AE}\right)^2}{1 + 1/N \left(\frac{CV}{AE}\right)^2}$$

Sample points were allocated by North East Space Application Centre as shown in the table below. After navigating to each sample point using a hand held GPS, a square plot of 0.1 ha was laid measuring 22.36 m horizontal distance i.e. half of the diagonal in all the four directions. After checking the dimensions of the plot, latitude, longitude and altitude were recorded using handheld GPS device. The main plot was used for recording the trees and bamboo stocking. The enumeration of trees was done by measuring the girth of each tree above 30 cm girth found in the sample plot. In case of bamboo, each clump was enumerated by taking its height, number of first, second and third year old culms, dried, congested culms and overall condition of the culms.

Table6.1a: Details of sample plots.

Plot ID	Latitude	Longitude	RF Name	Forest type
1	27.192482	95.412227	Joypur RF	1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
2	27.116026	95.377454		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
3	27.109067	95.370507		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
4	27.109086	95.377394		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
5	27.157707	95.38443		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
6	27.171596	95.384442		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
7	27.157747	95.405255		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
8	27.150802	95.405249		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
9	27.123024	95.405226		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
10	27.109109	95.391332		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
11	27.116067	95.398279		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
12	27.11608	95.40522		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
13	27.143804	95.377477		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
14	27.129929	95.384407		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
15	27.136845	95.370529		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
16	27.122956	95.370518		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
17	27.1299	95.370524		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
18	27.116012	95.370512		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
19	27.130005	95.426057		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
20	27.1369	95.398296		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
21	27.143832	95.39136		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
22	27.14387	95.412185		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)

Plot ID	Latitude	Longitude	RF Name	Forest type	
23	27.129981	95.412174		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
24	27.136994	95.453829		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
25	27.136972	95.439946		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
26	27.171696	95.439976		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
27	27.164751	95.43997		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
28	27.164728	95.426086		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
29	27.164782	95.460795		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
30	27.19247	95.405285		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
31	27.178581	95.405273		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
32	27.171706	95.446917		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
33	27.164772	95.453853		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
34	27.178651	95.446923		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
35	27.157795	95.433022		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
36	27.143882	95.419127		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
37	27.150851	95.433016		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
38	27.136961	95.433004		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
39	27.143917	95.439952		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
40	27.150862	95.439958		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
41	27.185525	95.405279		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
42	27.164704	95.412203		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
43	27.24113	95.433096		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
44	27.307758	94.745898		Dihingmukh R F	1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
45	27.307713	94.738956			1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
46	27.307804	94.75284			1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
47	27.293824	94.738946			1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
48	27.178629	95.43304			Joypur RF
49	27.178606	95.419157		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
50	27.171673	95.426092		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
51	27.185499	95.391395		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
52	27.178555	95.391389		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
53	27.171623	95.398325		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
54	27.213394	95.460838		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
55	27.192529	95.439994		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
56	27.199484	95.446942		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
57	27.199451	95.426116		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
58	27.248085	95.440044		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
59	27.241141	95.440038		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
60	27.227205	95.412258		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
61	27.22026	95.412251		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
62	27.227192	95.405316		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
63	27.227229	95.426141		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
64	27.220284	95.426135		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
65	27.206359	95.405297		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
66	27.206395	95.426122	1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)		

Plot ID	Latitude	Longitude	RF Name	Forest type
67	27.206383	95.419181		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
68	27.234162	95.419206		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
69	27.234149	95.412264		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
70	27.241094	95.41227		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
71	27.227303	95.474734		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
72	27.220348	95.467786		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
73	27.234238	95.467799		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
74	27.234228	95.460857		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
75	27.213373	95.446954		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
76	27.220318	95.446961		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
77	27.206418	95.440006		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
78	27.213351	95.433071		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
79	27.227252	95.440025		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
80	27.234196	95.440031		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
81	27.234185	95.433089		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
82	27.171727	95.460801		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
83	27.185616	95.460813		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
84	27.150776	95.391366		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
85	27.164638	95.377494		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
86	27.150893	95.460783		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
87	27.337113	95.030544	Telpani R F	1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
88	27.337175	95.044429		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
89	27.34412	95.044434		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
90	27.351002	95.030555		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
91	27.351064	95.04444		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
92	27.30206	94.961096	Namdang R F	1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
93	27.295045	94.947206		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
94	27.378306	94.933387	Jokai R F	1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
95	27.364344	94.919492		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
96	27.37827	94.926445		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
97	27.371325	94.92644		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
98	27.371362	94.933382		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
99	27.336339	94.877817		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
100	27.343361	94.891707		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
101	27.343399	94.898649		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
102	27.350381	94.905596		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
103	27.350343	94.898654		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
104	27.364231	94.898665		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
105	27.350305	94.891712		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
106	27.35721	94.884775		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
107	27.385214	94.926451		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
108	27.314793	94.759787		Dihingmukh R F
109	27.314838	94.766729	1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
110	27.300859	94.752835	1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	

Plot ID	Latitude	Longitude	RF Name	Forest type	
111	27.279935	94.738937	Jokai R F	1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
112	27.293915	94.75283		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
113	27.286926	94.745883		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
114	27.279917	94.731995		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
115	27.279917	94.731995		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
116	27.335803	94.78757		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
117	27.32187	94.780618		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
118	27.321826	94.773676		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
119	27.335759	94.780628		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
120	27.321582	94.732023		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
121	27.307738	94.725072		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
122	27.300839	94.718125		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
123	27.307784	94.71813		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
124	27.314682	94.725076		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
125	27.252276	94.711151		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
126	27.357325	94.905602		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
127	27.357362	94.912544		1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)	
128	27.328814	94.780623		Dihingmukh R F	1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)
129	27.34947	94.752869			1B/C1 Assam Valley Tropical wet Evergreen Forest (<i>Dipterocarpus</i>)

* one additional plot was laid to make cover the grid.

Blanks, important scattered trees, plantations raised were also noted. Information on drivers of forest degradation, NTFP species, intensity of invasive species, faunal sights/ traces, microhabitats of wildlife were recorded.

Local Volume table of distinguished tree species is shown table 6.1c

Table 6.1b Tree Standing Volume Table of Dibrugarh Forest Division

Sl. No.	Girth Class in C.M.	Hollong	Hollock & Others	Mekai	Nahar
1	20	0.0566	0.0566	0.0283	0.0283
2	30	0.0850	0.0707	0.0424	0.0424
3	40	0.1133	0.0850	0.0566	0.0566
4	50	0.1556	0.0990	0.1556	0.1133
5	60	0.1983	0.1133	0.0849	0.1699
6	70	0.2265	0.1699	0.1415	0.1839
7	80	0.2549	0.2265	0.1982	0.1982
8	90	0.4814	0.3115	0.2549	0.3681
9	100	0.5941	0.4248	0.3398	0.4814
10	110	0.6796	0.5097	0.4248	0.5097
11	120	0.9061	0.6796	0.5663	0.6796
12	130	1.1044	0.8778	0.6937	0.8212
13	140	1.3875	1.0477	0.9345	0.9486
14	150	1.6141	1.2176	1.0618	1.0618
15	160	1.9339	1.4442	1.2743	1.1893
16	170	2.2370	1.6707	1.4442	1.3309
17	180	2.5768	1.8972	1.7840	1.4442
18	190	2.5317	2.0671	2.0388	1.6141
19	200	3.0582	2.3786	2.4919	1.7273
20	210	3.5396	2.5768	2.8600	1.8972

21	220	4.3016	2.9450	3.3131	2.0671
22	230	4.3582	3.1998	3.7639	2.1804
23	240	4.7544	3.3131	4.1601	2.3078
24	250	5.1739	3.5396	4.5840	2.4352
25	260	5.6034	4.0469	4.9525	2.5768
26	270	6.0200	4.3016	5.3770	2.7184
27	280	6.2543	4.6129	5.9147	2.8458
28	290	6.3392	4.9808	6.5090	2.9733
29	300	6.3675	5.2921	7.1316	3.1149
30	310	6.9052	5.6317	7.7259	3.2564
31	320	7.9523	5.9147	8.0089	3.3980
32	330	8.5468	6.3109	8.4334	3.5396
33	340	8.8862	6.6222	8.9428	3.7073
34	350	9.3390	6.9618	9.5088	3.8205
35	360	9.7069	7.2731	10.0182	3.9903
36	370	10.2163	7.5561	10.4993	-
37	380	10.6691	7.8674	10.8955	-
38	390	10.3766	8.1504	11.3766	-
39	400	10.1407	8.5466	12.0558	-
40	410	12.6784	8.8296	12.5652	-
41	420	12.9614	9.1126	12.9848	-
42	430	13.3576	9.4522	13.5840	-
43	440	13.6689	9.7652	14.0934	-
44	450	14.0089	10.0182	14.6028	-
45	460	14.4330	10.3578	15.2254	-
46	470	15.0273	10.6974	16.0744	-
47	480	15.5933	11.0087	16.6404	-
48	490	16.1876	11.3200	17.3497	-
49	500	16.8102	11.6596	18.1686	-
50	510	17.2630	11.9143	18.8195	-
51	520	17.9139	12.2256	19.5701	-

Reserved forest wise the total growing stock (cu.m/ha) in Dibrugarh division is shown in Tables 6.1a. The total number of trees in different girth class is shown in Table 6.1b and girth class wise total volume is shown in Table 6.1c. Maps of growing stock (cu.m./ha) is shown in Figure 6.1a.

Table 6.1c: Compartment wise growing stock (cu.m/ ha) of Dibrugarh division

Name of the RF	Compt. No.	Growing stock (cu.m./Ha.)	Name of the RF	Compt. No.	Growing stock (cu.m./Ha.)
Dihingmukh R.F.	1	0.64	Joypur R.F.	29	114.22
	2	0.03		30	376.86
	3	2.17		31	374.06
Jokai R.F.	1	222.03		32	454.84
	2	121.54		33	229.75
	3	1.36		34	409.46
	4	69.14		35	273.17
	5	15.52		36	200.27
	6	14.55		37	2.22
	7	97.36		38	242.16
	8	65.57		39	515.52
	9	47.69		40	350.87
	10	2.18		41	386.91
Joypur R.F.	1	630.23		42	388.54

	2	383.32			43	300.66
	3	274.40			44	757.58
	4	271.59			45	43.26
	5	364.06			46	140.54
	6	305.44			47	270.47
	7	247.71			48	425.60
	8	63.24			49	201.33
	9	175.68			50	384.57
	10	331.50			51	388.54
	11	419.17		Namdang R.F.	1	0.47
	12	478.06		Telpani R.F.	1	2.08
	13	392.09				
	14	485.01				
	15	388.54				
	16	190.91				
	17	368.37				
	18	317.38				
	19	355.69				
	20	290.05				
	21	328.85				
	22	1688.00				
	23	168.68				
	24	372.82				
	25	322.03				
	26	429.15				
	27	1792.61				
	28	326.86				

Table 6.1d:RF wise growing stock (number of trees) in Dibrugarh Division, Assam

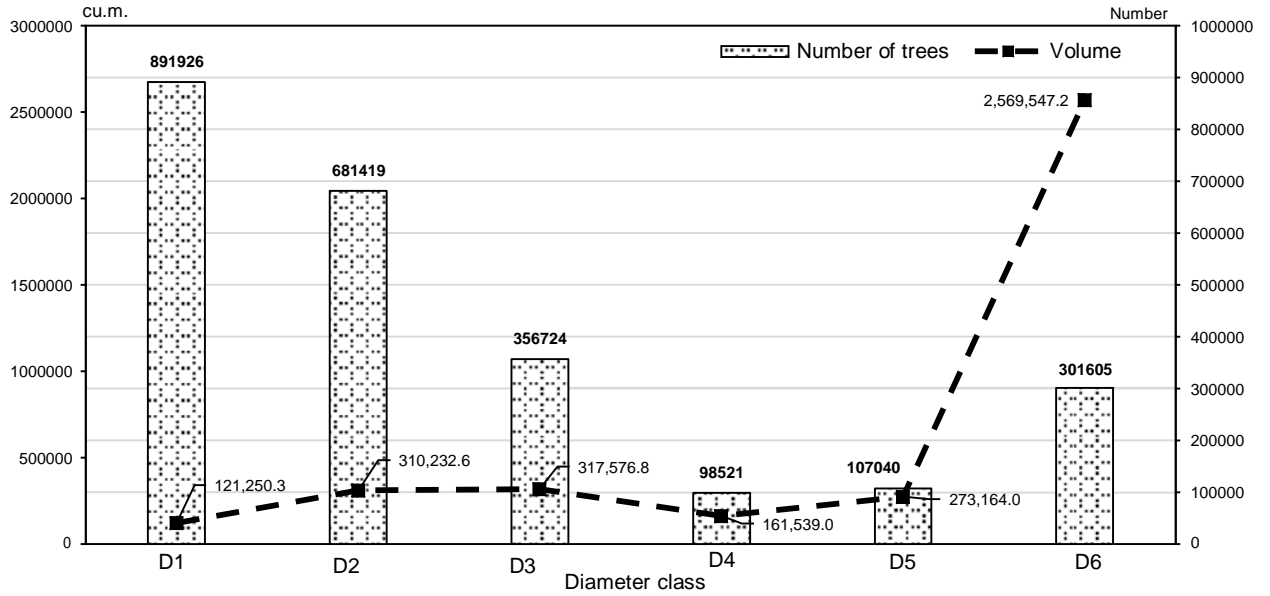
Name of the RF	Canopy cover	Diameter class						Total
		D1 10-20	D2 20-30	D3 30-40	D4 40-50	D5 50-60	D6 60-70	
Dihingmukh RF	Open forest	338	739	726	463	332	257	2,855
	Moderately dense forest	0	0	0	0	0	0	0
	Very dense forest	0	0	0	0	0	0	0
	Dihingmukh RF	338	739	726	463	332	257	2,855
Namdang RF	Open forest	280	611	601	383	274	212	2,361
	Moderately dense forest	0	0	0	0	0	0	0
	Very dense forest	0	0	0	0	0	0	0
	Namdang RF	280	611	601	383	274	212	2,361
Jokai RF	Open forest	966	2,111	2,076	1,325	949	734	8,161
	Moderately dense forest	4,350	12,842	16,890	8,370	7,131	6,982	56,565
	Very dense forest	0	0	0	0	0	0	0
	Jokai RF	5,316	14,953	18,966	9,695	8,080	7,716	64,726
Telpani RF	Open forest	316	691	679	433	310	240	2,669
	Moderately dense	493	1,455	1,914	948	808	791	6,409

	forest							
	Very dense forest	0	0	0	0	0	0	0
	Telpani RF	809	2,146	2,593	1,381	1,118	1,031	9,078
Joypur RF	Open forest	87,612	49,958	33,359	13,145	18,250	38,987	2,41,311
	Moderately dense forest	3,34,530	2,59,707	1,37,234	37,127	45,869	1,04,682	9,19,149
	Very dense forest	4,63,041	3,53,305	1,63,245	36,327	33,117	1,48,720	11,97,755
	Joypur RF	8,85,183	6,62,970	3,33,838	86,599	97,236	2,92,389	23,58,215
Total of the Dibrugarh division		8,91,926	6,81,419	3,56,724	98,521	1,07,040	3,01,605	24,37,235

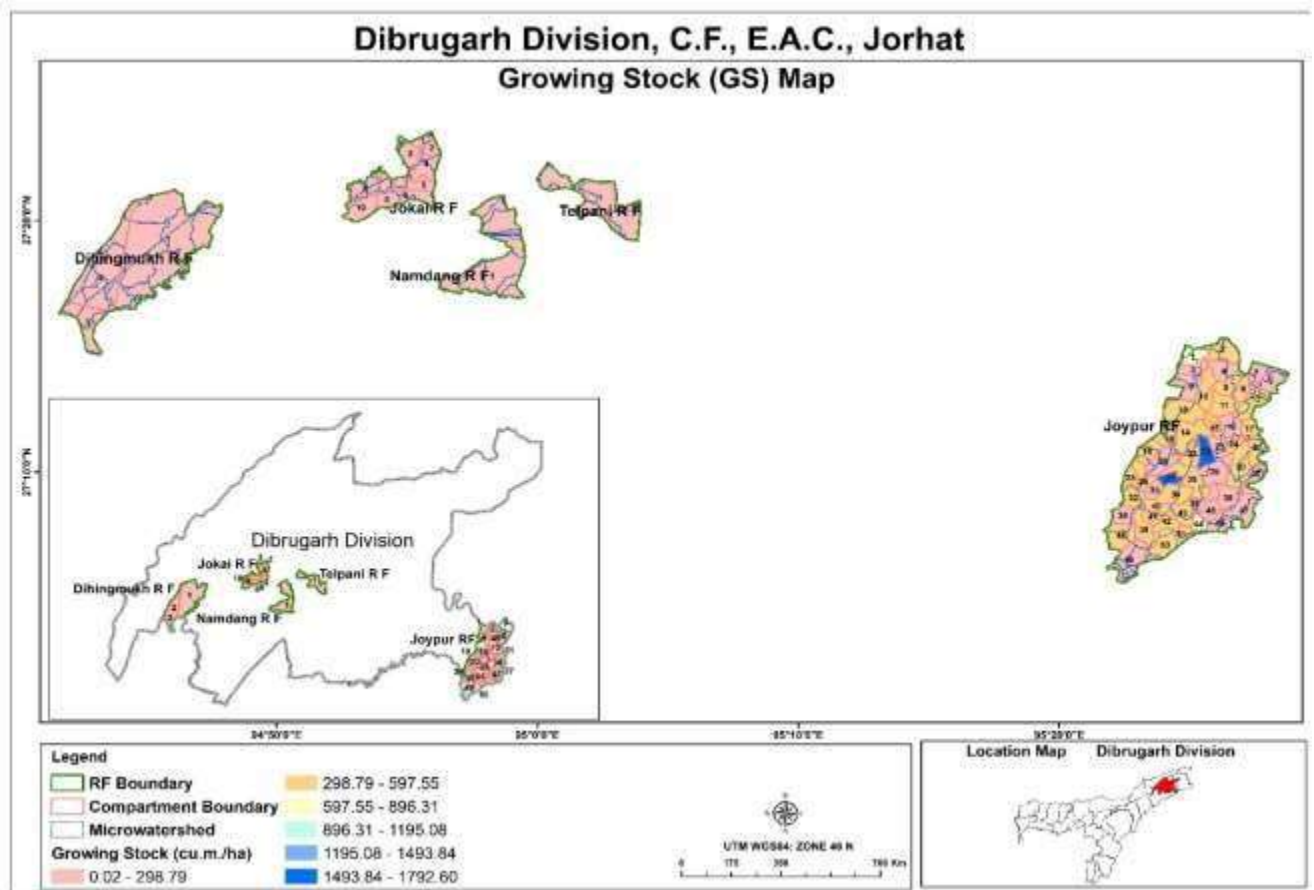
Table 6.1e: Statement showing RF wise total growing stock (*in cu m*) in Dibrugarh division.

Name of the RF	Canopy cover	Diameter class (cm)						Total
		D1 10-20	D2 20-30	D3 30-40	D4 40-50	D5 50-60	D6 60-70	
Dihingmukh RF	Open	41.6	295.6	586.6	663.5	786.3	1,270.3	3,643.9
	Moderately Dense	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Very dense	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Dihingmukh RF	41.6	295.6	586.6	663.5	786.3	1,270.3	3,643.9
Namdang RF	Open	34.4	244.4	485.1	548.7	650.3	1,050.5	3,013.4
	Moderately Dense	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Very dense	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Namdang RF	34.4	244.4	485.1	548.7	650.3	1,050.5	3,013.4
Jokai RF	Open	118.9	845.2	1,677.4	1,897.3	2,248.6	3,632.5	10,419.7
	Moderately Dense	787.4	4,848.0	13,540.3	11,876.1	16,284.5	35,557.8	82,894.2
	Very dense	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Jokai RF	906.3	5,693.2	15,217.7	13,773.4	18,533.1	39,190.4	93,314.0
Telpani RF	Open	38.9	276.3	548.3	620.2	735.0	1,187.4	3,406.1
	Moderately Dense	89.2	549.3	1,534.2	1,345.7	1,845.2	4,029.0	9,392.6
	Very dense	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Telpani RF	128.1	825.6	2,082.5	1,965.9	2,580.2	5,216.4	12,798.6
Joypur RF	Open	10,080.4	17,765.5	32,625.8	20,798.2	53,392.5	4,09,592.3	5,44,254.7
	Moderately Dense	47,073.0	1,24,423.0	1,28,523.5	60,149.4	1,17,524.3	7,89,800.4	12,67,493.6
	Very dense	62,986.6	1,60,985.3	1,38,055.6	63,640.0	79,697.4	13,23,426.9	18,28,791.8
	Joypur RF	1,20,140.0	3,03,173.9	2,99,204.9	1,44,587.6	2,50,614.1	25,22,819.6	36,40,540.1
Total of Dibrugarh division		1,21,250.3	3,10,232.6	3,17,576.8	1,61,539.0	2,73,164.0	25,69,547.2	37,53,309.9

Figure 6.1g: Number of trees and volume in each diameter class in Dibrugarh Forest Division.



Compartment wise growing stock is provided in Annexure VIa and species composition in RFs Annexure VIb.



6.1 h: Growing Stock map of Dibrugarh Division, Assam

6.2 Growing stock of bamboo: Bamboo observed to occur naturally in Jeypore RF. Further, bamboo plantations have been created under NBM in Jeypore, Jokai, Dihingmukh and Telpani RF. Damage due to floods and elephants have affected the growing stock of bamboo in the Division. Matured bamboos are being illegally removed by local population.

Table 6.2 No. of bamboo clumps, culms and their weight by species and age class ('000) in Dibrugarh District

Species	Clumps	Culms	< 2 Yr Culms	2 Yr Culms	> 2 Yr Culms	Damaged culms
<i>Bambusa tulda</i> (Jati)	292	20963	8914	7076	4700	275
Dry wieght (tons)		164	53	27	52	2

Source: Bamboo resource in non-forest areas of Assam and its industry, Assam Forest Department, 2018.

6.3 Increment in volume of identified timber species: Hollong is the most important timber species in the Division. Other associates are Mekai, Nahar, Hollock, Sam and Sopa.

Table 6.3: The growth of DBH(OB) at various ages in Dibrugarh Division, Assam

Age (in years)	Diameters (BH)		
	Hollong	Mekai	Nahar
10	11.00	10.90	13.70
20	17.50	17.30	17.50
30	24.50	24.30	21.60
40	32.50	32.00	26.00
50	43.00	40.80	30.60
60	55.50	50.00	35.60
70	78.50	59.00	40.20
80	108.50	67.20	45.20
90	-	74.50	50.20
100	-	81.30	-
110	-	88.00	-

6.4 Efforts towards enhancement of forest productivity through quality plantation

activities: Efforts to enhance forest productivity has been initiated through plantation activities carried out in the division from time to time. Various local bodies, state as well as national agencies have been involved for carrying out plantations. Table 6.4a presents details of various plantation activities undertaken in the Division between 2005-06 and 2014-15.

Table 6.4: Statement showing plantation activities for enhancing forest productivity

Year	Name of Scheme						Total
	CAMPA (in ha)	ABY (in ha)	NAP (in ha)	RDF (in ha)	Reg. of Silvi works (in ha)	APFBC (in ha)	
2008-2009	-	-	-	50	-	-	50
2009-2010	-	-	-	40	35.9	-	75.9
2010-2011	5	-	-	90	25	-	120
2011-2012	-	10	-	26	30	10	76
2012-2013	-	10	-	20	30	-	60
2013-2014	-	20	-	-	-	20	40

6.5 Carbon stock: Forests sequester and store more carbon than any other terrestrial ecosystem. Forests play an important role in mitigation and adaptation of climate change. Forestry activities are relatively inexpensive means of addressing climate change. Forests are sinks of carbon and matured forests are storehouse of carbon. The world's forests and forest soils store more than one trillion tons of carbon, twice the amount found floating free in the atmosphere. Therefore, assessment of carbon stock in forest division is vital.

6.5.1 Forest Carbon Inventory in India: India has been involved in climate change negotiations since the formation of UNFCCC in 1992, and is an international leader in carbon markets, especially in the Clean Development Mechanism (CDM). In forestry sector, India led the evolution of REDD to REDD+ through decisions adopted at the Climate Change COP at Bali, 2007. The Bali COP defined the instrument as “reducing emissions from deforestation and forest degradation; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries” (REDD+). With over 70 million hectares (ha) under forest cover (primarily stewarded by State governments and local communities), approximately 33% of which is managed through the Joint Forest Management (JFM) initiative, India is well-positioned to take advantage of and champion REDD+.

The Ministry of Environment and Forestry (MOEF) has created a REDD+ Cell, to lead the nation's efforts to participate in REDD+. To decrease national emissions and increase India's forest cover by over two million hectare annually and the carbon stocks within existing forest, the nation created the Green India Mission (GIM) and National Afforestation Program (NAP), along with other agricultural and rural development programs.

India is a country with tremendous human and institutional capacity and strong forest mapping capacity, extensive research and training capacity, and State Forest Departments (SFDs) that reach down into local communities or “beats.” The Forest Survey Institute (FSI) develops a bi-annual forest cover inventory, and it will lead the national-level carbon stock accounting system in coordination with the India Institute of Remote Sensing (IIRS), the India Institute for Sciences (IISc), and the India Council for Forestry Research and Education (ICFRE). All of these will be critical to the long-term success of REDD+ in India.

One of the biggest challenges on carbon forestry is quantifying nation's carbon emissions and storage in forests, which requires region specific information. A credible monitoring system that shall measure, report and verify carbon in the Indian forests is a very critical element for the mitigation activities of India. This involves developing cost-effective, robust and compatible national monitoring and MRV systems, innovating tools, methodologies, inclusive training and knowledge sharing that shall strengthen India's technical and institutional capacity for effective MRV systems. Monitoring of forest carbon requires remote sensing as well as ground based data. Monitoring is essential for appropriate compensation of the carbon sequestered as well as fulfilling India's commitments of the GIM.

The IPCC 2006 Guidelines provides advice on estimation methods at three levels of detail, from tier 1 (default) to tier 3 (most detailed locally applicable data). This consists of mathematical specifications of the

methods, information on emission factors or other parameters to use in generating the estimates, and sources of activity data to estimate the overall level of net emissions (emission by sources minus removals by sinks). When properly implemented, all tiers intend to provide unbiased estimates. Accuracy and precision should in general, improve from tier 1 to tier 3. The provision of different tiers enables inventory compilers to use methods consistent with their resources and to focus their efforts on those categories of emissions and removals that contribute most significantly to national emission totals and trends. The subsequent sub-chapters shall discuss the steps involved in carbon quantification of forests in Dibrugarh division.

6.5.2 Inventorying and reporting emissions and removals: The steps involved in inventorying and reporting follows the National Working Plan Code-2014, with additional references made to recommendations of reports of Forest Survey of India, Good Practice Guidance for Land Use, Land-Use Change and Forestry (GPG LULUCF) (IPCC, 2003) and the National Greenhouse Gas Inventory Guideline (IPCC, 2006). The steps in brief are given below:

- i) Identify land use category and, estimate the land areas in each land use category for the time period required.
- ii) As per GPG LULUCF, the total area is to be categorised into six major land classes, which are, forest land, cropland, grassland, wetlands, settlements and other land. The exact land area under each land classification is to be done by remote sensing analysis to reach at the area covered by each category. Carry out assessment for the relevant LULUCF categories. Within the key categories, carry out an assessment on which non-CO₂ gases and carbon pools are significant. Carbon pools are broadly classified into three groups:
 1. Living biomass: consisting of above ground biomass (AGB) and below ground biomass (BGB).
 2. Dead organic matter: consisting of Dead wood and Litter.
 3. Soil: consisting of soil organic matter.

For the computation purpose, all non-CO₂ gases and carbon pools that are significant are to be selected. As per the forestry regime in Dibrugarh division, no non-CO₂ gases are considered to be significant. There are no peat lands identified in the landscape; and the emissions from and fertilizer application in the forest nurseries are considered to be negligible as only organic fertilizers are used as much as possible. Among the carbon pools, Above Ground Biomass, Below Ground Biomass and Soil Organic Carbon are considered to be significant; Dead Wood and Litter are considered to be *de minimis* and is not considered in the estimations.

iii) Ensuring that the requirements in terms of emission and removal factors and activity data appropriate to the tier level are being met. As far as possible region specific volume equations, wood density, root to shoot ratio and biomass expansion factors are to be applied in the absence of tier-3 data sets. In the absence of tier-3 data, efforts are to be made to make them available.

(iv) Quantification of emissions and removals and estimation of the uncertainty in each estimate.

Quantification of total carbon content in steps

6.5.3 Carbon inventory: biomass and soil carbon

Carbon inventory at the national level is done mainly through the NFI of FSI. However, to make it more comprehensive and robust, the code suggests forward and backward linkage between forest inventory of working plan and the inventory of FSI. The forward linkages have been ensured by suggesting the working plan methodology of enumeration following the exact methods of NFI. The code suggests using NFI data as a historical reference for a particular forest grid as backward linkage. The code has adopted grid-based systematic sampling of NFI for the working plans to ensure the linkages between NFI and working plans. The grid-based systematic sampling design also offers a better opportunity to revisit the area for change detection. The total carbon stocked in the forest is divided into different pools similar to the Good Practices Guidance developed by IPCC (2003). Changes in carbon stocks in these pools are to be estimated following the methods of IPCC (2003). Working plans are suggested to highlight the gaps in data collection and research needs explicitly for further refinement of the inventory. Use of IPCC Tier 2 and Tier 3 methodology has been suggested to provide estimates of greater certainty. This is expected to have a better link between biomass and soil carbon dynamics.

It has been estimated that 50% of a tree's biomass by weight is carbon. By estimating the biomass of a tree, carbon content of a tree, or the AGB, can be calculated. Volume equations of most of the trees have already been developed by FSI. These regression functions in volume, height and DBH provide the merchantable or bole volume (m^3) of a species. Each forest class has a specific biomass expansion factor (BEF), which is the ratio of the total volume of a tree above ground (including leaves, branches etc.) to that of its merchantable volume. Further, species have a specific wood density (WD) which is used to convert volume into mass (in tons). Volume of BGB depends on AGB. IPCC in its Good Practice Guidance for Land Use, Land-use Change and forestry (GPG-LULUCF) has provided root-to-shoot ratios (RF) from which the root volume can be calculated. Since the mass of AGB in tons is already calculated, BGB is calculated using RF. Sum of AGB+BGB gives total biomass in tons in a tree. 50% of biomass by weight is carbon. Carbon is completely assimilated from atmospheric CO_2 . From the amount of carbon stored within a tree, the amount of CO_2 sequestered can be calculated using the molecular weights of carbon and oxygen. To this the carbon content in the dead wood, litter and soil organic carbon are added to arrive at the total carbon content. Wood density has been sourced from country specific (tier-2) data¹. Biomass expansion factor and root-to-shoot ratio have been sourced from GPG LULUCF (tier-1 data). The volume equations used are sourced from Forest Survey of India (tier-2 data). Soil Organic Content has been estimated from Government recognized laboratories using the soil samples collected during ecological data collection exercises.

(v) Using appropriate reporting tables to report emissions and removals estimates.

Appropriate tables shall be used in reporting that shall ensure transparency in calculation.

(vi) Documentation and archiving all information used to produce the emissions and removals estimates.

Appropriate documentation and archiving practices shall be followed for all the records used in the

calculations.

(vii) Quality control checks, verification, and expert/peer review of the emission estimates.

Appropriate quality control, which includes checking by competent source shall be undertaken to ensure the veracity of the calculations.

Quantification of total carbon content in steps

AGB:

Step 1: Calculate mercantile volume using volume equations (m^3).

$$V = a + bD^2H$$

Where V = Mercantile volume (m^3)

D = DBH (m)

H = Height (m)

Step 2: Calculate the mass of the AGB biomass in tons

$$G_{AGB} = V * BEF * WD$$

Where G_{AGB} = Biomass at above ground biomass in tons of dry matter (t)

V = Mercantile volume (m^3)

BEF = Biomass Expansion factor

WD = Wood density

BGB:

Step 3: Calculate the mass of BGB (roots) using the RF

$$G_{BGB} = G_{AGB} * RF$$

Where G_{BGB} = Biomass at below ground biomass in tons of dry matter (t)

G_{AGB} = Biomass at above ground biomass in tons of dry matter (t)

RF = Root to shoot ratio

Step 4: Calculate total biomass in tons of dry matter (tdm)

$$G_{TOTAL} = G_{AGB} + G_{BGB}$$

Where G_{TOTAL} = Total biomass of the tree in tdm

G_{BGB} = Biomass at below ground biomass in tons of dry matter (t)

G_{AGB} = Biomass at above ground biomass in tons of dry matter (t)

Step 5: Calculate the carbon content in a tree

$$C_{TOTAL} = G_{TOTAL} * 0.5$$

Where C_{TOTAL} = Total carbon content in a tree (tC)

G_{TOTAL} = Total biomass of the tree in tdm

Step 6: Calculation of net anthropogenic sequestration or CO_2 sequestered from living biomass

$$ER = C_{TOTAL} * 44/12$$

Where ER = Net anthropogenic sequestration or CO_2 sequestered in tCO_2

C_{TOTAL} = Total carbon content in a tree (tC)

Step 7: Calculation of carbon content in litter and dead wood and soil organic carbon as per the tier-3 methodology. In the absence of tier-3 data, tier-2 or tier 1, in that order may be used.

Step 8: $C_{living} + C_{dead} + C_{soil} = \text{Total Carbon content}$

6.5.4 Calculations of carbon stock in Dibrugarh Division: Biomass studies for carbon stock assessment were carried out in the Division by collecting samples from multiple forest plots. The preliminary carbon stock of Division showed that there are 49,90,161.12 tons of carbon in the living biomass of natural forest area. Forest carbon stock under different RFs is shown in table 6.5. Forest

carbon distribution is shown as per the existing compartment in Figure 6.5a. The assessment reveals that Jeypore RF is most densely stocked with Carbon followed by Jokai and Telpani RF.

Table 6.5:Reserved forest wise carbon stock in Dibrugarh Division

Reserved Forest	Carbon Stock (in tons)
Dihingmukh R F	1,797.76
Jokai R F	1,20,839.9
Jeypore RF	48,64,491
Namdang R F	822.61
Telpani R F	2,209.85
Total	49,90,161.12

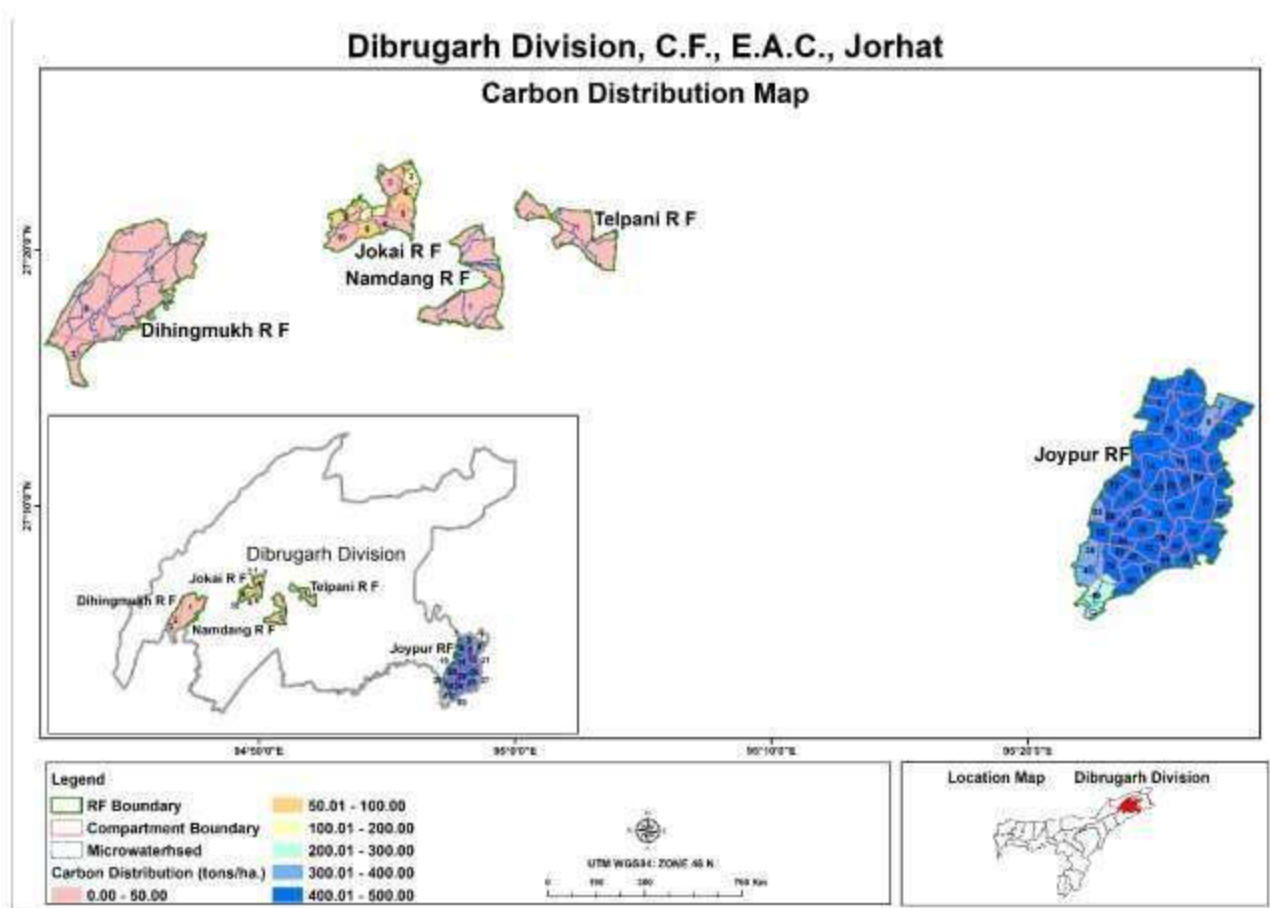


Figure 6.5a: Carbon distribution map of Dibrugarh Division as per the existing compartment

6.6 Carbon sequestration and mitigation:

6.6.1 Role of Forest wood and Biomass in retarding Climate Change

Due to various factors including anthropogenic activities, the earth is getting more and more warmer than ever. Human activities have caused an imbalance in natural carbon cycle, consequently greenhouse effect and global warming came into being. When fossil fuels are burnt for transportation, heating, cooking,

electricity, and manufacturing, we are effectively releasing more carbon into the atmosphere than it is being removed naturally. Ultimately we are causing more carbon concentration into atmosphere. As a result we are proceeding on the path of global warming and climate change. Global warming and climate change refer to an increase in average global temperatures. Natural events and human activities are believed to be contributing to an increase in average global temperatures. This is caused primarily by increases in “greenhouse” gases such as Carbon Dioxide. Climate change is a global threat that needs urgent action from global community. All countries will be affected by climate change and its impacts, particularly developing countries. If temperature is taken as an climate change indicator, it has been found that earth's average temperature has risen by 1.4°F (0.72°C) over the past century. It is projected that it will further likely to rise another 2 to 11.5°F over next century (NCAR, 2014). Therefore it is important to understand Carbon cycle, climate change and how climate change can be mitigated

Carbon cycle refers to the movement of carbon, in its different forms, between the biosphere, atmosphere, oceans, and geosphere. (i) Carbon exchange between atmosphere and vegetation - Plants absorb CO₂ from the atmosphere during photosynthesis, and release CO₂ back in to the atmosphere during respiration. Another major exchange of CO₂ occurs between the oceans and the atmosphere. The dissolved CO₂ in the oceans is used by marine biota in photosynthesis. (ii) Burning of Fossil Fuel- another important processes is fossil fuel burning. In fossil fuel burning, coal, oil, natural gas, and gasoline are consumed by industry, power plants, and automobiles. In this process carbon directly goes to the atmosphere from its source point. (iii) Change in Land use & Land cover - Changing land use also affect carbon cycle in broad term which includes essential human activities e.g. agriculture, deforestation, transportation activities etc. In modern world alterations in land use & land cover and ever increasing usage of energy for the purpose of development are the focal reasons for global warming and climate change. Global warming and climate change refer to an increase in average global temperatures over a very long period of time. As discussed in carbon cycle, natural events and human activities are believed to be contributing to an increase in average global temperatures. This is caused primarily by increasing in “greenhouse” gases such as Carbon Dioxide (CO₂). Small changes in the average temperature of earth so far, can transform into large in coming hundred years. Moreover, these climatic changes will have great potential to create negative impacts on environment and mankind. Therefore, it is essential to mitigate climate change for advance minimization of its dangerous impacts. Current evidence suggests that to avoid the worst impacts of climate change, we should aim to limit the global average temperature rise to 2°C (35.6°F), not beyond that. This requires undertaking immediate reduction in global greenhouse gas emissions in all the sectors.

Climate forcing refers to the amount of energy earth receive from sun and the amount of energy earth radiate back into space. All extra carbon dioxide in the atmosphere is increasing overall temperature of earth on day to day basis, causing global warming. It is changing climate in unpredictable ways, from floods and hurricanes to heat waves and droughts. To try and reduce the risk of global warming and extreme weather events, it is required to reduce the amount of fossil fuel we are burning. This isn't an easy process. In the 1997 Kyoto Protocol, it was decided that carbon emission in the atmosphere will be

reduced by 5% below 1990 levels between 2008 and 2012. Several measures can be found out to reduce carbon from atmosphere and thus to reduce adverse impacts of climate change.

One of the measure is carbon sequestration, which is cheap and simple as well as costly and complex. That is natural carbon sequestration and geological carbon sequestration.

6.6.2 Carbon Sequestration: Carbon sequestration is the process of capture and long-term storage of atmospheric carbon dioxide to mitigate global warming and to avoid dangerous impacts of climate change. In other words, it also refers to the process of removing carbon from the atmosphere and depositing it in a reservoir. This carbon storages or reservoirs are also known as carbon pools. Carbon pool refers to a system or mechanism which has the capacity to accumulate or release. It can be natural or human induced. Examples are forest biomass, wood products, soils, and water. Carbon pools in a forest are a complex mix of live and dead organic matter and minerals. Human induced carbon pools are geological storages of carbon dioxide. The quantity of carbon in a pool is known as carbon stock and any change may be expressed as 'stock change'.

The use of forest is also a financially viable technique to reduce emission from atmosphere. It could also bring significant benefits to the local communities involved and consequently helps in reducing poverty at the same time. Forestry projects can bring social, economic, and local environmental benefits to millions of people. Trees are natural sequesters of carbon, they take carbon from atmosphere; utilize it in the process of photosynthesis as well as they store it in the form of biomass or wood. For this process of carbon sequestration to be success it is essential that carbon must not return to the atmosphere from burning. Carbon Sequestration can assist significantly in maintaining the natural carbon cycle. Therefore, requirement is that we need to implement this practice properly. There is a need to go for natural sequestration first, thus conservation of existing forests and more and more reforestation is required. Only then we will be able to reduce carbon emission and corresponding harmful impacts

Greenhouse Gases (GHG) have the capability to reflect back shorter wavelength infrared (IR) radiation. GHGs allow the longer wavelength IR radiation from sun to reach earth through the atmosphere. Earth absorbs the IR radiation, and radiates shorter wavelength IR radiation back into the atmosphere, which is reflected back into earth by the GHGs. So, the GHGs (such as water vapor, CO₂, CH₄, SF₆, HFCs, PFCs and O₃ (in troposphere)) form a blanket around earth resulting less variation in night and day temperatures, which is critical for life to flourish. This phenomenon is called the greenhouse effect. Moreover, due to the increase in consumption of fossil fuels after the industrial revolution and other sustained life style patterns of humans, the concentration of GHGs in the atmosphere increased, leading to an increase in the average temperatures on land as well as oceans. This increase in temperature caused the air and ocean circulation systems to behave differently, and change course patterns in certain cases, resulting in a change in climatic patterns on the earth. Further, life on earth will have to adapt to this increase in temperatures in a very short period. This phenomenon, which threatens the very existence of life on earth, is termed as Global Climate Change or GCC. Since these changes have been brought about due to human action, these are also called anthropogenic climate change. Mitigation

Strategies include reduction in emissions of GHGs from sources as well as capture and storage of GHGs over a long period of time (sequestration).

Trees use the energy from sunlight to convert CO₂ in the atmosphere to sugars through the process of photosynthesis. Melvin Calvin was awarded the Nobel Prize in 1961 in Chemistry for his research on the process of carbon dioxide assimilation in plants using carbon isotopes, which proved that the carbon assimilated in trees, are absorbed from atmospheric CO₂. This way trees and forests act as a major sink of carbon in the natural carbon cycle. Destruction of forests leads to release of CO₂ into atmosphere, which has been calculated to be more than the global vehicular emissions. Harvested wood traps and stores the carbon within it over a long period of time. So promoting carbon sequestration in trees is a practical and cost effective way to capture carbon from atmosphere and store away for a long period of time. Hence the emission reductions are real and long term.

6.6.3 Enhanced carbon sequestration through recognised and innovative silvicultural practices, eco-restoration of degraded/mined out forest land:

Forestry has been recognized as a means to reduce CO₂ emissions as well as enhancing carbon sinks. Forests are a large sink of carbon and their role in carbon cycles is well recognized. Forestry provides a unique opportunity to combine the twin objectives of climate change adaptation and mitigation. It has the ability to enhance the resilience of the system for coping with the adverse impacts of climate change. Forestry systems offer important opportunities for creating synergies between both adaptation and mitigation actions. Forestry practices in climate change mitigation in India can be realized to its full potential by overcoming various technical, financial and institutional barriers.

The carbon storage capacity in plants varies across species and geography. Further, the amount of carbon in any forestry system depends on the structure and function of different components within the systems put into practice. The fact that forestry systems can function as both source and sink of carbon has been presented in literature. There is also clear evidence to suggest that forestry system greatly influences the source or sink of carbon. For example, agri-silvicultural systems where trees and crops are grown together are net sinks while agrosilvi pastoral systems are possibly sources of GHGs. Practices like tillage, controlled burning, manuring, application of chemical fertilizers and frequent soil disturbance can lead to significant emissions of GHGs. The carbon in the above ground and below ground biomass in an forestry system is generally much higher than the equivalent land use without trees (i.e. crop land without any trees). India has a long tradition of agroforestry practices. The agroforestry systems in India include trees on farms, community forestry and a variety of local forest management and ethno forestry practices. In India, the practice of growing scattered trees on farmlands is quite old and has not changed much over centuries; these trees are multipurpose, used for shade, fodder, fuel wood, fruit, vegetables and medicinal uses.

There is a growing interest in the role of different types of land use systems in stabilizing the atmospheric CO₂ concentration and reducing the CO₂ emissions or on increasing the carbon sink of forestry systems. Forestry has been recognized as a means to reduce CO₂ emissions as well as enhancing carbon sinks.

The role of forests (or trees) in carbon cycles is well recognized and forests are a large sink of carbon. There is considerable interest to increase the carbon storage capacity of terrestrial vegetation through land-use practices such as afforestation, reforestation, and natural regeneration of forests, silvicultural systems and agroforestry. Agroforestry systems are very important given the area currently under agriculture, the number of people who depend on land for their livelihoods, and the need for integrating food production with environmental services

Globally, climate negotiations have highlighted the importance of land use sectors in mitigating the climate change. Agriculture alone accounts for 10-12% of the total global anthropogenic emissions of GHGs with an estimated non-CO₂ GHG emission of 5120-6116 Mt CO₂ eq/yr in 2005. Since agricultural lands are often intensively managed, they offer many opportunities to improve agronomic practices, nutrient and water management, land use practices to fit the objectives of carbon sequestration. The emphasis of land use systems that have higher carbon content than existing plant community can help achieve net gains in carbon, specifically and significant increases in carbon storage can be achieved by moving from lower biomass land uses (e.g. grasslands, crop fallows, etc) to tree based systems such as forests, plantation forests and agroforestry.

Enhancement in biomass productivity, etc. results in improvement of forest health and vitality. Forest soil must be kept as healthy and fertile as possible and the forest crops must be kept as vigorous as possible to produce as rapidly as they can, till the biomass production attains its most desirable level. The growing stock of trees must be so constituted that it provides regularly the greatest possible quantity of the desired products, including intangible benefits. It is therefore essential that the specific composition and the structure or form of the forest must harmonise with the environment or factors of the locality, and the species grown and the methods of silviculture adopted must be suitable to the site to ensure full growth. Data is not yet available for carbon sequestration and mitigation.

6.6.4 Forest Carbon Finance: Carbon financing for forestry is a mechanism to incentivize carbon sequestration and long-time storage in forest lands. This can take different forms such as carbon credit based which includes Clean Development Mechanism (CDM) based Afforestation/Reforestation (AR) project activities and voluntary markets such as Agriculture, Forest and Other Land Uses (AFOLU) projects under Verified Carbon Standard (VCS), Plan Vivo and Gold Standard or program based where carbon forestry is made a part of a state's Nationally Approved Mitigation Activities (NAMAs) or a specific program aimed at improving tools and techniques and the Monitoring, Reporting and Verification (MRV) systems associated with carbon forestry. It is understood that the financing options could be domestic, bilateral or multilateral; in-line with the Government's decisions.

REDD+ is a mechanism being negotiated through the United Nations Framework Convention on Climate Change (UNFCCC) to mitigate climate change by compensating developing countries for demonstrated reduced emissions from deforestation and forest degradation. Since REDD was introduced on to the UNFCCC agenda in 2006 its scope has been expanded through successive negotiations to include not

only forest conservation activities, but also forest enhancement and sustainable management of forests. With growing momentum to develop REDD+ systems, there has been increasing focus on the appropriate institutional arrangements for implementing REDD+ at the international, national and project levels. Currently the Assam Forest Department has considered potential revenues from carbon that may arise from the REDD+ carbon projects, and had piloted a jurisdictional REDD+ project design in Nagaon division (Lowering Emissions, Enhancing Forests (LEEF) in Nagaon). This REDD+ design detailed the prescriptions for various elements and extent of conservation, regeneration and afforestation activities, which can be included in the working plans to account Carbon sequestration by this forest division also. This can eventually help in state-wide reporting of contribution to national NDC goals.

CHAPTER 7

Optimization of Forest Resources Utilization

7.1 Recorded removal of timber: Statement showing the recorded removal of timber from the Division during the period from 2009-2010 to 2017-2018 is presented in Table 7.1.

Table 7.1: Volume of timber as per Sale record in Dibrugarh Division, Assam

Reporting year	Extraction of wood (non-Sal) (cu.m)	Remarks
2010-2011	697.838	Total volume includes sale of lots of seized timber, dead dying and wind fallen trees.
2011-2012	723.6121	
2012-2013	667.4389	
2013-2014	320.794	
2014-2015	352.6361	
2015-2016	2593.4181	
2016-2017	7384.4918	
2017-2018	4736.034	
2018-2019	1276.2879	
2019-2020	1673.122	

7.2 Recorded removal of fuel-wood: 630 cum of fuelwood was extracted from the Division in 2014-2015. There is no record of removal of fuelwood in other years.

7.3 Recorded removal of bamboo/rattan: There is no extraction/removal of bamboo/rattan from the Division except in the year 2010-2011. 6,784 kg of bamboo was removed from the RFs of the Division in 2010-11. Bamboos/rattans are collected by villagers for domestic use.

7.4 Recorded removal of locally important NTFPs including maps: There is no record of removal of NTFPs from the Reserved forests of Dibrugarh Forest Division. Periodic removal of *Dilena indica* fruits, *Magnolia pterocarpa* (Barhamthuri) flowers, *Homalomena aromatica* (Gandikachu) were reported from fringe villagers. However systematic removal in commercial scale is not recorded. It has been observed that the Local community in Dibrugarh district is highly dependent on NTFPs as a major source of their income. Further, majority of the NTFPs are collected and marketed by females. Fruits (37%) were most extensively collected, followed by leaves (25%), whole plant (18%), bark (5%), stem and tuberous roots (3%) and seed, rhizome and shoot (2%). Fruits, vegetables and timber for construction purposes are largely collected by the community from the surrounding forests and natural habitat. It has also been estimated that the highest number of species the local community collects are used as vegetable (35%), followed by medicine (27%), fruit (raw edible fruits) (20%), forest products as construction materials contribute about 13% and other miscellaneous purpose contributes about 5% of the total recorded species. Apart from the plants, two other very important commercial NTFPs, viz. honey and silkworms were also reported from the area. In village markets of Sonitpur district, selling price of honey was recorded at Rs.100 for 500 ml and silk worm larvae at a price of Rs.120/- to 130/- for 1 kilogram. *Phyllanthus*

acidus is another commercially important NTFP largely marketed in this district. The availability of NTFPs are also recorded and found that majority of the recorded NTFPs are available throughout the year and some are also seasonal.

7.5 Demand and supply of timber and important non-timber forest produce: The demand of timber in the Division is very high, but due to poor stock in forests, supply from the region is not possible. Further, there is a ban imposed on tree felling in the Division.

7.5.1 Markets: With the increase of population and development of small townships in several places of the district and also development of plywood industries, there is an increased demand of plywood timbers, mainly Hollong and Mekai. In fact, the timber extracted from the forests is largely utilized by the plywood industries only for preparation of veneers for tea chests as well as commercial plywood. There are 14 nos. of wood based Industries, the annual requirement of which would be about 3 lakhs cu.m. of logs. The demand will have to be met by the timbers extracted not only from Dibrugarh division but also from the neighbouring divisions, such as Digboi, Doomdooma, Sibsagar divisions and also timbers flowing from the neighbouring state of Nagaland and Arunachal Pradesh.

Out of 14 wood based Industries there are 7 plywood factories, and 7 Saw mills to get clearance from the High Power Committee following Supreme Court directives. In view of scarcity of raw materials it is being considered to reduce the number of these wood based Industries. List of wood based Industries get clearance from the High Power Committee is in table 7.5.1.

Table 7.5.1: Wood based industries getting clearance from HPC and within industrial estate

S.No.	Name of the mills	Plywood, vaneers& saw mills	Location
1	M/S Plyboards India	Plywood	Chottohapjan
2	M/S Bimal Manufacturing CO.	Plywood	Tinsukia
3	M/S Everest Plywood	Plywood	Chottohapjan
4	M/S Sarda Plywood Industries Ltd.	Plywood	Joypur
5	M/S Jayshree Chemical Ltd.	Veneer	Chottohapjan
6	M/S Mandhanian Ply	Veneer	Makum
7	M/S Bhismak Ply Ltd	Veneer	Makum
8	M/S National Saw Mill	Saw Mill	Nahorkotia
9	M/S Dambaru Saw Mill	Saw Mill	Nahorkotia
10	M/S Ras Saw Mill	Saw Mill	Nahorkotia
11	M/S Khan Saw Mill	Saw Mill	Dibrugarh
12	M/S Santosh Kumar Dhelia Saw Mill	Saw Mill	Dibrugarh
13	M/S Mukti Singh Ram Avtar Saw Mill	Saw Mill	Dibrugarh
14	M/S Rupai Saw Mills	Saw Mill	Dibrugarh

The main minor forest produce include cane, bamboo, patidoi, thach grass and reeds, Nahor seeds and other minor forest produce.

i) Cane: Jatibet is found in some of the RFs in limited quantities, which is mainly consumed by the tea industry for making baskets for collecting tea leaves and also by the local people for meeting their day to day needs. Raidang bet is used for making furnitures like chair and tables. The species has decreased considerably.

ii) Bamboo: Amongst bamboos, Kako and Bajal are found most. Kako bamboos are mostly used by the army for constructing their camp huts. Otherwise, they are not used by local people for any purpose. Bajal bamboos are used by the local people for making fencing around the house compound and also by the railways for roofing, wall, etc of the temporary huts. Daloo bamboo is also used for house construction.

iii) Patidoi, thatch grass, and Reeds:Patidoi and reeds are not abundant in the division, Wherever these are available, patidoi is used for preparing Mat. Thatch is used for roof and reeds for construction of ealls.

iv) Nahor seed: Though Nahor seed contains a good quantity of oil and is inflamabale, yet Nahor seed is not collected from the forests as it is not found to be economically profitable because of is scattered availability.

v) Other minor forest produce:Dhekiallata and bark of Odal is collected for making ropes. Koupat is used for wrapping and binding of laterials and also as dishes. Dhuna is collected from Hollong, mekai and Dhuna trees. Jengpat, Kaupat, and Takaupat are used for making Japi and house roofing. Phuljharu is also collected wherever available for making brooms. Sand and gravels are also collected from different mahals for meeting the local demand.

7.5.2 Minor minerals: There is heavy demand of minor minerals. The status of minor minerals from the division is shown in table 7.5.2.

Table 7.5.2a: Table showing status of minorminreals in Dibrugarh division

Sl. No.	Name of MPA (Mahal)	Range	RF/Non RF	Area of Mahal (in Ha.)	Quantity		
					Stone / Gravel (m ³)	Sand (m ³)	O / Clay Earth (in m ³)
1	DBR/01/Dilliriver Stone MPA	Joypur Range	Non RF	2.90	14000	-	-
2	DBR/02/Dilliriver Stone MPA	Joypur Range	Non RF	3.30	12000	-	-
3	DBR/Joypur/03 Stone MPA	Joypur Range	Non RF	1.00	5000	-	-
4	DBR/04/Dilliriver Stone MPA	Joypur Range	Non RF	3.34	8000	-	-
5	DBR/05/Dilliriver Stone MPA	Joypur Range	Non RF	2.10	3000	-	-
6	DBR/06/Dilliriver Stone MPA	Joypur Range	Non RF	4.44	3000	-	-
7	DBR/Joypur/7	Joypur Range	Non RF	4.9	-	6000	-
8	DBR/Joypur/8	Joypur Range	Non RF	4.9	-	6000	-
9	DBR/Joypur/9	Joypur Range	Non RF	4.9	-	6000	-
10	DBR/Joypur/10	Joypur Range	Non RF	4.9	-	4000	-
11	DBR/12/Buridihing / Gamonghat / Sand O / Clay MPA	Khowang Range	Non RF	3.50	-	8000	8000
12	DBR/13 /Buridihing/ Deorighat / Sand O / Clay MPA	Khowang Range	Non RF	3.75	-	8000	8000

13	DBR / Khowang / 14	Khowang Range	Non RF	3.00	-	6000	-
14	DBR/15 / Buridihing / Gamon Sand MPA	Khowang Range	Non RF	1.40	-	6000	-
15	DBR/16/Buridihing / Gamon Sand MPA	Khowang Range	Non RF	2.00	-	5000	-
16	DBR/17/Disang Sand MPA	Khowang Range	Non RF	1.26	-	1600	-
17	DBR/18/Buridihing / Bhekulajan / Sand MPA	Dibrugarh Range	Non RF	3.85	-	5000	-

Revenue generation from minor minerals from 2009-10 to 2018-19 in Dibrugarh Division, Dibrugarh

Table 7.5.2b: Table showing Revenue generation from minor minerals from 2009-10 to 2018-19

Year	Amount (in Rs.)	Year	Amount (in Rs.)
2009-10	5,34,21,073.00	2014-15	2,74,53,206.00
2010-11	2,32,68,233.00	2015-16	1,68,42,621.00
2011-12	1,92,70,447.00	2016-17	2,80,24,798.00
2012-13	54,22,036.00	2017-18	2,95,68,654.00
2013-14	78,56,670.00	2018-19	3,20,90,023.00

7.5.3 Marketable produce: The most marketable timbers are the Hollong and Mekai, the veneers of which are used for tea chests as well as commercial plywood. Other produce of these plywood factories are decorative plywood for which Titasopa, Bogipoma, Dhuna, etc. are used. Though Hollock is also one of the approved species of the plywood factories, yet it is not used by them and is mainly consumed by the sawmills industries for meeting the local demand of the constructions and furniture timbers.

Earlier, there was a good demand of Nahor timber for railways sleepers. However, shifting of use of railway sleepers from timber to concrete has reduced pressure on the forests. Yet Nahor is mostly used for bridge piles and house-posts. Ajar is mainly used for boat making though Sam and Gonsoroi are also sometimes used for the same purpose in a limited scale.

7.6 Import and export of wood and wood products: No import and export of wood and wood products takes place under this Division.

7.7 Import and export of NTFPs: There is no record for import and export of NTFPs in the Division.

7.8 Removal of fodder: No recorded removal of fodder in the Division. However, the forest villagers and nearby villagers collect fodders from the RFs.

7.9 Valuation of the products: The past and current prices of the various forest produces are presented in Table 7.9a.

Table 7.9: Past and current prices (Rs.) of products in Dibrugarh Division, Assam

S.No.	Items	Quantity (t)	Past prices (Rs.) cu.m	Current prices (Rs./cft)
1	Hollong	per cu.m	12,250.00	700
2	B. &C.Class	per cu.m	5,650.00	400 & 240
3	Scantlings		7,700.00	-
4	Planks		8750	-
5	Thatch	Per 100 bundles	65	-
6	Bamboo	Per quantity	30	120
7	Cane	Running meter	720	-
8	Koupat (100 nos)	nos	15	-
9	sand (per cum)	per cu.m.	150	1,000
10	Stone(per cum)	per cu.m.	530	1,300

CHAPTER 8

Maintenance of Social, Economic, Cultural and Spiritual Benefits

As per the National Forest Policy of India 1988, the participation of local community living in and around the forest areas is vital for the conservation and development of forests. In order to implement this policy, the Government of India issued a clear Guideline on 1st. June, 1990 to develop and manage degraded forestland with the help of the local community and voluntary organizations. Communities organize themselves into a Joint Forest Management Committee (JFMC) to protect and manage forests. The benefits to them is direct access and control on the use and sale of most NTFPs and a share in the income from timber as well as other intangible benefits from local ecosystem services – like water recharge, pollination, eco-tourism etc. Thus involvement of communities in conservation of forests and wildlife is of paramount interest. Also, as per the Assam Forest Policy 2004, Joint Forest Management (JFM) practices would form the basis of forest management in the State. Hence, the Working Plan will make all the necessary provision for participation of forest fringe communities aiming to sustainable forest management and benefits of communities.

8.1 Number of JFM committees and area protected by them:

Table 8.1 shows the number of JFM committees constituted for protection of forests in the Division.

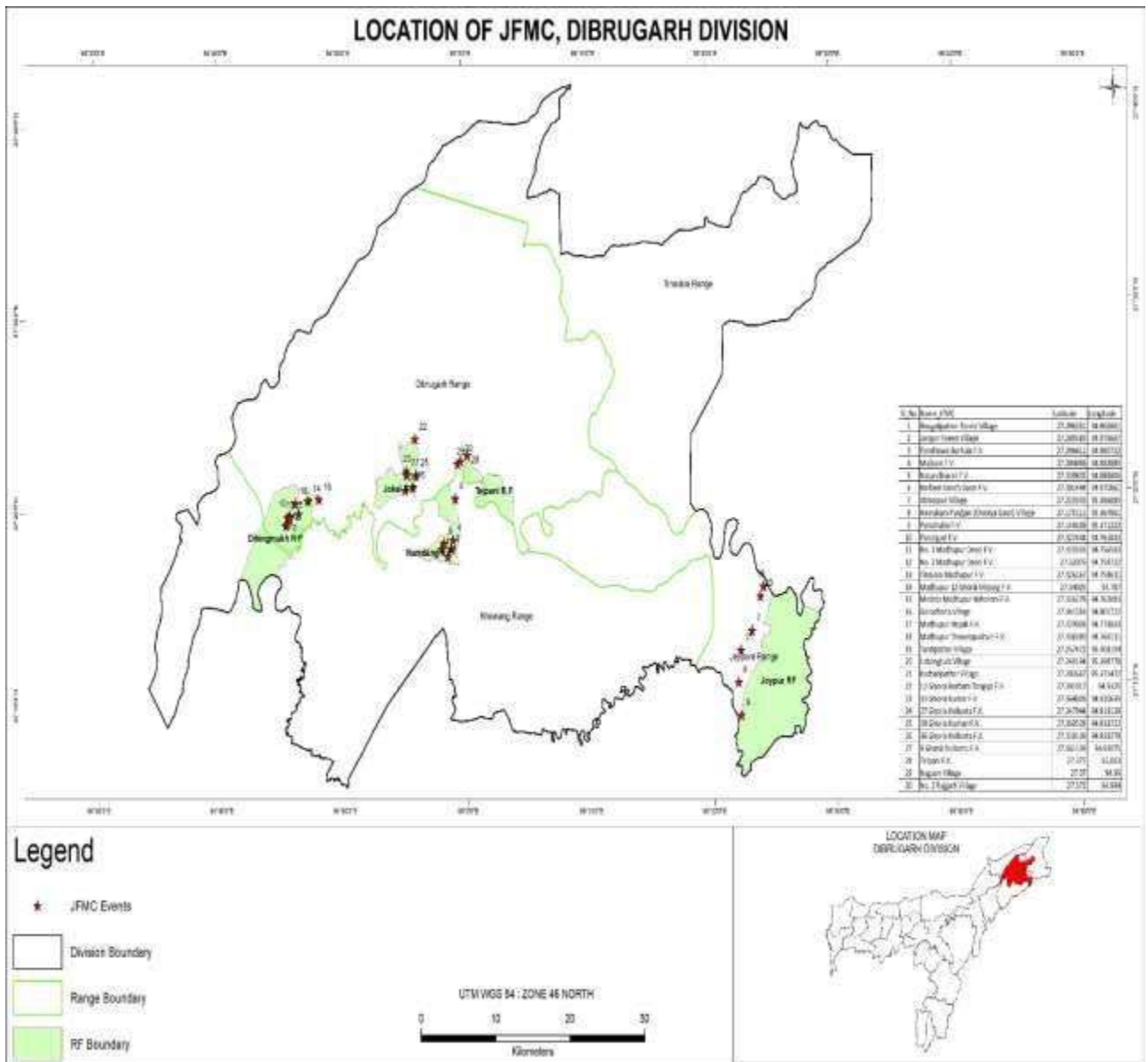
Table 8.1: JFMCs constituted in Dibrugarh Division, Assam

S.No.	Name of JFMC	Year of Establishment
1	Abhoypur Village,Jeypore RF	2002-2003
2	Kachari Pathar Village,Jeypore RF	2002-2003
3	Tanti Pathar Village,Jeypore RF	2002-2003
4	Lebangkhula Village,Jeypore RF	2002-2003
5	Panichukia Forest Village,Jeypore RF	2006-2007
6	Hamukjan(chaikya Gaon) Village,Jeypore RF	2004-2005
7	Majbam Forest Village,Namdang RF	2002-2003
8	Bhogali Pathar Forest Village ,Namdang RF	2002-2003
9	Pandhowa Forest Village,Namdang RF	2002-2003
10	Borbil Kochgaon Forest Vilage,Namdang RF	2002-2003
11	Jariguri Forest Village,Namdang RF	2002-2003
12	Natun Bharali Forest Village,Namdang RF	2006-2007
13	Tinsukia Madhupur Forest Village,Dihingmukh RF	2002-2003
14	NO.1 Madhupur Deori Forest Village, Dihingmukh RF	2002-2003
15	NO.2 Madhupur Deori Forest Village, Dihingmukh RF	2002-2003
16	Paroliguri Forest Village, Dihingmukh RF	2002-2003
17	Madhupur Nepali Forest Village, Dihingmukh RF	2004-2005
18	Garudharia Village, Dihingmukh RF	2004-2005
19	Medela Madhupur Nahoroni Forest Village, Dihingmukh RF	2004-2005
20	Madhupur 12 Ghoria Missing Forest Village, Dihingmukh	2004-2005

21	Thekerapukhuri Forest Village, Dihingmukh RF	2006-2007
22	Telpani Forest Village, Telpani RF	2002-2003
23	NO.2 Rajgarh Village, Telpani RF	2004-2005
24	Nagaon Village, Telpani RF	2004-2005
25	9 GhoriaKaibarta Forest Village, Jokai RF	2002-2003
26	36 GhoriaKaibarta Forest Village, Jokai RF	2002-2003
27	20 GhoriaKachari Forest Village, Jokai RF	2002-2003
28	12 GhoriaBorbamTungya Forest Village, Jokai RF	2002-2003
29	31 Ghoria Kumar Gaon Forest Village, Jokai RF	2002-2003
30	27 Ghoria Kaibatara Forest Village, Jokai RF	2002-2003

Maps showing locations of JFMCs is shown in Figure 8.1

Figure 8.1: Map showing locations of JFMCs in Dibrugarh division.



8.2 Status of empowerment of JFMCs:JFMCs are to be empowered with induction of more and more members. Women members shall be encouraged to participate the JFMCs.

8.3 Labour welfare:Wages in prescribed rate by the Forest Department or by the JFMCs are paid to the labourers when engaged for any forestry activities. The labours are also used to collect MFP like kachu, Dhekia, Betgaj, Bamboo shoots and other edible fruits like Outenga, Hilikha, Amora, Bhomora, Amlakhi, Jalphai, Jackfruit, Mango etc. Medicines are also being provided to the labourers engaged as and when required during forestry activities. Insurance policy for labours engaged in various forestry activities including plantation works need to be considered.

8.4 Use of indigenous knowledge:Use of indigenous knowledge is integrated into the plan through involvement of local communities while making decisions in plantation and regeneration activities. Local guides also engaged for tourism purpose. Further, during the tenure of this Working Plan documentation of the indigenous traditional knowledge and incorporation of the same in the micro-plans and other prescriptions of the plan will be taken up.

As per the guidelines of Assam State Biodiversity Board, the following Biodiversity Management Committees are constituted by the local bodies under Dibrugarh Division to promote biodiversity conservation through preservation of indigenous knowledge and sustainable use of natural resources for development of sustainable livelihoods.

Table 8.4: Table showing different biodiversity management committee formed in Dibrugarh division

Sl. No.	Name of Bio-diversity Management Committee	Name of Range	Year of Creation
1	Barbaruah Anchalik Panchayat BMC	Dibrugarh Range	11/12/2014
2	Joypur Anchalik Panchayat BMC	Joypur Range	29/05/2013
3	Khowang Anchalik Panchayat BMC	Khowang Range	20/11/2014
4	Panitola Anchalik Panchayat BMC	Tinsukia Range	30/05/2013
5	Guijan Anchalik Panchayat BMC	Tinsukia Range	29/05/2013
6	Lahowal Anchalik Panchayat BMC	Dibrugarh Range	20/06/2015
7	Tingkhong Anchalik Panchayat BMC	Khowang Range	05/12/2014

8.5 Extent of cultural/sacred groves:There are no reports of presence of sacred grooves in the Division's forests. However, there are traditional Muslim graveyards, Hindu funeral grounds and Christian graveyards having patches of trees that are untouched and considered sacred. Ownership of these lands belong to the local community.

8.6 Ecotourism areas and activities:

Ecotourism is a form of tourism involving visits to fragile, pristine, and relatively undisturbed natural areas, intended as a low-impact and often small scale alternative to standard commercial (*mass*) tourism. Eco tourism is directed towards natural environments intended to support conservation efforts and also observe wildlife protection ethics which helps in bringing economic benefits to the local people without involving any middle man. This form of tourism is based further on traditional, cultural and ethnic value of

the locality. Therefore, ecotourism is a form of 'Sustainable Tourism' as these values along with natural values are depicted and highlighted to the tourists. Ecotourism provides effective economic incentives for conserving and enhancing biocultural diversity and helps protect the natural and cultural heritage of our beautiful planet.

The Dibrugarh Forest Division has a number of Eco-tourism hotspots which have great potential to be developed as Eco-tourism hubs in the following location in different Reserved Forests under this Division to protect and conserve its natural habitat and pristine environment /forest. Out of 5 (five) R.Fs under Dibrugarh Forest Division the Jokai R.F. (Area 1848.01 Ha.) situated about 12 Kms away from Dibrugarh town and towards the southern side of Dibrugarh Town, assumes significance for the presence of diverse orchid (both common and rare) beside rich diversity of flora and fauna. To conserve and preserve the different type of orchid/herbs & shrubs/medicinal plant etc. the Jokai Botanical Garden-cum-Germ-plasm centre" was established during 2001 to attract tourists/research scholars /scientists to study or to carry out environmentally friendly activities. Moreover, the Botanical Garden preserves more than 200 medicinal Plants and a good number of orchid are planted which are of great importance.

Table 8.6: List of species in the Botanical garden

LIST OF ORCHID:

1. *Agrostophyllum khasianum*
2. *Dendrobium fimbriatum*
3. *Gastrochilus dosypogon*
4. *Acampe multiflorum*
5. *Eridis odoratum*
6. *Cymbidium ansifolium*
7. *Oberania micrantha*
8. *Phaiustanker villae*
9. *Liparis spp.*
10. *Aeridis multiflorum*
11. *Luisia spp.*
12. *Dandrobium anceps*
13. *Dandrobium jenkinsii var aggregatum*
14. *Bulbophyllum caryenium*
15. *Eria flava*
16. *Dandrobium moschatum*
17. *Vanda teres*
18. *Dandrobium fomosum*
19. *Eulophia graminee*
20. *Zeuxine stratumeticum, etc.*

LIST OF MEDICINAL PLANTS:

- | | | |
|-----|----------------------------------|----------------|
| 1. | <i>Aristolochia bracteata</i> | Nilkantha |
| 2. | <i>Stemona tuberosa</i> | Komal satamul |
| 3. | <i>Litsea cubeba</i> | Mejankori |
| 4. | <i>Ruellia spp.</i> | Nilaagiachit |
| 5. | <i>Flemingia strobilifera</i> | Makhiati |
| 6. | <i>Garcinia cowa</i> | Kujithekera |
| 7. | <i>Atropa curcas</i> | Bhut era |
| 8. | <i>Zanthoxylum hamiltonianum</i> | Tezmui |
| 9. | <i>Piper nigrum</i> | Jaluk |
| 10. | <i>Sapindus mukrossi</i> | Manisal |
| 11. | <i>Solanum ferox</i> | Jamuna bhekuri |
| 12. | <i>Plumbago gelenica</i> | Boga agiachit |

13.	<i>Pogostemon benghalensis</i>	Suklati
14.	<i>Diospyros</i> spp.	Bonpitha
15.	<i>Clitoria ternatea</i>	Nilaaporajita
16.	<i>Costus speciosus</i>	Jamlakhoti
17.	<i>Croton caudatus</i>	Latamahudi
18.	<i>Solanum torvum</i>	Hatibhekuri
19.	<i>Catharanthus rosea</i>	Noyantora
20.	<i>Ceasalpinia spinosa</i>	Lataguti
21.	<i>Phlogocanthus thyrsoiflorum</i>	Titaphool
22.	<i>Adhatoda vesica</i>	Boga bahak
23.	<i>Abelmoschus moschatus</i>	Kasturi bhendi
24.	<i>Padoria phoetida</i>	Bhedailota
25.	<i>Citrus medica</i>	Gulnemo
26.	<i>Calotropis procera</i>	Akon
27.	<i>Aloe vera</i>	Salkonwari
28.	<i>Euphorbia neripholia</i>	Hiju
29.	<i>Cissus quadriangularis</i>	Harjora lota
30.	<i>Rouwolfia serpentina</i>	Sarpagandha
31.	<i>Piper longum</i>	Pipoli
32.	<i>Stephania japonica</i>	Tubuki lota
33.	<i>Oxalis martiana</i>	Bortengesi
34.	<i>Bacopa monieri</i>	Brahmi
35.	<i>Acorus calamus</i>	Buch
36.	<i>Hydrocotyle retundifolia</i>	Sarumanimuni
37.	<i>Centella asiatica</i>	Bormanimuni
38.	<i>Andrographis paniculata</i>	Kalmegh
39.	<i>Gymnema sylvestra</i>	Gymnema
40.	<i>Tylophora</i> spp.	Anantamul, etc.

LIST OF OTHER PLANTS:

1.	<i>Terminalia arjuna</i>	Arjun
2.	<i>Mimosops elengii</i>	Bokul
3.	<i>Cinnamomum tamala</i>	Tezpat
4.	<i>Saraca asoca</i>	Ashok
5.	<i>Emblica officinalis</i>	Amlokhi
6.	<i>Azadirachta indica</i>	Mohaneem
7.	<i>Elaeocarpus ganitrus</i>	Rudrakhya
8.	<i>Averrhoa carambola</i>	Kordoi
9.	<i>Aquillaria malacansis</i>	Sashi
10.	<i>Pterocarpus santalinum</i>	Rongachandan
11.	<i>Terminalia belerica</i>	Bhumura
12.	<i>Cinnamomum camphora</i>	Karpoor
13.	<i>Terminalia chebula</i>	Hilikha
14.	<i>Hytnocarpus kurzii</i>	Chalmugra
15.	<i>Syzygium macrocarpa</i>	Naharpatiajamuk
16.	<i>Syzygium fruiticosa</i>	Kotahi jamuk
17.	<i>Entada phascoloids</i>	Makorighila
18.	<i>Canarium bengalense</i>	Dhuna
19.	<i>Shorea assamica</i>	Mekahi
20.	<i>Depterocarpus retusa</i>	Hollong
21.	<i>Kayea assamica</i>	Sia nahar
22.	<i>Morinda aungustifolia</i>	Asukath, etc.

The Dibrugarh Forest Division have another beautiful R.F. called Jeypore R.F. with high density of Hollong, Nahar, Mekai, which is located towards Eastern part of the District and along the inter state bordering areas of Assam-Arunachal Pradesh. It is well known for its mega Bio-diversity and is recognized as a **Rain**

Forest of Upper Assam. For so many years it has become a cynosure for the botanists and researchers to appreciate its floral diversity. The endangered Hoolock Gibbon is found extensively in the RF. The rivers Buridihing and Namsang flow along with the boundary of the reserved forests. There is good scope of introducing boating facilities in the Buridihing river. Jeypore RF because of its hilly terrain has a potential of providing trekking facilities. There is a Forest Inspection Bungalow situated in a beautiful location on the bank of the river Buridihing. There is a beautiful park at Namrup which needs to be developed further to attract more and more tourists. There are many other sites where eco camps can be constructed. There are places where picnic spots can be developed. Elephant / jeep safari can also be introduced in many places. There is a holy place named “Sita Kund” a mini island on the Buridihing river near Nagaghat Beat, where devotees use to come to worship goddess Sita and some time people from nearby areas come for picnic, etc. Machine boat service can be put in place for devotees and public to visit the Sita Kund for religious and other recreational purposes. Besides enjoying the natural beauty of the jeypore RF, two more sites at the periphery of the RF, one at Merbil and the other at Namphake village attract a lot of tourists, boating is commonly observed in both these locations and local guides are available for tourists. With sustained interventions the Jeypore R.F. along with its adjacent areas can become an important eco-tourism centre in the North – East India.

8.6.1 Ecotourism Activities: Activities that can be undertaken in Dibrugarh forest division for promotion of ecotourism is furnished in table 8.6.1. Construction of an Interpretation/ Information Centre, landscaping and development of the park and providing infrastructure for development of the areas as picnic spots may be developed.

Table 8.6.1: Ecotourism activities that can be undertaken in Dibrugarh Division

Name of the RF/ WLS	Location	Name of JFMC / EDC / BMC	Probable Ecotourism activities	Carrying capacity (Visits /day)	Details of infrastructure available	Prominent attractions	Remarks
Joypur	Namsang	Namsang TE EDC	<ul style="list-style-type: none"> ➤ Nature trail ➤ Trekking ➤ Night camping ➤ Bird watching ➤ Photography ➤ Boating ➤ Rock climbing ➤ Cycling ➤ Awareness camps ➤ Jeep safari ➤ Cultural 	100/Day	Range Office Forest IB	<ul style="list-style-type: none"> ➤ Rich Bio-diversity ➤ Habitat of rare flora and fauna ➤ Burhidihing river waterscape ➤ Tropical Rainforest ➤ Jeep safari ➤ Sita Kund 	Potential site for Eco-Tourism with available infrastructure
Jokai	Jokai	No. of JFMC, SHGs	<ul style="list-style-type: none"> ➤ Nature trail ➤ Trekking ➤ Night camping ➤ Bird watching ➤ Photography ➤ Boating ➤ Cycling ➤ Canopy walk ➤ Awareness camps ➤ Jeep safari ➤ Community home stays 	200 /Day	Range Office Beat Office, Home Stay Interpretation Centre	<ul style="list-style-type: none"> ➤ Rich Bio-diversity ➤ Habitat of rare flora and fauna ➤ Era suti for Boating / Rafting ➤ Water Games ➤ Home stays ➤ Orchid House ➤ Canopy Walk (<i>in process with Oil India</i>) ➤ Rescued animals wildlife trails 	Potential site for Eco-Tourism with available infrastructure and being well connected with the nearby town of Dibrugarh

8.7 Social customs:Muli and Bhuluka bamboo species are traditionally used in the winter season for preparation of Chunga Pitta (the young shoots of bamboo are used to pour the sticky rice for boiling, specially prepared for Poush Sankranti/ Bhogali Bihu festival). It is estimated that approximately 50,000 units of 2 years old bamboo of the said varieties are used by the local people for the festival.

8.8 Status of compliance of Forest Rights Act (FRA):Implementation of Forest Rights Act was initiated in this Division. Gram Sabha recommended 733 claims to SDLC out of which 38 individuals including 9 community titles were issued in Naharani Forest Village and 12-Ghoria Jokai Tangia village. Land deeds for total area of 110.3 Hectares were issued to above villages. Table 8.8a provides an overview of the status of FRA in the Division.

Table 8.8: Overview of FRA in Dibrugarh Division, Assam

Sl. No.	Description of Item	Status
1	Appointment of a nodal officer	-
2	Status of formation of various committees	9 and 3
3	Translation of Act and the rules in the regional languages and distribution to Gram Sabha, FRCs etc.	Yes
4	Creation of Awareness about the provisions of the Act and the Rules	Yes by holding G.S. and creating FRCs, etc.
5	Arrangement made for the training of PRI officials, SDLC, DLC Members	Yes-13 nos
6	Gram Sabha meetings organized on Feb29,2008 onwards for explaining the provisions of the Act and the rules and responsibilities of PRIs, Gram Sabhas,FRCs etc.	7
7	Constitution of Forest Right committees by the Gram Sabhas	11
8	No.of claims filled at Gram Sabha Level	733
9	No. of claims recommended by the Gram Sabha to SDLC	733
10	No. of claims verified by the FRCs and submitted to Gram Sabha for consideration	733
11	No. of claims recommended by SDLC to DLC	108
12	No. of title distributed	38 patta 9 com.
13	No. of claims rejected	10
14	Project data for distribution of title deeds	383 villages
15	Arrangements made for provision of regular information	Yes
16	Mechanism for monitoring the implementation of the Act by the SMLC or Web based management information system	3 Nos. of village completed 1.Bisghoria 2.Borbam Tangia 3.Naharani
17	Mechanism for quickly responding to court petition/stays	Survey already done 2 Nos. of villages namely pandhuwa & Bhogali Pather. Another survey report not yet received

8.9 Other rights and concession:Forest villagers and beneficiaries of JFMC are allowed to collect MFP like Thatch grass,Canes,edible fruits,fallen and dried firewood.

Table 8.9: Statement of other rights and concession

Sl. No.	Nature & Extent of Rights	Rights and concession holder	Remarks
1	Right to entry in the R.F. area	JFMC beneficiaries and forest villagers along with FRA Rights holders.	Being they are living in the forest area
2.	Cattle grazing	-do-	-do-
3.	Fuel and fodder collection	-do-	-do-
4.	NTFP for domestic uses	-do-	-do- and along with the fringe villages
5.	Domestic and small wood collection	-do-	-do-

8.10 Dependency of local people on NTFPs: During the constitution of the RFs, certain rights and concessions were allocated to the people living in and around the RFs. Forest villagers, JFMC beneficiaries and FRA Rights holders are dependent on NTFPs produced in the forest. They are legally empowered for collecting NTFPs for their domestic need. The people from forest villages and from forest fringe villages are accustomed to collect firewood and other Non Timber Forest Produce (NTFP) from R.F. areas. The items generally collected are vegetables mainly-Outenga, Tikoni Baruah, Bamboo Shoot, Cane shoot, Fern, etc. Medicinal plants like Nephaphu, Jamlakhuti, Bon haladhi, Boga bahek, Bhatghila, Borthekera, Salmugra, Titaphul, etc. to get relief and healing from common flue, stomach problems, body pain, muscle pain as a traditional practice. Besides these other forest products like Patidoi, Tokowpat, Cane, Bamboo, etc. are collected for domestic purposes. Though the Assam Forest Regulation (Amendment) Act 1995 and other regulations/Rules/Act prohibit collection beyond domestic need and selling of forest grown products, yet it cannot be enforced in consideration of the fact that the these fringe villagers otherwise plays an important role in forest protection. The Forest department and JFMCs shall evolve a mechanism for assessing the quantity for domestic needs and also assess the quantity extracted for marketing in the local market; and thereby find a way for revenue generation from NTFPs. Revenue generated from NTFPs shall go to JFMC.

8.11 Other aspects: Other aspects are not yet listed. A brief account of other rights and concessions, their extent, nature, etc. which are to be regulated or met under working plan prescriptions will be provided during tenure of this Working Plan.

CHAPTER 9

Adequacy of Policy, Legal and Institutional Framework

9.1 Existing Policy and Legal Framework and their Compliance

Forest resources have been regulated since early times. The roots of legislations, policies and guidelines for natural resource management in India can be traced back to the days of British Colonialism. The relevant constitutional frameworks at the backdrop of management of forests resources are briefly enumerated as following.

9.1.1 The Constitution of India

Article 48 of the Directive Principles, states that the State shall endeavour to protect and improve the environment and to safeguard the forests and wildlife of the country.

Article 51 A deals with the fundamental duties of citizens, which includes the citizen's duty to value and preserve the rich heritage of our composite culture and to protect and improve the natural improvement including forests, lakes, rivers and wildlife and to have compassion for living creatures.

Article 246 points towards the Seventh Schedule to the Constitution, which enlists (in the union list, and the concurrent list) the subjects that the Central and State governments are to legislate upon. Forest is one of the subject placed in the Concurrent List on which both the Central and State Government shall legislate upon.

In 1952, the erstwhile Ministry of Food and Agriculture, Government of India enunciated a Forest Policy to be followed in the management of Forests in the country. Subsequently, due to large scale deforestation and diversion of forest land for non forestry uses finally led to the formulation of a new forest policy in 1988. The Forest Policy of 1988 was a pro people document, placing greater emphasis on the ecological role of forests and recognizing for the first time the rights of the people, especially the tribals, with the direction that their domestic requirements of fuel wood, minor forest produce and construction timber would be the first charge on forest produce. Subsequently Assam enunciated a Specific Forest Policy for the State in the year 2004 with certain definite objectives.

The management of Forests in the Division is to be in accordance with the existing Assam Forest Policy 2004. The Reserved Forests have been declared as per the provisions made in Assam Forest Regulation 1891 and in managing Forests, provisions made in the said Regulation and Assam Forest Regulation (Amendment) Act 1995 are strictly followed. The Wildlife (Protection) Act 1972 as amended till date and the The Wildlife Protection Rule 1995 are other Acts and Rules in force for dealing with the matter related to Wildlife in the Division. Other Acts and Rules which are held by the Division for discharging its functions for management of Forests are 'The Assam (Control of felling and Removal of trees from non-forest lands Rule, 2002', 'The Assam Joint Management Rule (Amendment) 2003', 'The Assam Wood Base Industries

Establishment and Regulation Rules 2000', 'Forest Conservation Act. 1980', 'Schedule Tribe and other Traditional Forest Dwellers (Recognition of Forest Right) Act. 2006', 'Assam Sale of Forest Produce Coupe and Mahal (Amendment) Rules, 2000'.

The Policy and the Rules and Acts are in place in the Division to ensure Conservation, Protection and Sustainable use of forest produces in scientific manner.

9.2 Status of approved working plans and their compliance: The last working plan for Dibrugarh Division was written by **Sri M.C. Malakar, I.F.S.** for the period of 2000 -2001 to 2009 -2010, this plan was not approved. During this period, two nos R.F.s viz Padumoni and Bherjan were included but the same were transferred to Tinsukia W.L. Division in the year 2001 and further an area of 2406.96 hectares of Joypur R.F. was notified as a part of Dehing Patkai Wildlife Sanctuary in 2004.

9.3 Number of forest offences: There are number of forest offences that have been reported in the Division. Table 9.3 presents a list of offences in the Division from 2006-06 to 2016-17.

Table 9.3: Number of forest offences in the Division between 2006-07 and 2016-17

Year	Types of offence	Number	Cases taken to the court of law	Types of loss to forest and revenue
2009-2010	Illegal removal of Sand	11		
	Stone	4		
	Earth	2		
	Timber	9	8	94,380.00
	River Silt	42		
	Firewood	Nil		
	Agarwood	Nil		
	Charcoal	1		
	Lime stone	Nil		
	Sand gravel	Nil		
Single	Nil			
2010-2011	Illegal removal of Sand	22		
	Stone	2		
	Earth	2		
	Timber	7	13	
	River Silt	19		
	Firewood	2		
	Agarwood	Nil		
	Charcoal	1		
	Lime stone	Nil		
	Sand gravel	Nil		
Single	Nil			
2011-2012	Illegal removal of Sand	42		
	Stone	21		
	Earth	9		
	Timber	3	2	
	River Silt	57		
	Firewood	2		
	Agarwood	Nil		

	Charcoal	1		
	Lime stone	Nil		
	Sand gravel	Nil		
	Single	Nil		
2012-2013	Illegal removal of Sand	84		
	Stone	35		
	Earth	24		
	Timber	4	4	14,942.00
	River Silt	26		
	Firewood	Nil		
	Agarwood	1		
	Charcoal	Nil		
	Lime stone	Nil		
	Sand gravel	Nil		
	Single	Nil		
2013-2014	Illegal removal of Sand	72		
	Stone	51		
	Earth	23		
	Timber	4	2	19,645.00
	River Silt	41		
	Firewood	Nil		
	Agarwood	Nil		
	Charcoal	1		
	Lime stone	Nil		
	Sand gravel	7		
	Single	Nil		
2014-2015	Illegal removal of Sand	35		
	Stone	4		
	Earth	5		
	Timber	4	3	
	River Silt	23		
	Firewood	1		
	Agarwood	1		
	Charcoal	Nil		
	Lime stone	Nil		
	Sand gravel	Nil		
	Single	Nil		
2015-2016	Illegal removal of Sand	19		
	Stone	22		
	Earth	Nil		
	Timber	6	1	
	River Silt	12		
	Firewood	Nil		
	Agarwood	1		
	Charcoal	Nil		
	Lime stone	Nil		
	Sand gravel	Nil		
	Single	Nil		
2016-2017	Illegal removal of Sand	85		
	Stone	18		
	Earth	25		

	Timber	8	6	89,435.00
	River Silt	57		
	Firewood	Nil		
	Agarwood	4		
	Charcoal	Nil		
	Lime stone	Nil		
	Sand gravel	Nil		
	Single	Nil		
2017-2018	Illegal removal of Sand	21		
	Stone	4		
	Earth	4		
	Timber	3		
	River Silt	31		
	Firewood	Nil		
	Agarwood	4		
	Charcoal	1		
	Lime stone	Nil		
	Sand gravel	Nil		
	Single	Nil		

9.4 Status of research and development: One Preservation plot was laid at Mohan Singh(Tipam) under Joypur Reserved Forest in 1975 covering an area 4.2 ha. And one Sample Plot was laid in Jeypore Range jurisdiction raised by Jeypore Silviculture Range to monitor their growth and other silvicultural aspect of different indigenous species of Assam. The details of these two plots are given in table 9.4.

Table: 9.4 Preservation plot and Sample plot in Jeypur RF.

Sl. No.	Plot 1		Sl. No.	Plot 2	
1	Name of the Plot	Preservation Plot	1	Name of the Plot	Sample Plot
2	Location	Mohan Singh Ali (Tipam)	2	Location	Jeypur RF
3	Name of RF	Jeypur RF	3	Name of RF	Jeypur RF
4	Year of Creation	1975	4	Year of Creation	1980
5	Area	4.2 Hect	5	Area	0.20 hect.
6	Date of Measurement	27-11-2017	6	Date of Measurement	2018
7	Species	Hollong, Phul Gamari, M/Sal, Pan Sopa	7	Species	Hollong
8	Total No. of trees planted	170 nos of trees	8	Total No. of trees planted	40 nos of trees

The preservation plot is an important means for conserving and protecting the existing biodiversity of important floral species as well as for assessing ecological changes occurring in such areas over a period of time. Assam has recently introduced three new preservation plots with an aim to protect such species like *Morus laevigata* Wall.(Bola) in Behali Reserved Forest, *Dipterocarpus turbinatus* C.F.Gaertn.(Garjan) in Innerline Reserved Forest, *Shorea assamica* Dyer(Mekai) in Upper Dehing Reserved Forest. The main aim and objective of creating such plots is to study the species in their natural habitat by focusing a)

Percentage of natural regeneration, b) Search of healthy mother tree for quality seed production, c) Study of soil and other biotic and abiotic factors etc. For comparative data base study we may also lay out some Control Plots of those specifically targeted species in the selected areas where there were past records of abundant growth of that species, but at present there are no further records of satisfactory growth. Here we may carry out the study related to the poor growth of the concern species by studying the a) Soil condition of both plot 1 and plot 2. b) Study of any invasive species in the control plot which may threaten the growth of particular species.

9.4.1 Orchids: Orchids are good bioindicators because they have very low tolerance for changes in their environment and are most valuable and commercially demanding flowering plant. The forest of entire North East and Assam is naturally blessed with numerous beautiful orchids. Not only orchids have highest market demand for its long lasting beautiful flowers but also medicinal properties. Many of Dendrobium orchids are used as Ayurvedic medicine to cure many diseases like treating cancer, strengthen the immune system and improve eye sight. The Joypur Reserved Forest of Dibrugarh division and UDRF of Digboi division is itself a big hotspot of many rare and endangered orchid species. This zone has the most rare and beautiful orchid like *Anoectochilus sikkimensis* King&Pantl (Jewel orchid), *Rhynchostylis retusa* alba (white Rhynchostylis). Similarly Garampani area, in Karbi Anglong, Borail range in Barakvalley, Dibru - Saikhowa and Chandubi Forest etc, we have very good concentration of orchids. In Garampani R.F. we have valuable species like *Vanilla pillifera* (climbing orchid), *Phalaenopsis mannii*, *Acanthephippium sylhetense*, etc. According to the concentration of occurrence of orchid species in various Reserved forest areas we may create some special plots to conserve and preserve this beautiful flora. Again we may also propose an orchid park, orchid sanctuary, etc which will help us to protect the orchids in their natural habitat and by which we may also generate revenue.

9.4.2 Medicinal plants: The variety of medicinal plants found in the North Eastern part of India makes Assam the perfect spot to harbour the process for conserving, preserving and utilising the important aspects of medicinal plant. The traditional system of medicine plays an important role in the health care of rural people for all types of ailments. However the scope of development in this field is almost none and so, we need to look into the miraculous and potential phytochemical constituents which could be modified for formulating medicines, which are present in the plants grown in wild and ignorance on the roadside, backyards and villages of Assam.

9.5 Human resources, capacity building efforts: The capacity building of the existing staff is carried out through a number of trainings, field visits and workshops. The foresters and Forest Guards are imparted training in Assam Forest School, Jalukbari and Assam Forest Guards School, Makum. The effectiveness of the training programmes is also assessed. The capacity building programmes helps to build active taskforce. The details and the status of human resources as part of the capacity building plan (training carried out) for efficient utilization of the human resource in Dibrugarh Division is shown in the Table 9.5a.

Table 9.5a: Frontline staffs of Dibrugarh Division undergone training in two SFTIs of Assam

Year	Person attended Training	Title of training
2014	Phatik Saikia, Fgd	FGD training
2014	Rupeshwar Baruah, Fgd	FGD training
2014	Ajit Sonowal, Fgd	FGD training
2014	Dilip Dey, Fgd	FGD training
2014	Khagen Dihingia, Fgd	FGD training
2014	Utpal Konwar, Fgd	FGD training
2014	Phanidhar Bargohain, FR	NEC sponsored Training on capacity building of development function
2014	Ranjan Phukan, DYR	Two weeks general refresher course training at Jalukbari
2014	Kamesh Das, FR I	Two weeks general refresher course training at Jalukbari
2012	Dilip Saikia, Fgd	FGD training
2012	Rohan Phukan, Fgd	FGD training
2012	Jatin Sonowal, Fgd	FGD training
2012	Photik Saikia, Fgd	FGD training
2012	Ranjit kurmi, Fgd	FGD training
2012	Prodeep Sonowal, Fgd	FGD training
2012	Karuna Kanta Das, Fgd	FGD training
2012	Sekhawat Ali, Fr-I	Two weeks general refresher course training at Jalukbari

9.6 Forest resources accounting: Tangible benefits from forests are timber, NTFPs, fuelwood, fodder, livelihood, ecotourism, biodiversity, etc. while intangible benefits of forests are carbon sequestration, soil erosion control, water recycling, oxygen production, control of air pollution, wildlife habitat, etc. During the tenure of this working plan, positive efforts will be made to quantify the intangible benefits. Location of forest camps, nursery is provided in Figure 9.6a. Details of sawmills in Dibrugarh division is provided in table 9.6a

Figure 9.6a: Statement on Sawmills in Dibrugarh Division

Name of the Division	Name of Saw Mill	License No	Location
Dibrugarh Division	M/s Rupai Saw Mill, Dibrugarh	DIB/SAW/Mill/DIB/M.I.E. 11/19 dtd. 29 th September 2004.	M.I.E. – II, Maijan Borsaikia Gaon Dibrugarh
	M/s Muktisingh Ramavatar Saw Mill	DIB/SAW Mill/DBR – M.I.E. - 11/27 dtd. 25/10/2013	M.I.E. – II Maijan Borsaikia Gaon, Dibrugarh
	M/s Santosh Kr. Dhelia Saw Mill	DIB/Saw Mill/DIB M.I.E./16 dtd. 12/10/2001	M.I.E. – II Maijan Borsaikia Gaon, Dibrugarh
	M/s Raj saw Mill	DIB/Saw/Mill/DIB/M.I.E. II/18 dtd. 19/02/2003	M.I.E. – II Maijan Borsaikia Gaon, Dibrugarh
	M/s Khan Saw Mill	DIB/Saw Mill/DIB/M.I.E. – I/14 dtd. 11/09/2001	M.I.E. – I, A.T. Road, Panchali, Dibrugarh
	M/S National Saw Mill, Naharkatia	DIB/Sawmill/Naharkatia I.E/04 Dt: 10.08.2000	Naharkatia
	M/S Dambaru Saw Mill	DIB/Sawmill/Naharkatia/ I.E/06 Dt: 29.09.2000	Naharkatia

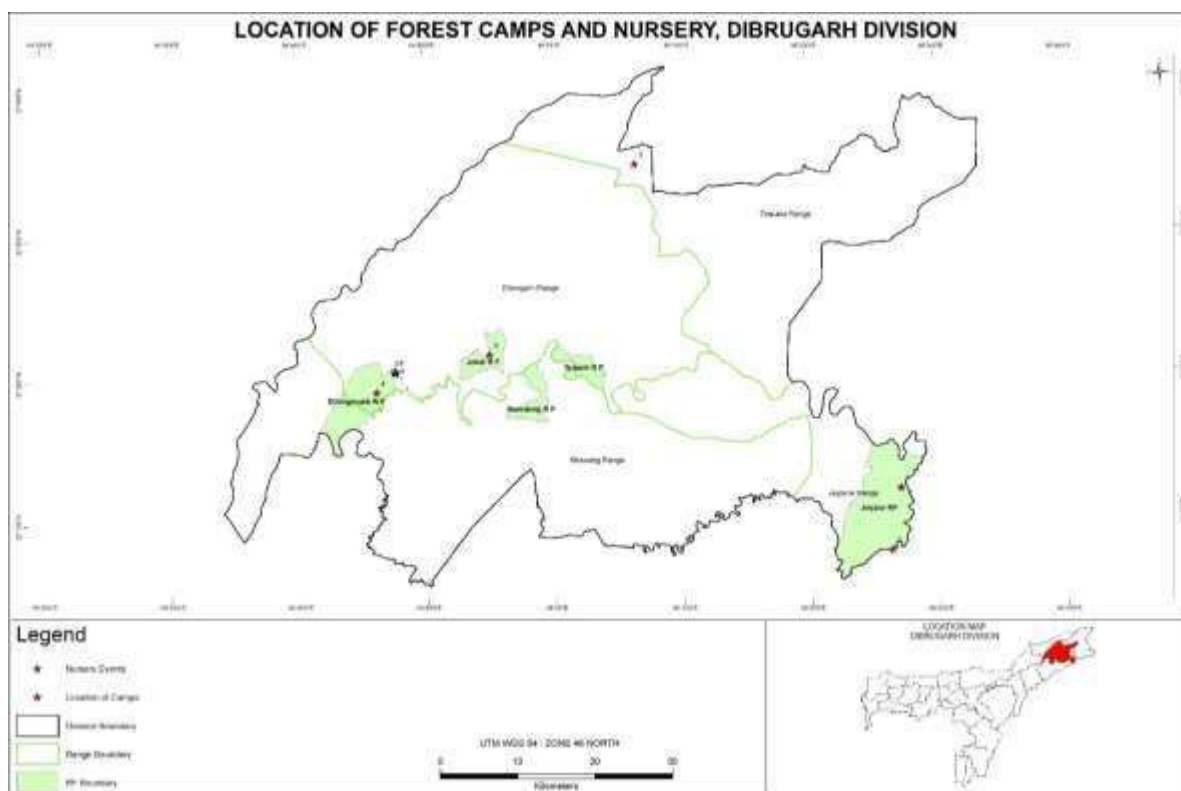


Figure 9.6a: Location of forest camps and nursery in Dibrugarh division

Details list of sawn timber trading depots with the geo-coordinates in the division is provided in Annexure 8.

Details list of mining permit areas with the geo-coordinates in the division is provided in Annexure 9.

9.7 Budgetary allocation to the forestry sector: The total budgetary allocation for planned and non-planned budgets for the years 2006-07 to 2014-15 are presented in Table 9.7.

Table 9.7: Allocated budget for the years 2006-07 to 2014-15 in Dibrugarh Division, Assam

Sl.No.	Year	Allocated budget provisions (Plan) (Rs)	Allocated budget provisions (Non - plan)(Rs)
1	2006-2007	69,91,400	10,78,700
2	2007-2008	38,74,000	12,71,000
3	2008-2009	80,86,454	42,83,114
4	2009-2010	97,94,285	30,94,929
5	2010-2011	59,10,026	25,02,801
6	2011-2012	67,70,881	24,78,000
7	2012-2013	4,59,227	25,94,000
8	2013-2014	54,40,958	14,51,000
9	2014-2015	68,18,308	28,73,000
10	2015 - 2016	2,50,000	5,68,38,000
11	2016 - 2017	87,14,600	5,69,37,000
12	2017 - 2018	15,50,000	8,45,52,999
13	2018 - 2019	1,70,860	6,37,48,312

9.8 Existence of monitoring, assessment and reporting mechanism: Physical and financial monitoring are being undertaken from time to time by CCF, CF, DFO and other external agencies. The record reveals that there is transparent monitoring and assessment system for the works executed. Though there is no control for uses but a proper quarterly and annual monitoring system of the various schemes exist. The monitoring and assessment practices done by the Forest Range Officer at 100%, ACF 50 %, DFO 25% and CF 10% along with the seasonal inspection by the CCF, Addl. PCCF and even in some cases the PCCF and HoFF, Assam. Execution takes place through the Range officer of the respective Ranges with guidance by the Divisional Forest Officer. Monitoring, assessment of the executed work is done by the Divisional Forest Officer himself or through the Assistant Conservator of Forests and report to the Circle Conservator. In their fortnight diaries the Assistant Conservator of Forests and Divisional Forest Officer record their findings of monitoring and assessment and submit to the Circle Conservator of Forests. The Circle Conservator also monitors and assesses the work and reports to the Addl Principal Chief Conservator of Forests who subsequently reports to the Principal Chief Conservator of Forests and finally it reaches to the Government accordingly. The Addl. Principal Chief Conservator of Forests of Upper Assam Zone also time to time monitors and assesses the work and reports to the Principal Chief Conservator of Forests.

9.9 Public awareness and education: Environmental awareness programmes, training on microplans, awareness on need to conserve signature species, plantation drives are being carried out in the division from time to time. The field level front line staff and officers are actively engaged in raising awareness among the people residing adjacent to R.Fs, Forest Fringe and Forest Villages for promoting voluntary participation towards conservation of the rich biodiversity around them. In this regard numbers of workshop/training/orientation programmes are being organized amongst the people directly and indirectly depending on forest and biological resources for proper understanding of Biodiversity and the needs of its conservation. The involvement of JFMCs is being promoted with the main objective of conservation of the forests and wild life and their habitat and at the same time to generate income and livelihood for the rural poor and forest fringes. Furthermore, the indigenous people of forest fringe and forest villagers are more or less conscious about the biological diversity around them as their livelihoods dependent on them. So there is an urgent need for sensitize the people of forest fringe/ other traditional dwellers / forest villagers to check and prevent further degradation of forests, grasslands and grazing lands and introduction of reforestation in the deforested area through Govt. Scheme involving local people and NGOs. To maintain proper conservation measure people are being sensitized to refrain from excessive use of pesticides and weedicides in small and big Tea Gardens adjacent or along the R.F. as these harmful chemicals invite adverse impact on the surrounding Eco-system. Instead of adopting chemical, organic manure is better to apply as alternative. Awareness Camp / Campaign are being organized time to time among forest personnel and local people from forest fringe pertaining to legal aspect towards wildlife crime, poaching, etc. in collaboration with District Judiciary.

During the tenure of this working plan, the efforts should be made to increase public awareness of the important forestry programmes, benefits provided by forests and sustainable management of forests,

along with distribution of published materials such as brochures, pamphlets, leaflets, posters etc. Forestry/environmental awareness and education programmes should be conducted for students. Meetings and workshops are to be held regularly inviting resource persons from outside. Powerpoint presentations and documentary films should be exhibited during such workshops.

9.10 Adequate manpower in Forest Division:The position of staff of the Division is presented in Table 9.10.

Table 9.10: Position of staff in Dibrugarh Division, Assam (Jan 2020)

Sl. No.	Name of post	No. of posts	Total amount of the month (Rs.)	Total amount for the year (Rs.)
1	Dy. C F	1	186396.00	2236752.00
2	ACF	2	160825.00	1929900.00
3	Forest Ranger	6	357633.00	4291596.00
4	Dy. Ranger	5	321606.00	3859272.00
5	Forester Grade - I	22	1031045.00	12372540.00
6	Forester Grade - II	3	148690.00	1784280.00
7	Forest Guard	34	1478729.00	17744748.00
8	Draftsman	Nil	-	-
9	H. Asstt.	1	68863.00	826356.00
10	Acctt.	2	118813.00	1425756.00
11	U. D. Asstt.	5	260285.00	3123420.00
12	L. D. Asstt.	3	110232.00	1322784.00
13	O.P.	2	48663.00	583956.00
14	Driver	1	31340.00	376080.00
15	Gate Chowkidar	Nil	-	-
16	Night Chowkidar	1	33372.00	400464.00
17	I. B. Chowkidar	3	74248.00	890976.00
18	Mali	Nil	-	-
19	Dak Runner	Nil	-	-
20	Chalanman	2	70035.00	840420.00
Total		93	4500775.00	54009300.00

CHAPTER 10

Five Years Plans

10.1 Five Year Plans:The First Five Year Plan (1951-56) laid significant importance on the development of forests. The Plan aimed for the improvement as well as expansion of the areas under forests to cater the increased demand for timber and forest produce in sustainable manner. The enunciation of the New National Forest Policy of India,1952 was a major step in this direction to revise and align with the trends of economy. The policy emphasized the protective as well as productive roles of forests and envisaged that one third of the land area (around 33%) should be under forests including 60% of the land 86 in hilly regions and 20% in the plains. The First Five Year Plan also laid importance to the role of forests in soil conservation.

The Second Five Year Plan (1956-1961) aimed mainly at adopting measures for afforestation and improvement of backward areas in the forests and extension forestry, formation of plantations of species of commercial and industrial value, promotion of methods for increased production and availability of timber and other forest produce for the future, conservation of wildlife, amelioration of the conditions of staff and labour in the forests, increased volume of forest research, increased provision of technical personnel and central coordination and guidance in the implementation of forest development schemes all over the country.

The Third Plan (1961-1966) laid special emphasis on adopting measures which ensured more economic and efficient utilization of the available forest products including inferior timber and wood residues. Major forest development programmes included in the plan were economic plantations for industrial and commercial purpose, plantations of quick growing species, village and extension forestry. The plan included programmes for the development and establishment of five zoological parks, five national parks and ten wildlife sanctuaries.

The Fourth Five Year Plan (1969-1974) laid emphasis on three main objectives in the area of forestry, namely, to increase the productivity of forests, to link up forest development with various forest based industries and to develop forests as a support to rural economy. Important objective was to achieve self-sufficiency in forest products especially for major forest based industries. The plan also recommended special training in ecology and conservation. Two centrally-sponsored schemes- Project Tiger and Development of National Parks and Sanctuaries also came into existence in 1973.

The major programmes of forest development included in the Fifth Five Year Plan were large scale commercial plantations, plantations of quick growing species, social forestry, forest consolidation, surveys and statistics, communications and logging. 1974-1991.

Mass afforestation and social forestry programme programmes were emphasised during the Sixth Five Year Plan (1980-1985). The Forest (Conservation) Act was enacted in 1980 with the main objective of

checking the diversion of forest land for non- forestry purposes. Forest Survey of India (FSI) was established in June 1981 (on the recommendations of the National Commission on Agriculture) for carrying out regular surveys of forest resources of the country.

The policy encouraged people's participation in the protection and management of forests and a decentralized system of forest management was started during the Seventh Plan with the introduction of JFM programme in 1990. Despite various efforts undertaken to enhance and promote the area under, the forests faced massive destruction due to anthropogenic pressure which ultimately resulted in the degradation of forests.

The Eight Plan (1992-1997) also initiated various programmes and schemes regarding the protection and conservation of forests. A number of afforestation schemes like Integrated Afforestation and Eco-Development Project Scheme, Fuel wood and Fodder Project Scheme, Non-Timber Forest Produce Scheme, etc were initiated under NAEB for reclaiming degraded forest areas.

The Ninth Five Year Plan (1997-2002) stressed on massive afforestation programmes, control over hacking and grazing and provision of cheap fuel through alternative technologies. A National Forestry Action Plan was also launched during the plan in 1999 to address major issues in forestry sector. The plan also laid emphasis on the conservation of biodiversity in the country.

The Tenth Five Year Plan (2002-2007) further emphasized on the important role of forests in achieving environmental and economic sustainability as well as in maintaining life support systems on earth. The target of Tenth Five Year Plan had stipulated the need to bring 25% of area under forest and tree cover by 2007 and 33% by 2012. It was also proposed to merge all afforestation programmes of National Afforestation and Eco-development Board (NAEB) into a single scheme called National Afforestation Program (NAP). This 100% Centrally Sponsored Scheme (CSS) was started in 2002-2003 for regeneration and eco-development of degraded forests and adjoining areas on watershed protection and conservation of natural resources through active involvement of people and checking land degradation, deforestation and loss of biodiversity (The Tenth Five Year Plan, 2002-2007).

The strategy of the Eleventh Plan for forestry sector development was to create an environment for achieving sustainable forestry and wildlife management with specific focus on the socio-economic targets. Accordingly, the plan initiated various programmes for developing forestry and improving the status of green cover.

Table 10.1. Funds allotted to the Division for development works during five-year plan

Development agencies	Year	Development programmes	Total funds allocated (₹)
Bamboo Mission (JFMC)	2011-2012	Bamboo Plantation (Advn. Work & Creation) 50 Ha.	6,25,000.00
		District Level Workshop – 1 No.	1,00,000.00
		Farmers Training within the state – 50 Nos.	76,000.00
		Design & Handy craft Training – 25 Nos.	1,25,000.00

	2012-2013	Bamboo Plantation (Advn. Work & Creation) 40 Ha.	5,00,000.00
		Bamboo Plantation (Maint.) 50 Ha.	6,25,000.00
	2013-2014	Bamboo Plantation (Maint.) 40 Ha.	5,00,000.00
		Bamboo Plantation (Advn. Work & Creation) 20 Ha.	2,50,000.00
	2014-2015	Micro Irrigation (Bamboo Plantation) 20 Ha.	4,00,000.00
		District Level Workshop – 2 Nos.	2,00,000.00
	2015-2016	Bamboo Plantation (Maint.) 20 Ha.	2,50,000.00
	2016-2017	Nil	Nil
	2017-2018	Nil	Nil
NAP (JFMC)	2011-2012	Artificial Regeneration Plantation (Maint.) -250 Ha	5,78,000.00
	2012-2013	Aided Natural Regenerational Plantation (Maint.) – 155 Ha/ Artificial Regeneration (Maint) – 250 Ha and Cane/Patidoi (Maint) -110 Ha.	10,02,000.00
	2013-2014	Nil	Nil
	2014-2015	Nil	Nil
	2015-2016	Nil	Nil
	2016-2017	Nil	Nil
	2017-2018	Nil	Nil
CAMPA	2011-2012	Nil	Nil
	2012-2013	Nil	Nil
	2014-2015	Nil	Nil
	2015-2016	Nil	Nil
	2016-2017	Nil	Nil
	2017-2018	Nil	Nil
APFBC	2013-2014	Nil	Nil
	2014-2015	Nil	Nil
	2015-2016	Nil	Nil
	2016-2017	Nil	Nil
	2017-2018	Nil	Nil

Table 10.2: Past revenue and expenditure of Dibrugarh division

Year	Revenue (Rs.)	Expenditure (Rs.)	Surplus / Deficit(Rs.)
2008-2009	2,85,64,533	1,28,13,118	1,57,51,415
2009-2010	5,57,47,932	1,28,95,214	4,28,52,718
2010-2011	2,51,79,703	93,36,026	1,58,43,677
2011-2012	2,13,29,481	92,48,881	1,20,80,600
2012-2013	70,52,034	71,86,297	-1,34,263
2013-2014	1,04,67,829	68,91,958	35,75,871
2014-2015	2,92,59,175	96,91,308	1,95,67,867
2015-2016	2,06,70,177	37,39,444	1,69,30,733
2016-2017	3,97,48,256	27,47,194	3,70,01,062
2017-2018	3,48,92,462	95,12,857	2,53,79,605

CHAPTER 11

Past Systems and Management

11.1 General history of the forest: Records such as relics of old roads, tanks, temples and bunds along the banks of the Burhi-Dihing River provide evidence that the Jokai, Telpani, Namdang and Dehingmukh RFs and their surrounding tracts had been under cultivation since the reign of the Ahom Kings. The existing forests in these areas date from the beginning of the nineteenth century when the whole tract got depopulated as a result of the Burmese invasion. Dihingmukh RF was the most populated region. This inference is based on the presence of more relics of past inhabitation in this RF as compared to the other RFs. The forests in the plain portion of the Division were subjected to jhumming by the Motoks, Morans and Missing who were the original inhabitants of the tract. The stretches of open forest covered by bamboos and creepers alternating with better stocked areas are probably the vestiges of such past jhumming.

11.2 Past system of management: The first scientific management of the forests was attempted in Jokai RF under the Working Plan compiled by F.H. Gavendish in the year 1910. An area of 7 square miles was brought under the purview of the Working Plan. Under the above plan, improvement of the growing stock of Nahar and Ajhar was aimed at by improvement felling and subsidiary operation. As per records, the operations as per working plan prescription were mostly carried out and the working plan expired in 1920. No attempt was however made to revise the plan thereafter and to assess the result of the plan. On the contrary heavy fellings were done in this RF subsequently and hence the benefit that might have accrued due to scientific management under the plan was lost. The forest thus reverted to unregulated working for a period of 10 to 12 years till another plan was compiled.

From 1912 to 1914, an area of forest comprising of about 2 square miles in the south west corner of Upper Dihing Portion of Jeypore RF was worked under a lease given to Saw Mill named Naharkatiaya Ltd. The prescription of working Plan was for felling of Nahar trees under girth limit of 6' and for other trees 7'6". The company went into liquidation in 1914 and hence operation was limited. In the year 1922, Jeypore RF was opened for operation of Nahor trees for railway sleepers, under permit system. After 4 to 5 years, operation of other species for sleepers also took place. In the same year the Assam Railway and Trading Co. Ltd. got a thirty years lease (in the Upper Dehing Reserve West Block, near the Tingrai Railway Station). As per this lease, felling of trees of girth limit 6' for Nahor and 7'6" for other species was allowed. During subsequent years, heavy operation of Nahor trees was continued to meet the demand of railway sleepers. The other species operated for sleepers on a smaller scale were Ajhar and Uriam. As a result, Nahor trees of girth 5' and up become rare in all the accessible areas of these Reserved forests.

The next Working Plans that were compiled for these reserves were that on Macherness dealing with Upper Dehing Reserve, Digboi, Derak and Jaipur Reserve, and Kakojan, Dangori, Doomdooma, Bharjan, Podumoni, Jokai, Telpani, Namdang and Dehingmukh Reserves.

Macherness's Plan

This plan covered a period of 10 years from 1931-1932 to 1940-1941. All the RFs formed one working circle with five felling series. The first felling series covered the area leased out to the Assam Railway and Trading Co. Ltd. The plan prescribed felling of selection type under the girth limits fixed i.e 7'6" for Hollong, Hollock, Mekai and Sam and 5'6" for Nahar. The rotation was fixed at 150 years, and felling cycle at 30 years.

The regeneration operation prescribed was to encourage average advance growth and regeneration and supplement by artificial regeneration in the moderately stocked areas and artificial regeneration in the opened areas. Climber cutting was prescribed on a 15 years cycle.

The prescriptions of this plan could not be carried out properly due to lack of demands for timber following the general depressions. A certain amount of fellings took place in Jaipur and Makum Block of Upper Dehing Reserve. The Powai Block was operated from 1937 onwards by the Assam Railway and Trading Co. Ltd. The position remained like this till the second World War when destructive felling took place in the forest along the road sides without any silvicultural consideration. In Powal Block, the Kherjan Mining lease area of the Assam Oil Co. was heavily operated.

Regarding regeneration works, subsidiary operation was taken up in the worked out areas of Powal Block since 1988-1989 by assisting the natural regeneration of Hollong. Attempt was made to improve the existing growth of Nahor and other valuable species including Ajhar, Sam, Sopa, Jutuli, Gonsoroi, etc. which grew sporadically. Climber cutting and subsidiary operations were prescribed.

The clear felling working circle comprised of the poorly stocked miscellaneous forests and was divided into six felling series, each with a conversion period varying from 100 to 140 years. The areas to be planted up during the period of the plan were allotted as P.B.I. and one tenth of its area was to be regenerated annually. Hollock, Amari, Sopa, Sam, were the main species prescribed for planting on the higher land not subjected to flooding in Dibru and Mechaki reserve. Ajar was prescribed for low lying areas. In the other reserves, species like Ajhar, Jutuli, Poma, Sam, Sopa and Gansoroi were prescribed.

The plan also constituted a cane working circle which overlapped all the three above working circles. The prescription was to cut cane on a cutting cycle of three years, the period considered necessary for cane to grow to maturity.

The plan which was compiled in great details, met h the same as that Macherness for the same reason of demands for timbers and hence remained practically unworked. Having the war years specially from 1945 onwards heavy angulated felling took place all over the accessible of these forest reserves without any silvicultural consideration.

The subsequent Plan was compiled in 1949 and covered the period from to 1950-1960. The areas dealt within this plan comprised of the Forests Reserves covered by the previous plans of Macherness and Purkayastha, and hence this may be taken as revision of these two plans, and embodied in one plan.

The plan constituted four working circles, namely Veneer Wood Working circle, Hollong local trade working circle, miscellaneous working circle and felling working circle. The Veneerwood working circle comprised of the major portion of Hollong Mekai forests and the object of management was to get a sustained yield of veneer species of Hollong for the plywood industries. The silvicultural system prescribed was Selection-cum-Improvement marking with compensatory regeneration in more accessible areas of the past worked out forests. The rotation was calculated at 180 years to produce a crop of 7'6" in girth for Hollong and Mekai and for Hollock the rotation was fixed at 75 years to produce the tree of the same girth. But due to preponderance of trees of higher girth classes in the existing growing stock, the girth limit prescribed for felling in the first felling cycle had to be kept higher to remove the over matured trees initially and accordingly the girth limit of 9 ft was fixed. The felling cycle was taken as 30 years. The yield was prescribed for the three veneer species together by volume on a rather conservative estimate.

No rigid marking rules were prescribed due to variable nature of the crop. The general principles to be followed in marking were stated as follows –

Not to create a big gap, and accordingly one out of five exploitable trees was to be retained. Thinning in the congested young crops to be done. The middle canopy of Nahor was to be generally retained to act as a cover for the ground after removal of the top canopy so as to keep down repaid growth of weeds and climbers. The minimum areas to be regenerated during the period of the plan under this working circle was prescribed at 1400 acres, but much larger areas were allotted under regeneration block comprising part of Powal Block - 4322 acres and part of Upper Dihing Reserve West Block 1900 acres. Subsidiary operations were prescribed in these areas according to the necessity and availability of funds. Raising of the canopy was prescribed as regeneration progresses. Hollock was to be planted up artificially at the rate of 28 acres annually along the bank of the Buri Dihing River, but to start with the same could be done in the existing centers like Powai, Naharjan and Dilli. Climbers cutting scheme for twenty years to cover the entire areas of the working circle was prescribed. The Hollong trade working circle comprised of the remaining portion of the Hollong bearing areas. The objective was to meet the demands of the local people for constructional timbers as well as to meet the demand of the Railway sleepers for treatment at Naharkatiya sleeper treating plant.

The Silvicultural system prescribed was the same as in case of the Veneer wood Working circle. The total area to be regenerated during the period of the plan was 2800 acres. As against this an area of 5179 acres were allotted as regeneration blocks. Another 550 acres was prescribed for plantation with other miscellaneous species like Ajhar, Sam, Hollock, Sopas, Amari, Bola, Gomari, Gonsoroi etc. Climber cutting was prescribed on a twenty-year cycle with 4,038 acres as the annual area. The miscellaneous working circle consisted of the major portion of the Dibru Reserve. The forests contained Hollock as an important species in appreciable proportions. The Silvicultural system prescribed was selection marking with

compensatory plantation in accessible areas, with a girth limit for Hollock, Ajhar and Simul, Sam at 9' Amari, Bogipoma, Sopas 7' and others 5'. The felling cycle was fixed at 25 years. The felling cycle was fixed by the number of trees above the girth limit. The annual area to be planted was based on one acre per 20 trees felled. The clear felling working circle comprised of the forest reserves situated in the plains and having poorly stocked areas. The object of the constitution of this working circle was to meet the demand of the surrounding population for supply of timber and firewood.

The silvicultural system prescribed was clear felling and planting. The yield was prescribed by areas to be clear felled as well as the maximum number of trees above girth limit that could be felled annually which was fixed at 400 trees. The total annual area to be clear felled and planted was worked out to 62 acres. The plan prescribed under miscellaneous regulation the method of working of cane by reconstitution the cane bearing areas of the reserves and the U.S.F. into 8 mahals and fixing a 3 year cutting cycle. Out of six felling series formed in the Veneer wood working circle, four were leased out to M/S A.R.T. & Co, for a period of 20 years from 1950 to be operated as per working plan prescription. Accordingly the trees were marked and operated by the company. The company worked 22 lacs cft of Veneer species during the plan period as against almost 25 lacs cft which was prescribed. The company worked 22 lacs cft. of veneer species during the plan period as against almost 25 lacs cft prescribed. The other two felling series remained unoperated due to their inaccessibility. In the Hollong trade working circle out of five felling series, only in one felling series namely Joypur felling series comprising of Kathalguri Block of Joypur reserve markings of trees as per working plan prescription was followed and the trees were operated, although the systematic marking was under taken only during the latter part of the plan period. In all 1.966 million cft of veneer wood species were operated during the period of the plan as against 2.27 million cft prescribed.

In the other felling series no marking was required to be done due to heavy timber operation in the adjoining U.S. Forests, which were opened up for settlement by the revenue department to large number of families from different parts of the district which were uprooted from their original home due to erosion of the rivers following the great earthquake of 1950. As a result, markings remained in arrears in the reserves like Doomdooma, Borguri, Kakojan etc. This is however in consistent with the recommendation put down in the plan, the idea being to conserve the resources of the reserve for future. Dibru reserve constituted the Miscellaneous Working Circle. Area under this working circle got destroyed by the 1950 earthquake. A large portion of the forest was washed away, and silt covered the remaining portion after flooding. As a result, trees in almost all the area under the RF began to die, so, dead and dying/wounded Hollock and other species worked under departmental operation. The clear felling and planting was done in other reserves falling under the clear felling working circle.

Almost simultaneously another plan was prepared by **C.S. Purkaystha** for the plan reserves on the south bank of Brahmaputra River of then Lakhimpur Division. This plan was also prepared for a period of 10 years from 1933 -1934. Then the third plan was prepared by **M.M. Srinivasan, I.F.S.**, and prepared the fourth plan of the Division for the period from 1974 -1975 to 1986 -1987 which had to be revised by **Sri**

A.C. Das, I.F.S. in between the period from 1974 -1975 to 1986 -1987 for incorporating some new schemes of plywood plantation. The last working plan for Dibrugarh Division was written by **Sri M.C. Malakar, I.F.S.** for the period of 2000 -2001 to 2009 -2010, this plan was not approved. During this period, two nos R.F.s viz Padumoni and Bherjan were included but the same were transferred to Tinsukia W.L. Division in the year 2001 and further an area of 2406.96 hectares of Joypur R.F. was notified as a part of DehingPatkai Wildlife Sanctuary in 2004.

11.3 Special works of improvement undertaken

11.3.1 Silvicultural improvement: Due to gradual expansion of the plywood industries in this district, the demand for veneer wood species increased considerably and hence the marking prescription of these trees was followed as per working plan prescription in the leased areas as well as in Jeypore Reserve. It was however noticed that marking of trees above the prescribed girth limit only was done and no attempt was made to improve the crop by thinning in congested young patches as prescribed. In felling of big trees, a large number of young patches was prescribed. In felling of big trees, a large number of young poles are also damaged at places. Moreover, climber cutting prior to marking was not done. This resulted in heavy felling damage. As no subsidiary operation was also prescribed felling the timber operation in a coupe, nothing could be done to clear the area to free regeneration. As a result, the felling gaps remained uncovered with consequent growth by climbers and under growth. As a result, markings remained at halt in the reserve like Doom Dooma, Borguri, Kakojan etc. This is however in consistent with the recommendations put down in the plan, the idea being to conserve the resources of the reserve for future.

11.4 Past yield, revenue: There was no yield from harvesting of crop in reserve forests except realization of a little amount as revenue from selling of seized timber. However, the division earns a sizeable amount as revenue from mines and minor mineral. Revenue collection and expenditures in the Division between the years 2006-07 and 2017-2018 is presented in Table 11.4.

Table 11.4: Past revenue and expenditure of Dibrugarh division

Year	Revenue (Rs .)	Expenditures	
		Non-Plan Expenditure (Rs .)	Plan Expenditure (Rs .)
2008-2009	2,85,64,533.00	43,10,864.00	85,02,254.00
2009-2010	5,57,47,932.00	30,99,929.00	97,95,285.00
2010-2011	2,51,79,703.00	34,26,000.00	59,10,026.00
2011-2012	2,13,29,481.00	24,78,000.00	67,70,881.00
2012-2013	70,52,034.00	25,94,000.00	45,92,297.00
2013-2014	1,04,67,829.00	14,51,000.00	54,40,958.00
2014-2015	2,92,59,175.00	28,73,000.00	68,18,308.00
2015-2016	2,06,70,177.00	34,89,444.00	2,50,000.00
2016-2017	3,97,48,256.00	26,47,194.00	1,00,000.00
2017-2018	3,48,92,462.00	17,48,447.00	77,64,410.00

In future, major revenue is expected from mine and minor minerals. It has been prescribed that, felling will be carried out as per the rotation which falls after the tenure of this working plan. Fencing, control burning

& control of grazing will be ensured in all the areas. If these things cannot be ensured due to financial or other constraints, then felling may be differed.

11.4.1 Volume of out turn recovered:

Table 11.4.1: Volume of out turn recovered in Division for the last 10 year period (2008-2009 to 2017-2018)

Year	Volume (cu.m.)	Government value (Rs.)
2008-2009	23.820	37,556.00
2009-2010	Nil	Nil
2010-2011	9.893	37,916.00
2011-2012	Nil	Nil
2012-2013	7.264	29,041.00
2013-2014	4.919	9,927.00
2014-2015	13.833	47,917.00
2015-2016	8.973	31,670.00
2016-2017	Nil	Nil
2017-2018	4.345	21,696.00

11.4.2 Statement of revenue and expenditure from 2008-2009 to 2017-2018: The forest department generates revenue through sale of wind fallen trees, timber seized from forest offences and trees felled due to widening of roads or other developmental works. Further, revenue is generated from minor minerals such as sand, gravel and boulder etc.

All mahal operations and government permit were stopped due to lack of Environmental clearance from State Environmental Impact Assessment Authority of Assam. Assam Minor Mineral Concession Rules 2013 was notified vide No. PEM 83/2009/Pt-1/627 Dated the 16th March 2013 and subsequently all notified Minor Mineral Contract area were put up for sale on open tender. Thus, it is expected that revenue generation shall increase once all minor mineral contract area is settled after due environmental clearance from State Environment Impact Agency.

Table 11.4.2: Revenue and expenditure of the last 10 year period with effect from 2008-2009 to 2017-2018

Year	Revenue (Rs.)	Expenditure (Rs.)	Surplus / Deficit (Rs.)
2008-2009	2,85,64,533	1,28,13,118	1,57,51,415
2009-2010	5,57,47,932	1,28,95,214	4,28,52,718
2010-2011	2,51,79,703	93,36,026	1,58,43,677
2011-2012	2,13,29,481	92,48,881	1,20,80,600
2012-2013	70,52,034	71,86,297	-1,34,263
2013-2014	1,04,67,829	68,91,958	35,75,871
2014-2015	2,92,59,175	96,91,308	1,95,67,867
2015-2016	2,06,70,177	37,39,444	1,69,30,733
2016-2017	3,97,48,256	27,47,194	3,70,01,062
2017-2018	3,48,92,462	95,12,857	2,53,79,605

CHAPTER 12

Statistics of Growth and Yield

12.1 Statistics of growth:Hollong is the most important timber species in the Division with other associates such as Mekai, Nahar, Hollock, Sam and Sopa.The growth of DBH(OB) at various ages of Hollong, Mekai and Nahar are presented in Table 12.1a to Table 12.1c.

Table 12.1a: Age wise diameter of Hollong in Dibrugarh Division, Assam

Age (in years)	Diameters (OB) in centimeters
10	11.00
20	17.50
30	24.50
40	32.50
50	43.00
60	55.50
70	78.50
80	108.50

Table 12.1b: Age wise diameter of Mekai in Dibrugarh Division, Assam

Age (in years)	Diameters (OB) in centimeters
10	10.90
20	17.30
30	24.30
40	32.00
50	40.80
60	50.00
70	59.00
80	67.20
90	74.50
100	81.30
110	88.00

Table 12.1c: Age wise diameter of Nahar in Dibrugarh Division, Assam

Age (in years)	Diameters (OB)
10	13.70
20	17.50
30	21.60
40	26.00
50	30.60
60	35.60
70	40.20
80	45.20
90	50.20

The following graph shows the increment (age- volume) of Hollong trees in the division. The graph shows that the increment in volume of Hollong was 8.26cu.m. at 80 years' age class.

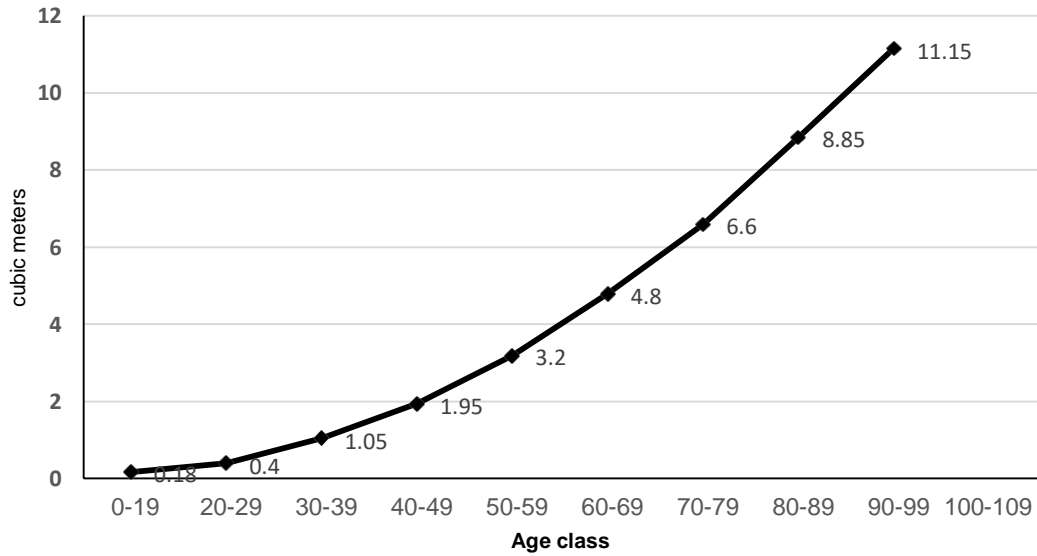


Fig. 12.1a: Volume curve of *Dipterocarpus retusus* in Dibrugarh division.

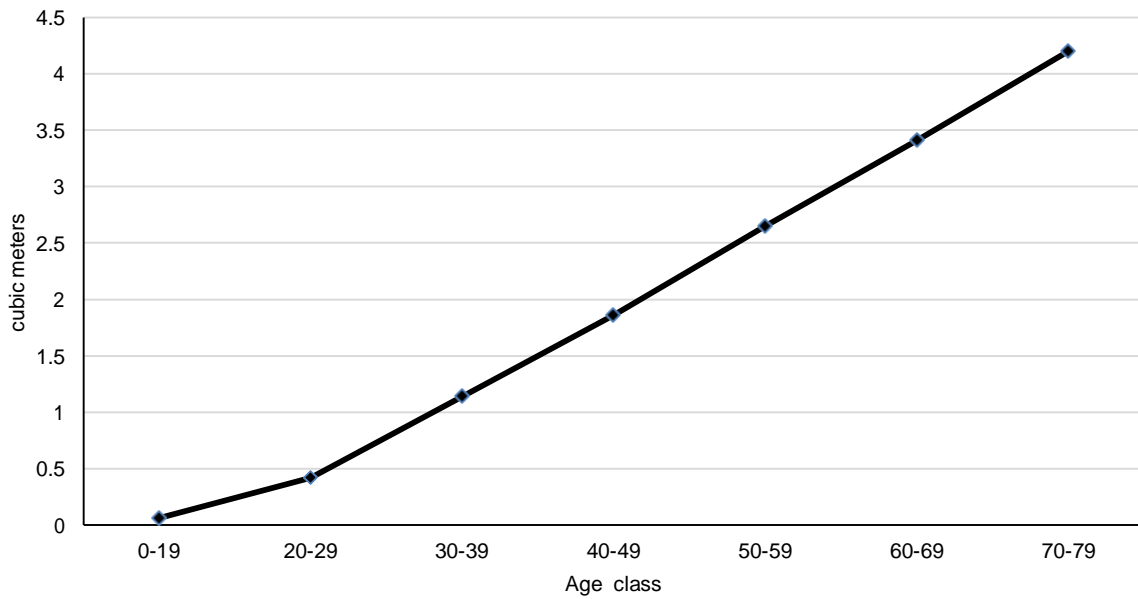


Fig. 12.1b: Volume curve of *Shorea assamica* in Dibrugarh division.

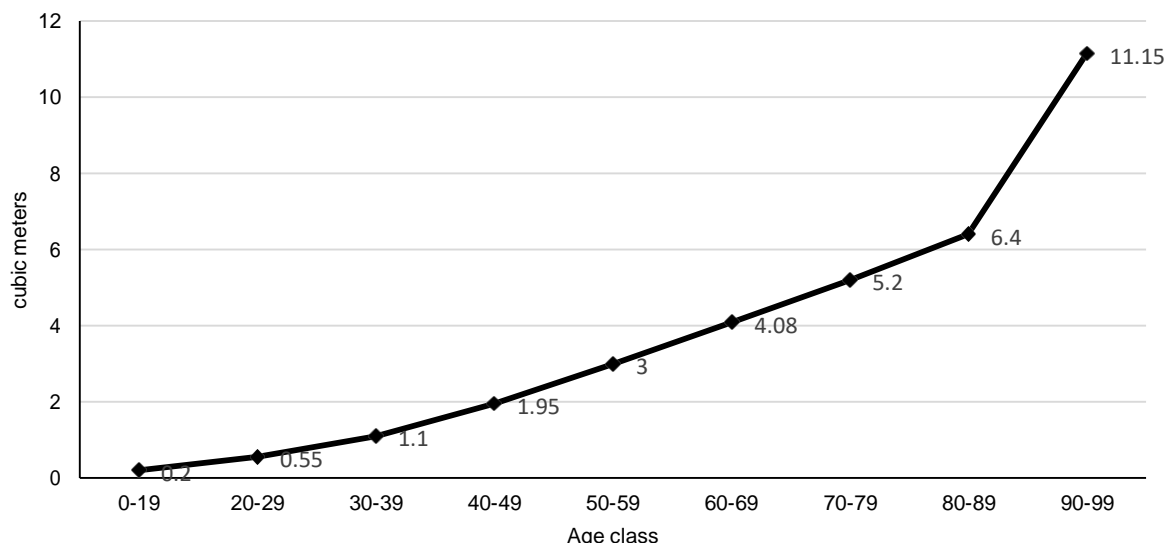


Fig. 12.1c: Volume curve of *Mesua ferrea* in Dibrugarh division.

Mean Annual Increment (m.a.i.) is the volume of the tree divided by its age. Figure 12.1a, 12.1b and 12.1c shows m.a.i. Measurements after 5 or 10 years are not available so c.a.i. has not been plotted against its age of *Dipterocarpus retusus*, *Shorea assamica* and *Mesua ferrea*. The m.a.i. shows a smooth curve which rises steadily and reaches its highest point in *Dipterocarpus retusus*. whereas, in *Shorea assamica*, the curve rises smoothly and after 80 yrs it reaches a peak at a faster rate. On the other hand the curve reaches slowly till 29 years and then it reaches smoothly throughout.

Table: 12.1.d: Statement showing RF wise total growing stock (in cu m) in Dibrugarh division.

Name of the RF	Canopy cover	Diameter class (cm)						Total
		D1 10-20	D2 20-30	D3 30-40	D4 40-50	D5 50-60	D6 60-70	
Dihingmukh RF	Open	41.6	295.6	586.6	663.5	786.3	1,270.3	3,643.9
	Moderately Dense	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Very dense	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Dihingmukh RF	41.6	295.6	586.6	663.5	786.3	1,270.3	3,643.9
Namdang RF	Open	34.4	244.4	485.1	548.7	650.3	1,050.5	3,013.4
	Moderately Dense	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Very dense	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Namdang RF	34.4	244.4	485.1	548.7	650.3	1,050.5	3,013.4
Jokai RF	Open	118.9	845.2	1,677.4	1,897.3	2,248.6	3,632.5	10,419.7
	Moderately Dense	787.4	4,848.0	13,540.3	11,876.1	16,284.5	35,557.8	82,894.2
	Very dense	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Jokai RF	906.3	5,693.2	15,217.7	13,773.4	18,533.1	39,190.4	93,314.0

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Telpani RF	Open	38.9	276.3	548.3	620.2	735.0	1,187.4	3,406.1
	Moderately Dense	89.2	549.3	1,534.2	1,345.7	1,845.2	4,029.0	9,392.6
	Very dense	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Telpani RF	128.1	825.6	2,082.5	1,965.9	2,580.2	5,216.4	12,798.6
Joypur RF	Open	10,080.4	17,765.5	32,625.8	20,798.2	53,392.5	4,09,592.3	5,44,254.7
	Moderately Dense	47,073.0	1,24,423.0	1,28,523.5	60,149.4	1,17,524.3	7,89,800.4	12,67,493.6
	Very dense	62,986.6	1,60,985.3	1,38,055.6	63,640.0	79,697.4	13,23,426.9	18,28,791.8
	Joypur RF	1,20,140.0	3,03,173.9	2,99,204.9	1,44,587.6	2,50,614.1	25,22,819.6	36,40,540.1
Total of Dibrugarh division		1,21,250.3	3,10,232.6	3,17,576.8	1,61,539.0	2,73,164.0	25,69,547.2	37,53,309.9

Table 12.1.e: Compartment wise growing stock (cu.m./Ha.) of Dibrugarh Division

Name of the RF	Compt. No.	(cu.m./Ha.)
Dihingmukh R.F.	1	0.64
	2	0.03
	3	2.17
Jokai R.F.	1	222.03
	2	121.54
	3	1.36
	4	69.14
	5	15.52
	6	14.55
	7	97.36
	8	65.57
	9	47.69
	10	2.18
Joypur R.F.	1	630.23
	2	383.32
	3	274.40
	4	271.59
	5	364.06
	6	305.44
	7	247.71
	8	63.24
	9	175.68
	10	331.50
	11	419.17
	12	478.06
	13	392.09
14	485.01	
15	388.54	
16	190.91	
17	368.37	
18	317.38	
19	355.69	
20	290.05	
21	328.85	
22	1688.00	
23	168.68	

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Namdang R.F.	1
Telpani R.F.	1

12.1.1 Past statistics of growth of Hollong and other species in the division: Previously recorded statistics of growth of Hollong, Mekai, and other species under different felling series is furnished in Table 12.1.1. As the Compartment numbers of the then Working Plan do not correspond to the Compartment numbers of present Working Plan, this statistics will give an approximation of the growth of trees.

Table 12.1.1: Previously recorded growth statistics (number of stems) of the signature species

F.S. & RF./ Block	C. No	Species	Girth classes							Total	
			29-38	39-48	48-57	58-67	67-76	77-86	86-96		>96
Joyur F. Series: Joypore RF. Kathalguri Block	202	Hollong	504	560	371	168	126	56	14		1799
		Others	2723	2611	1764	1218	371	98	28		8813
	203	Hollong	1212	720	708	600	648	372	216	216	4692
		Mekai	84	72	58	36	72	36			358
		Others	5388	5916	3110	924	288	144	48	132	15950
	204	Hollong	1474	1155	770	726	759	341	44	33	5302
		Mekai	38	88	77	33	33				269
		Others	3977	5511	2442	627	77	77		44	12755
	205	Hollong	645	455	440	355	285	230	80	30	2520
		Mekai	5	10	15						30
		Others	2660	2150	885	295	65	40	40	70	6205
	206	Hollong	870	710	405	230	210	75			2500
		Mekai	15				5				20
		Others	1985	2120	960	440	30	5	5		5545
	208	Hollong	390	635	445	380	190	150	55		2245
		Mekai	60	50	60	55	80	75	50	105	535
		Others	1875	2215	1080	405	105	35	10	10	5735
	209	Hollong	480	340	235	230	195	160	125	165	1930
		Mekai	70	160	155	120	140	65	65	50	825
		Others	1205	1425	725	255	80	30	180	45	3945
210	Hollong	790	665	370	240	260	250	125	60	2760	
	Mekai	30	40	35	35	60	55	5		260	
	Others	2790	1680	650	250	70	20	10	60	5530	
211	Hollong	918	336	216	192	216	126	90	18	2112	
	Mekai	96	132	120	114	78	84	90	84	798	
	Others	2104	1848	1206	450	102	36		8	5754	
1. Joypore F. Series: Joypore RF. Kathalguri Block	212	Hollong	366	360	306	234	114	120	84	150	1734
		Mekai	216	252	282	168	66	54	42	36	1116
		Others	1152	1734	840	240	66	30	24	12	4098
	213	Hollong	285	300	270	250	155	80	55	135	1530
		Mekai	125	180	215	150	85	65	20	20	860
		Others	1705	1010	815	245	30	30	110	20	3965
	214	Hollong	1250	695	370	240	215	130	5		2905
		Mekai	270	105	95	80	35	80	85	70	820
		Others	2300	1990	1115	325	45	30	20		5825
	215	Hollong	785	395	255	230	145	105	10		1925
		Mekai	175	60	125	80	90	60	85	140	815
		Others	1335	1185	980	340	105	45	5		3995

219	Hollong	15	95	175	135	70	35	30	5	560
	Mekai			30	60	40	20	15		165
	Others	495	1020	890	365	75	95	65		3005
220	Hollong	1287	902	649	737	660	506	385	308	5434
	Mekai	176	220	220	154	33	33	11	22	869
	Others	3410	6512	3467	1155	407	132	11	55	15149
221	Hollong	140	235	240	155	160	160	65	25	1180
	Others	1385	1565	1325	980	430	120	50	60	5915
222	Hollong	105	215	195	255	140	90	15		1015
	Mekai	10	35	125	155	90	40	20	20	495
	Others	740	1005	1250	920	400	90	10	15	4430
223	Hollong	198	216	210	156	132	84	72	12	1080
	Mekai	138	120	138	138	36	12	42	42	666
	Others	1548	1254	780	390	228	84	6		4290
224	Hollong	110	215	150	195	130	65	25	15	905
	Mekai	60	60	65	80	90	30	60	5	450
	Others	710	1055	805	445	180	115	15		3325
225	Hollong	385	240	185	210	140	125	105	180	1570
	Mekai	100	230	195	125	70	70	60	90	940
	Others	975	1145	715	205	50	15	10	10	3125
226	Hollong	286	325	221	195	247	156	91		1521
	Mekai	39	91	130	143	91	52	26		572
	Others	1820	2951	1391	507	234	130			7033
229	Hollong	15	135	180	127	67	15	15	8	562
	Mekai		23	68	60	30	8			189
	Others	308	440	697	286	83	45			1859
233	Hollong	258	156	198	216	168	84	156	96	1332
	Mekai	24	108	108	132	132	90	48	12	654
	Others	1812	1980	1278	918	420	198	132	144	6882
235	Hollong	430	300	230	265	165	100	40	40	1570
	Mekai	125	180	155	210	175	105	40	20	1010
	Others	1715	2295	1115	315	85	35	10	25	5595
236	Hollong	255	175	190	195	110	70	65	25	1085
	Mekai	95	175	180	95	120	65	135	60	925
	Others	860	1305	535	110	40	25	15	20	2910
237	Hollong	930	282	258	258	210	138	102	114	2292
	Mekai	120	234	180	216	120	114	36	30	1050
	Others	1782	1668	918	198	48	12	12	18	4656
238	Hollong	1278	288	258	234	180	102	66	78	2484
	Mekai	138	228	174	162	96	30	36	18	882
	Others	1992	1656	762	204	36	12	12	12	4686
239	Hollong	680	635	295	145	135	65	10		1965
	Mekai	210	265	240	330	205	110	60	85	1505
	Others	2285	2105	1020	320	165	30	15	5	5945
240	Hollong	528	396	270	282	222	174	96	72	2040
	Mekai	132	192	204	276	174	162	120	72	1332
	Others	1500	1986	1068	282	60	36	30	6	4968
241	Hollong	310	165	155	120	75	40	30	10	905
	Mekai	130	165	175	180	85	135	60	60	990
	Others	670	960	395	105	50	25	5	10	2220
242	Hollong	822	732	282	150	126	108	36		2256

1. Joypore F. Series: Joypore R.F. Kathalguri Block

		Mekai	336	222	342	354	324	174	66		1818	
		Others	2664	2232	894	306	36	6			6138	
Namrup F. Series Joypore RF. Hiliikha Block	207	Hollong	1176	1200	608	304	152	152	16		3608	
		Mekai	64	24	24	48					160	
			Others	4880	4186	2392	1056	320	80			12914
	217	Hollong	130	317	437	317	208	68	21			1498
		Others	1258	1446	1057	411	224	78	62	77		4613
	218	Hollong	40	150	320	330	200	75	20	5		1140
		Mekai	5	10		5	10					30
		Others	755	1740	1640	885	310	160	70	45		5605
	230	Hollong	112	148	196	184	180	152	128	156		1256
		Mekai		4	8	8	16	16	12	4		68
		Others	674	1608	1272	708	296	132	60	44		4794
	231	Hollong	270	261	234	258	234	294	138	36		1725
		Mekai		36	24	24	48	18	48	18		216
		Others	2040	2382	1968	1062	642	462	276	432		9264
	232	Hollong	50	70	75	120	95	50	45	20		525
		Mekai		5	15	10	5	10	5	5		55
		Others	790	1020	925	580	330	230	175	135		4185
	245	Hollong	80	70	40	90	65	75	55	15		490
		Mekai			10							10
		Others	915	780	615	365	220	85	125	115		3220
	246	Hollong	40	175	205	195	135	65	5			820
		Mekai			5	5				5		15
		Others	535	965	1030	69	355	200	155	185		3494
	247	Hollong	46	112	143	122	92	102	36	10		663
Mekai			10	5	26	20					61	
Others		413	478	705	658	508	268	203	76		3309	
248	Hollong	24	168	176	176	176	160	46	56		982	
	Mekai	8	48	80	72	112	24	56	40		440	
	Others	696	1616	1606	1000	512	296	272	288		6286	
252	Hollong	32	211	216	178	167	130	108	5		1047	
	Mekai							5			5	
	Others	524	1096	1339	951	486	405				4801	
	Total	Hollong	2000	2882	2650	2274	1704	1323	618	303	13754	
		Mekai	77	137	171	198	211	68	126	72	1060	
		Others	13480	17317	14549	7745	4203	2396	1398	1397	62485	

12.1.2 Past statistics of volume of Hollong and other species in the division: Previously recorded statistics of growth (volume in cu.m.) of Hollong, Mekai, and other species under different girth classes is furnished in Table 12.1.2.

Table 12.1.2: Past growth statistics (volume cu.m.) of important species of Dibrugarh Division, Assam

Girth class (cm)	Hollong	Mekai	Nahor	Hollock	Sam	Sopa
60 - 90	0.18	0.20	0.06	0.05	0.10	0.08
90 - 120	0.40	0.55	0.42	0.32	0.52	0.40
120 - 250	1.05	1.10	1.14	0.88	0.98	0.87
150 - 180	1.95	1.95	1.86	1.65	1.56	1.60

180 - 210	3.20	3.00	2.65	2.66	2.25	2.60
210 - 240	4.80	4.08	3.41	3.85	3.15	3.65
240 - 270	6.60	5.20	4.20	4.98	4.27	4.77
270 - 300	8.85	6.40	-	6.05	5.55	5.92
300 - 330	11.15	-	-	6.90	6.85	6.97
330 - 360	-	-	-	-	8.25	-

12.2 Statistics of forest carbon stock: Under the national forest inventory programme, FSI has been calculating carbon stock of forests under different types. As per the methodology, in each sample plot all trees of diameter 10 cm and above are measured. The woody volume of trees for each sample plot is calculated using volume equation developed by FSI for various species. The volume equation provides above ground woody volume i.e. above ground volume, which includes volume of mainstem measured upto 10 cm diameter and volume of all branches having diameter 5 cm or more. Data of specific gravity and percentage carbon content of most of tree species have been obtained from different published literature. Standard formulae were used to calculate biomass and carbon content of each tree.

During forest inventory the data on above ground biomass and soil carbon is collected from each sample plot. For collecting soil carbon, two sub-plots of size 1m×1m were laid out within the main plot and at the centre of these two sub-plots, a pit of 30cm × 30cm × 30cm was dug and a composite sample of soil weighing 150 gm was kept for organic carbon analysis. Samples of soil were analysed and were used for carbon calculation. Below ground biomass was being calculated using a relationship (usually a root-to-shoot ratio) to above ground biomass which had been established by FRI. GPG also provided default ratios for six major global forest types. FSI had selectively used these defaults to arrive at the carbon number. The forest Carbon stock was analysed for different species under different girth classes. It was found that carbon content was maximum under girth class >180 cm. A direct relationship was found between girth class and carbon. Average carbon content in different girth class is shown in table 12.2.

Table 12.2: Average Carbon content tons/tree in different girth class in Dibrugarh Division

Girth Class (cm)	Average Carbon Content (tons/tree)
<30	0.17
30-60	0.25
60-90	0.49
90-120	0.98
120-150	2.00
150-180	3.21
>180	9.83

VOLUME 1

PART II



FUTURE MANAGEMENT

CHAPTER 1

Basis of Proposal

The working plan of Dibrugarh Division is a technical document prepared to manage the forest under Dibrugarh Division on sustainable basis with the overall objective to conserve biodiversity, soil and water regime, enhance production of forest produce to meet the market needs and also the needs of the local people. It is aimed to meet the national and global needs in general and the necessity of the local people. The plan preparation and implementation of the plan it is necessary to examine the relevant policies, Laws, Rules, Court orders and various administrative orders issued by the Government of India and Assam, so that all the prescriptions are brought under the umbrella of the existing policy framework.

1a) The National Forest Policy

The National Forest Policy was first enunciated in 1894 and was revised in 1952, after independence. It was again revised in shape of the National Forest Policy 1988, presently in force. The basic objectives and thrust areas enshrined in the National Forest Policy, 1988 are given as under -

- a) Maintenance of environmental stability through preservation, restoration of the ecological balance that has been adversely disturbed by serious depletion of forests.
- b) Increasing productivity of forests to meet essential national needs.
- c) Conserving the natural heritage of the country by preserving the remaining natural forests with the vast variety of flora and fauna, that represents the remarkable biodiversity and genetic resources of the country.
- d) Checking the soil erosion and denudation in the catchment area of the rivers, lakes and reservoirs in the interest of soil and water conservation for mitigating flood and droughts and for retardation of siltation of reservoirs.
- e) Increasing the forest/tree cover in the country through massive afforestation and social forestry programmes, especially, on all denuded, degraded and unproductive lands.
- f) Meeting the requirements of fuel wood, fodder, minor forest produce and small timber of the rural and tribal populations.
- g) Encouraging efficient utilization of forest produce and maximizing substitution of wood.
- h) Creating a massive people's movement with the involvement of women, for achieving these objectives and to minimize pressure on the existing forests.

The principal aim of the Forest Policy is to ensure environmental stability and maintenance of ecological balance including atmospheric equilibrium, which is vital for sustenance of all life forms, human, animals and plants. The derivation of direct economic benefit is secondary to this principal aim. Further, essentials of Forest Management embodied in the National Forest Policy, 1988 are mentioned below –

- a) Existing forests and forest lands should be fully protected and their productivity improved. Forests and vegetative cover should be increased rapidly on hill slopes, in catchments of the rivers, lakes, reservoirs, ocean shores, on semi-arid, arid and desert tracts.
- b) For conservation of biodiversity, network of national parks, sanctuaries, biosphere reserves and other protected areas should be strengthened and extended adequately.
- c) Provision of sufficient fodder, fuel and pasture, especially, in areas adjoining to forest is necessary in order to prevent depletion of forests beyond sustainable limit.
- d) Minor forest produce provides sustenance to the tribal population and other indigenous population residing in and around the forests. Such produce should be protected, improved and their production should be enhanced with due regard to generation of employment and income.
- e) Schemes and projects which interfere with forests on the steep slopes, catchments of rivers, lakes and reservoirs, geologically unstable terrain and other ecologically sensitive areas should be severely restricted.
- f) No forest should be permitted to be worked without the approved working plan, which should be in keeping with the National Forest Policy and directions of the Hon'ble Apex court.
- g) The rights and concessions enjoyed by the tribal and other rural poor living within and near the forests should be fully protected. Their domestic requirements of fuel wood, fodder, minor forest produce and construction timber should be the first charge on forest produce.
- h) Inculcate in the people, a direct interest in forests and make them conscious of the value of forests, wildlife and nature in general through forest extension, education and training.

1b) National Forestry Action Plan

Having about 2.5% of world's geographic area, India at present is supporting 16% of world's human population and 18% of cattle population. About 41% of forest cover of the country has already been degraded and dense forests are losing its crown density and productivity continuously. A large number of India's livestock population graze in the forests causing serious damage to soil, ground flora, including regeneration, and productivity of the forests. The use of forests beyond its carrying capacity and encroachments are the main cause of continuous degradation of forests.

- a) To reverse the process of degradation and for sustainable development of forests, the Government of India has prepared National Forestry Action Plan (NFAP), a comprehensive strategic programme. These programmes are as follows –
- b) Protect Existing Forest Resources
- c) Improve Forest Productivity
- d) Reduce Total Demand of Forest Produce
- e) Strengthen Policy and Institutional Framework
- f) Expand Forest Area
- g) Further, the following strategies are to be adopted for the same –
- h) For sustainability and productivity of forests, the production to be increased at least 3 to 5 m³ per ha per year by promoting appropriate silvicultural treatments.
- i) Hygiene of forests to be improved through suitable silvicultural practices.

- j) Efforts to be made to bring one-third geographic area of the country under forest and tree cover by plantations on all categories of wastelands and agro forestry.
- k) Plantations on non-forest wastelands to be done mostly with fuel wood species as 70% of the wood produced from forests are used as fuel wood. Species of pulpwood and other industrial wood may be encouraged in farm forestry.

1 c) National Wildlife Action Plan

Ministry of Environment and Forests, Govt. of India has formulated National Wildlife Action Plan (2002-2016) based upon the decision taken in the 21st meeting of the Indian Board of Wildlife held on January 2002. National Wildlife Action Plan outlined the strategies and action points for conservation of wildlife.

The strategies are –

- a) Strengthening and Enhancing the Protected Area Network
- b) Effective Management of Protected Areas
- c) Conservation of Wild and Endangered Species and Their Habitats
- d) Restoration of Degraded Habitats outside Protected Areas
- e) Control of Poaching, Taxidermy and Illegal Trade in Wild Animal and Plant Species
- f) Monitoring and Research
- g) Human Resource Development and Personnel Planning
- h) Ensuring People's Participation in Wildlife Conservation
- i) Conservation Awareness and Education
- j) Wildlife Tourism
- k) Domestic Legislation and International Conventions
- l) Enhancing Financial Allocation for Ensuring Sustained Fund Flow to the Wildlife Sector.

1 d) Court Judgments and Related Committees

Hon'ble Supreme Court passed an Order in Writ petition (202 of 1995) in the matter of "Godavarman Thirumalkpad" V/s Union of India. The order speaks about the felling of trees in all forests is to remain suspended except in accordance with the working plans of the State government, as approved by Central government. Hon'ble Supreme Court passed an order on 22.09.2000 in Inter- Locutory application No 424 saying that regeneration of forest should be commensurated with felling carried out under a working plan. To achieve this, it must be ensured that no felling be carried out without allocating necessary fund to regenerate the felled areas. In the event of failure in regeneration or any shortfall in carrying out regeneration operation no further felling shall be undertaken until the failure/shortfall is made up.

Following the directions of Hon'ble apex court in their order dated 22.09.2000 in IA No 424; a core group was constituted to decide the extent of felling. As per these Orders, felling are to be carried out by the State Governments only after obtaining the permission from core group constituted by the Ministry of Environment and Forests, New Delhi.

1 e) Peoples' Participation through JFM

Joint Forest Management approach was adopted for degraded forest area of the State vide GR dated 16 March 1992. The programme was extended to Good Forest areas vide Govt. Resolution dated 25/4/2003. The latest revision in G.R. has been made on 5th October 2011 and 10th July 2012. All JFM activities should be in consonance with the broad prescriptions of the Working Plan. The Micro plans are to be dovetailed with the prescriptions of the Working Plan.

1f) The Scheduled Tribes and other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 and the Amendment, 2012

After the enactment of this Act, the administration of the forest will be greatly influenced, as this act recognizes several individual as well as the community rights over the forest land and its produce. All the provisions of this Act will have to be taken into consideration while managing the forest.

1g) The Biological Diversity Act, 2002

This Act aims to provide for Conservation of biological diversity and sustainable use of biological resources. These issues are reflected in various Working Circles and the prescriptions made there under. Other Special Acts/ Regulation/ Rules the Forest Department under Indian Penal Code, Criminal Procedure Code on arrest/ forwarding/ investigation of the offences.

1.1 Objectives of Management: The national goal is to have a minimum of one- third total geographical area of the country under tree cover. Effort should focus for consolidation and preservation of the existing forest cover and increase their productivity. The objectives of this forest management plan is organised around the following major elements for sustainable management.

1.1(1) Dynamics of Forests and Stands: Forest is a dynamic system. It is disturbed, destroyed and regains its status through a dynamic process. Forest disturbances are events that cause change in the structure and composition of a forest ecosystem, beyond the growth and death of individual organisms. Disturbances can vary in frequency and intensity, and include natural disasters such as fire, landslides, wind, outbreaks of insects, fungi, and other pathogens, animal-caused effects such as grazing and trampling, and anthropogenic disturbances such as warfare, logging, pollution, the clearing of land for urbanization or agriculture, and the introduction of invasive species. Not all disturbances are destructive or negative to the overall forest ecosystem. Many natural disturbances allow for renewal and growth and often release necessary nutrients.

Small-scale disturbances are the key to creating and maintaining diversity and heterogeneity within a forest. Small-scale disturbances are events such as single-tree blowdowns, which create gaps that let light through the canopy to the understory and forest floor. This available light allows early-successional shade-intolerant species to colonize and maintain a population within the dominant forest, leading to the complex spatial mosaic forest structure recognized as old-growth. This process is referred to as patch dynamics or gap dynamics and has been described across many types of forests, including tropical, temperate, and boreal.

The sets and patterns of natural disturbances that characterize a particular area or ecosystem are referred to as the ecosystem's disturbance regime. A natural community is closely linked with its natural disturbance regime. For example, temperate and boreal rainforests typically have a disturbance regime consisting of high-frequency but small-scale events, resulting in a highly complex forest dominated by very old trees. In contrast, forests that have a disturbance regime consisting of high-severity stand-replacing events, such as frequent fires, tend to be more uniform in structure and have relatively young tree stands.

Forest succession is the process by which species recover and regenerate after a disturbance. The type of disturbance, the climate and weather conditions, the presence of colonizing species, and the interactions among species all influence the path that succession will take. Species diversity and composition fluctuate throughout succession. The classic model of succession is known as *relay floristics* and refers to a relay of dominant species. After a stand-replacing disturbance, shade-intolerant species colonize and grow into a dominant canopy, but due to their shade-intolerance they are unable to regenerate under their own canopy; the understorey (composed of shade-tolerant species) gradually replaces the canopy, and due to its shade-tolerance it can regenerate under its own canopy and therefore becomes the dominant species. Often succession is not so complete or directed as the relay floristics model describes. Species can be mid-tolerant of shade and survive by taking advantage of small amounts of light coming through the canopy, and further disturbances can create small gaps. These and other factors can lead to a mixture of dominant species and a not so obvious "end" to succession (climax community).

Many successional trajectories follow a basic four-stage development pattern. The first of these stages, *stand initiation*, occurs after a major disturbance and involves many species arriving in the area of abundant light and nutrients. The second stage, *stem exclusion*, describes the growth and competition of these species as resources become less available; likely one or a few species out competes and becomes stand-dominating. The third stage, *understorey reinitiation*, involves further disturbance and the creation of gaps; at this point stratification develops, with layers of canopy, midstorey, and understorey appearing. The final stage, known as *old-growth*, is the extension and completion of the understorey reinitiation; a complex multi-aged and multi-layered forest has developed.

1.1(II) Forests and Soil: Forests and forest soils play a broad, complex and interactive role within the environment. Soils have provided the foundation for trees and entire forests over millions of years. Soil is an important component of forest and woodland ecosystems as it helps regulate important ecosystem processes, such as nutrient uptake, decomposition, and water availability. Soils provide trees with anchorage, water and nutrients. In turn, trees as well as other plants and vegetation, are an important factor in the creation of new soil as leaves and other vegetation rot and decompose.

1.1(III) Forests and Water: Water is the most vital element of all natural resources and is essential to life. Forests and woodlands have a close relationship with our water resources, and forest management and water quality are closely linked. It is widely recognised that sustainably managed forests play an

important role in maintaining water quality. Through stabilisation of soil, forests minimise erosion and hence reduce the impairment of water quality due to sedimentation. Woodlands protect water bodies and watercourses by trapping sediments and pollutants from other up-slope land use and activities. Forests also play a role in water availability. They influence the amount of available water by intercepting precipitation, evaporating moisture from vegetative surfaces, transpiring soil moisture, capturing fog water and maintaining soil infiltration. At the same time, forests may influence the timing of water delivery by maintaining and improving soil infiltration and the soil's water-storage capacity.

1.1(IV) Forest Biodiversity: Forest biological diversity is a broad term that refers to all life forms found within forested areas and the ecological roles they perform. As such, forest biological diversity encompasses not just trees, but the multitude of plants, animals and micro-organisms that inhabit forest areas and their associated genetic diversity. Forest biological diversity can be considered at different levels, including the ecosystem, landscapes, species, populations and genetics. Complex interactions can occur within and amongst these levels. In biologically diverse forests, this complexity allows organisms to adapt to continually changing environmental conditions and to maintain ecosystem functions. Forest biological diversity results from evolutionary processes over thousands and even millions of years which, in themselves, are driven by ecological forces such as climate, fire, competition and disturbance. Furthermore, the diversity of forest ecosystems (in both physical and biological features) results in high levels of adaptation, a feature of forest ecosystems which is an integral component of their biological diversity. Within specific forest ecosystems, the maintenance of ecological processes is dependent upon the maintenance of their biological diversity.

1.1(V) Climate and Forests: Forests' role in climate change is two-fold. They act as both a cause and a solution for greenhouse gas emissions. Around 25% of global emissions come from the land sector, the second largest source of greenhouse gas emissions after the energy sector. About half of these (5-10 GtCO₂e annually) comes from deforestation and forest degradation. Forests are also one of the most important solutions to addressing the effects of climate change. Approximately 2.6 billion tonnes of carbon dioxide, one-third of the CO₂ released from burning fossil fuels, is absorbed by forests every year. Estimates show that nearly two billion hectares of degraded land across the world – an area the size of South America – offer opportunities for restoration. Increasing and maintaining forests is therefore an essential solution to climate change.

IUCN's forest work tackles the role of trees and forests in building resilience to climate change in several ways:

- **Combatting deforestation and forest degradation** in areas of high biodiversity and cultural significance, such as primary forests and World Heritage sites. This helps conserve the benefits that people and societies get from forests, including forest carbon stocks and livelihoods.
- **Restoring forest landscapes** helps enhance climate change mitigation and adaptation. As the co-founder and Secretariat of the Bonn Challenge – a global effort to bring 150 million hectares of

deforested and degraded land under restoration by 2020 and 350 million hectares by 2030 – IUCN supports national and sub-national decision makers in reaching this important goal. Reaching the 350 million hectare target could sequester up to 1.7 gigatonnes of carbon dioxide equivalent annually.

- **Enabling rights-based land use** ensures community involvement in land-use outcomes. IUCN produces results on the ground through partners and projects worldwide to help strengthen community control over forests, alleviate poverty, empower women and men, enhance biodiversity, and sustainably manage forests.
- **Unlocking forest benefits** is critical to a sustainable and equitable supply of forest goods and services. IUCN builds capacity for implementing restoration, engaging the private sector and striving to make sure benefits – such as those from Reducing Emissions from Deforestation and Forest Degradation (REDD+) – are equitably shared with local landowners and forest communities.

1.1(VI) Socioeconomic considerations and generation of forest based employment opportunities and livelihood options:

India is a developing nation. The majority of its population resides in rural areas. Forests are important renewable natural resources generating livelihood requirements for more than 25% of the world's population. Forests play an important role in the rural economy. In many areas, forests and trees are among the few resources that are available to rurals. They provide different kinds of benefits: employment and incomes often needed to supplement inadequate returns from agriculture; produce such as fuel wood, food, fodder and poles for the home; and -a range of environmental benefits, without which other activity, such as agriculture might be impossible. Forest sector is the second largest land use after agriculture. Statistics reveals, in remote forest villages about 300 million tribal and other local people depend on forest for their subsistence and livelihood and about 70% of India's rural population depends on fuel wood to meet its domestic energy needs. For about 100 million of them, forests are main source for livelihood and cash income from fuel wood, non-timber forest products or construction materials. The application of local skills and village-level technology in wood-based and small-scale forest based enterprises provide secondary employment and livelihood opportunities for rural people, Forest development integrated with agricultural and industrial progress has great potential to enhance livelihood security, poverty reduction and food security for vulnerable section of society including illiterate, unskilled, resource-poor, jobless, landless and labourers people in rural India.

1.1(VII) Tool for integrated development:This Working Plan may be a tool for integrated development. The main objective of integrated development is to provide employment opportunities to the poor as well as to provide opportunities to develop their skill sets so as to improve their living conditions. This Working Plan emphasizes in upliftment of socio-economic condition the village community. Working in convergence with other line departments for upliftment of socio economic condition of rural people shall be emphasized. Details are mentioned in para 8.17, chapter-8 of Part- II.

Considering the above major elements and with a view for sustainable management, the following objectives are set for this forest management plan.

- i) To restock the depleted and degraded forests with its origin indigenous variety of species (Sal) under intensive system of management with the aim of attainment of normal forest in due course.
- ii) To protect the forest from various forest depletion drivers e.g., illegal felling, encroachments and other anthropogenic factors.
- iii) To improve of degraded habitat of wildlife ensuring availability of basic habitat formation criteria e.g, food, water and shelter. Biodiversity conservation shall be one of the prime agendas.
- iv) To retain and enrich all the moist deciduous forests of comparatively poor value by raising plantations of more valuable indigenous species.
- v) To protect the crests, ridges and steep slopes from the point of view of watershed management and soil conservation.
- vi) To protect and preserve some of the miscellaneous forests in its present state to maintain biodiversity by a system involving least disturbance to the forest cover.
- vii) To raise plantations of timber species, fuel wood and minor forest produce with people's participation for household requirement and economic upliftment of the communities who are bonafide residents of the Reserved Forests of the Division and also those living in the outskirts of the Reserved Forests & proposed Reserved Forests to save the Forests from rampant destruction.
- viii) To improve the living conditions of tribals and forest dependent communities through sustainable harvest of non timber forest products.
- ix) To protect the forest areas outside the Protected Areas (PA) for protection and conservation of wildlife.

1.2 Methods of treatment to be adopted:To attain at the above objectives and for ecological and silvicultural requirements for sustainable management of different identified forests it is suggested that the silvicultural system to be adopted is **Irregular Shelter Wood system** for Plantation and Regeneration Working Circles.

Irregular Shelterwood system, structurally different from even-aged and balanced uneven-aged forest, is a silvicultural system most desirable for maintenance or restoration of irregular stand (forest) especially for ecosystem-based management. This silvicultural system is compatible with ecosystem-based management in forest types driven by partial stand mortality and gap dynamics and provides opportunities

for maintaining old-growth forest attributes. This is a system involving successive regeneration with a long and indefinite period of regeneration. The aim is to produce more or less even aged crops.

1.3 Treatments Prescribed: All treatments (Tending operation e.g., spacing, pruning, thinning, and improvement cutting) required for improvement of the forest shall be applied as pre-harvest silvicultural treatment. But there shall not be harvesting during this Working Plan period. The other general approach of treatments are-

- a) The entire forests will be protected from harvesting.
- b) 20 meters wide strips on both sides of streams, watercourses and 40 meters from the river will be protected, no harvesting in these strip areas.
- c) Special habitat management for wildlife conservation will receive high priority. Dibrugarh being frequented with riparian zones and mesic sites these needs to be protected with extra care. Adequate buffer will be provided to any such important sites in the Division for preparing treatment maps including any harvestings. Dead, dying, decay snag, den trees and down logs will be protected to cater the habitat requirement of birds and small animals, they prefer to build their nests in such build formations. Wildlife requirements shall be the most important consideration for water body management in forest areas.
- d) Forests of the Division are extremely important from wildlife management point of view as they intersperse with unique Dibru Saikhowa protected areas.
- e) Preference will be given to natural regeneration and root stock management. Natural regeneration and promising coppice growth will receive suitable tending and soil working to stimulate growth and development. Areas having good natural regeneration of valuable species shall be protected from fire and grazing. Artificial regeneration will be taken up as supplementary activity, at places, where natural regeneration is inadequate or is not likely to succeed.
- f) Management of forests close to villages will be given priority for meeting demands of local people for small timber, poles, firewood, fodder, non-wood forest produce, etc. Local people will be actively involved in forest management, forest protection, plantations and development of natural resources in the village. Management of forests close to villages shall primarily be done through JFM committees.
- g) Non-Timber Forest Produce (NTFP) has great potential for sustainable economic development of local communities with conservation of forest resources. Sustainable NTFP production will be given high priority in the forest management.
- h) Sustainable use of forest resources will remain the guiding principle for managing the demands of forest produce and services. Various government and non-government agencies will be engaged in identification and promotion of ecologically sound and economically feasible alternatives like wood saving technology, stall-feeding, population control of cattle and livestock improvement.

- i) Involving local people in managing forests and generating awareness in rural and tribal areas is considered indispensable for the forest conservation.
- j) Reducing biotic pressure on forests, particularly, illicit felling, unsustainable grazing, fire and encroachment near villages will be considered on priority basis.
- k) Forests capable of producing medium to large sized timber will be harvested under the Selection-Cum-Improvement management system.
- l) Boundary demarcation will be carried out in time-bound manner for ensuring territorial integrity of forests.
- m) Action will be taken to convert all the miscellaneous forests adjoining the Reserved Forests and large patches, away from villages into Reserved Forests.
- n) Method of treatments will depend upon requirements of environmental stability, protection of topography, biodiversity conservation and characteristics of growing stock in the forest and the objectives of management.
- o) Existing protection forests will be preserved. Soil and moisture conservation works should improve the moisture content and prevent soil erosion and siltation of the water bodies.
- p) Suitable tending and soil working operations will be carried out to stimulate the growth of the naturally regenerated seedlings and root stock.
- q) Timber, if silviculturally available, will be extracted from the dense tree forests capable of producing medium to large-sized timber and poles on sustained basis.
- r) Open forest areas and traditional pastures will be managed with active participation of tribal and village communities for improving the productivity of the land to meet the local domestic needs of fodder and fire wood.
- s) Uncontrolled grazing, fire, poaching, illicit cutting and uncontrolled encroachment, the major threats for sustainable growth for forest, shall be curbed.

1.4 Constitution of Working Circles

The working circles proposed and approved in Preliminary Working Plan Report for Dibrugarh Forest Division are as follows.

- a) Joint Forest Management Working Circle.
- b) Plantation and Regeneration Working Circle.
- c) Forest Protection Working Circle.
- d) NTFP (overlapping) and Bamboo Working Circle.
- e) Soil and Water Conservation (overlapping) Working Circle.
- f) Wildlife Management and Biodiversity Conservation (overlapping) Working Circle.

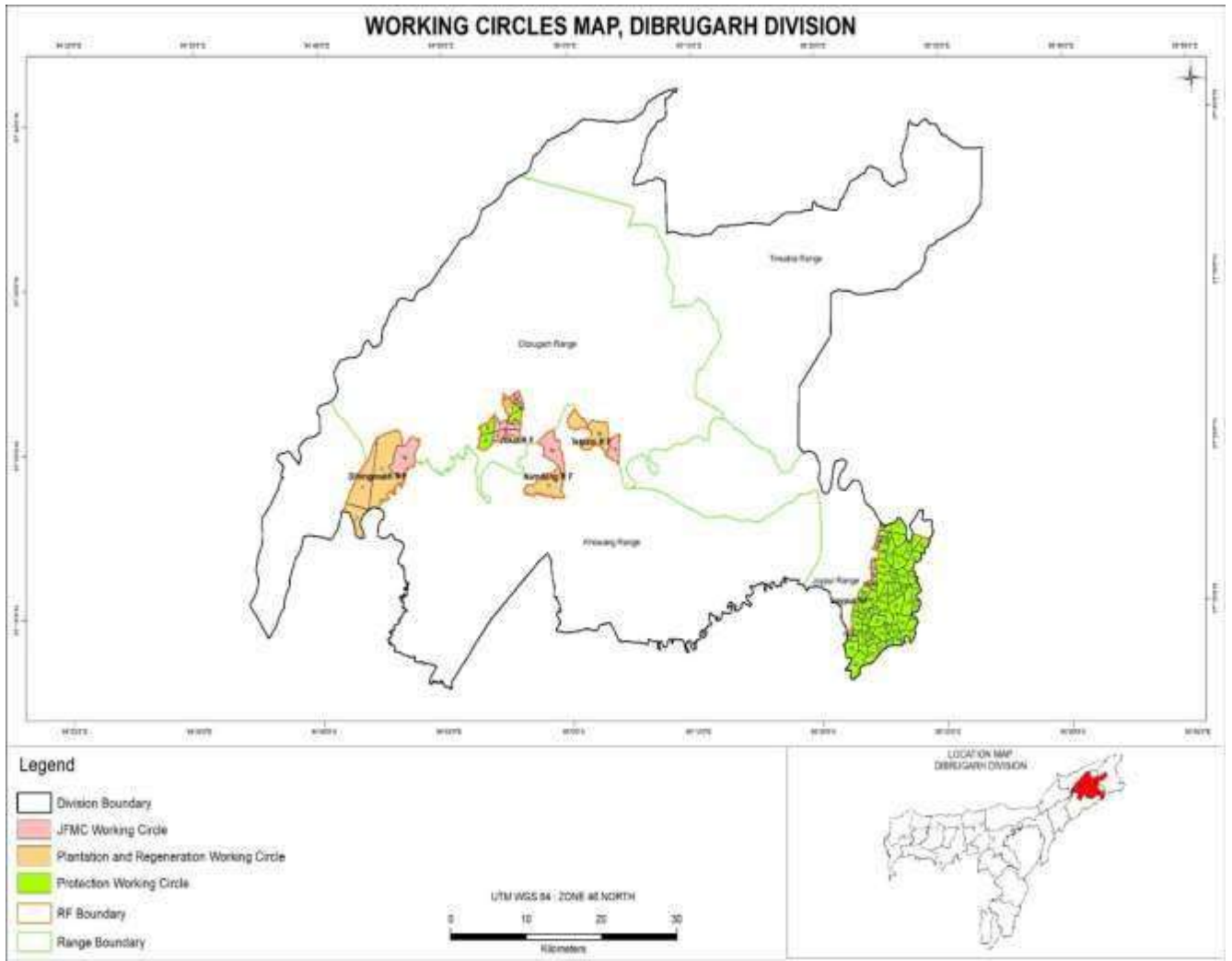


Figure 1.3.1: Working Circles map of Dibrugarh Division

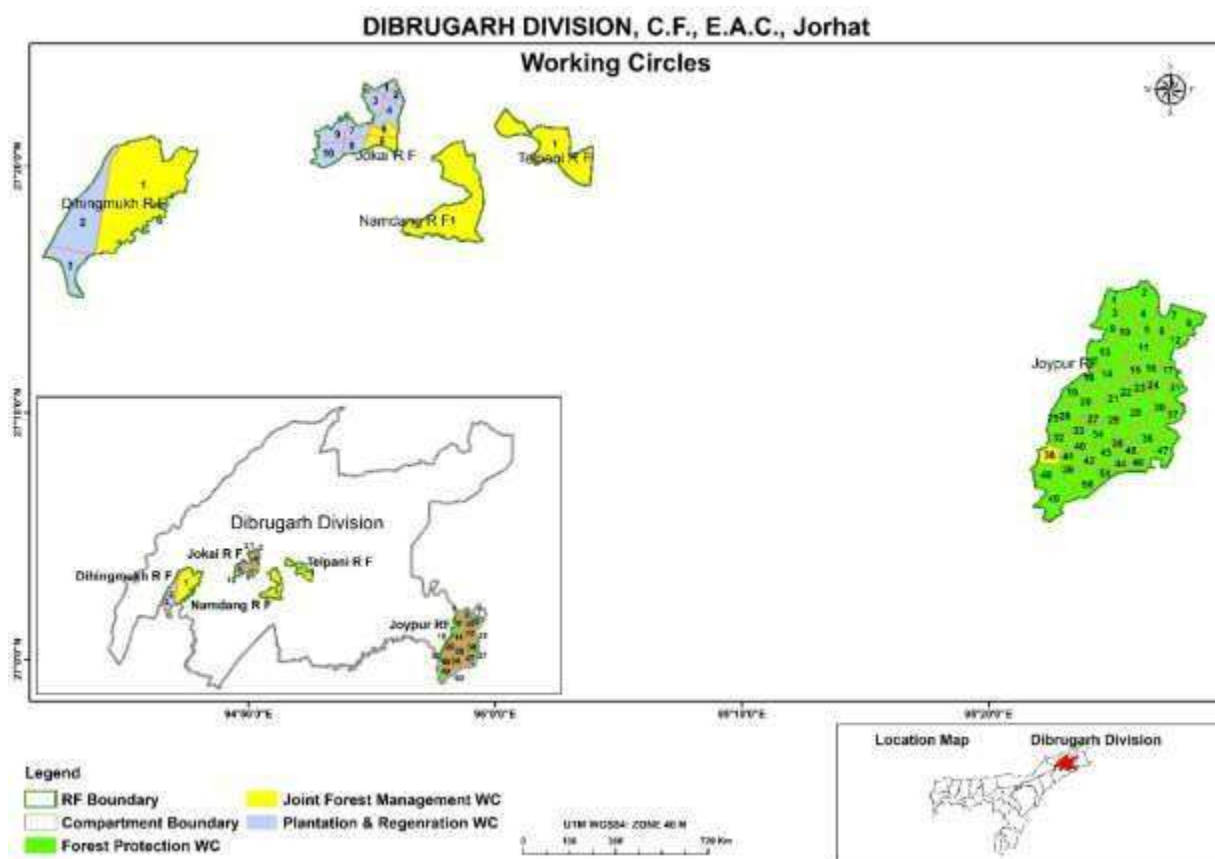


Figure 1.3.2: Map showing the proposed Working Circles as per the recasted microwatershed based compartments.

1.4.1 Joint Forest Management Working Circle

This working circle should be seen as the pivotal Working Circle. The success of the rest of the working plan depends entirely on the successful management of the JFM working circle. Joint Forest Management is sharing of responsibilities, authority and usufructs between the village community or the forest user group and the forest department on the basis of a memorandum of understanding (MoU) between the two. The management of the jointly managed forests is done through the provisions of a micro-plan prepared by the community on participatory rural appraisal (PRA) basis with the technical help of the officials of the forest department. The concept of this Working Circle will be participatory approach, participatory planning, participatory implementation and participatory sharing of the outturn as per "The Assam Joint (peoples' participation) Forestry Management Rules 1998".

This Working Circle shall include the entire existing plantation in this Division raised with the help of JFMCs under different schemes. The areas allotted to this Working Circle will mainly consist of fringe forest areas that are poorly stocked or productive blank areas. All the areas treated under this circle along with the Microplan prescriptions shall be synchronized with the working plan prescriptions and the compartment boundaries shall be realigned according to boundary of village/JFMC unit. The microplans of the JFMCs constituted in Dibrugarh Division include activities such as creation of fuel wood, NTFP, aromatic and medicinal plantations depending upon the need and expectations of the people. Important

Entry Point activities such as construction of community halls, repairing of School buildings, construction of Ring wells and installation of tube wells for drinking water etc. have been taken up. Implementation of several other income generating activities like Bee-keeping, Agarbatti stick making, bamboo mat making, weaving etc. have been done through SHGs showing sincerity and seriousness of department to convince villagers with a view to attract rural people as partners in sustainable management of forests.

Map showing compartments of JFMC Working Circle is in figure 2.1, Area details is in table 2.6a and list of JFMC is in table 2.6b.

Justification for constitution of JFMC Working Circle: Management of forest can not be thought of without peoples' participation. Success of forest management depends upon local people living in and around forests. The local people are very much dependent on forest for their livelihood. Socio-economic development of these people will only protect the forest. It is therefore, decided to constitute the JFMC Working Circle.

1.4.2 Plantation and Regeneration Working Circle

Plantation working circle to cover existing plantations done by the department, blanks and under stocked areas not suitable for ANR, clear felled areas, roadside, riverside, railway side areas and lands under compensatory afforestation etc. which are suitable for plantations have been identified and allocated to different years of plan period. Every effort will be made to restore the ecology of such areas to their previous status. All the plantation areas focused on enhancement of the carbon stocks, register of such plantations under REDD+ is proposed. Periodic monitoring of carbon stocks in such areas requires support from the State government in the form of instruments and subject matter experts.

All the compartments having natural regeneration of different plant species will be protected. Canopy manipulation to be done to assist proper growth of the upcoming seedlings where the crop density is high or crop is well stocked. Protection measures like erection of fencing or digging of trenches, removal of *Michenia* spp. wherever required protecting the regenerations from biotic interferences.

Map showing compartments of Plantation Working Circle is in figure 3.1, Area details is in table 3.6 and Proposed plantation and regeneration series is in table 3.10.

Justification for constitution of Plantation and Regeneration Working Circle: The forest has been degraded in as much as important tree species have been exploited. Natural regeneration found limited because of various factors including biotic factors. It has become an urgent to restock the forest and as such this Plantation and Regeneration Working Circle has been constituted with the objectives mentioned in chapter 3.

1.4.3 Forest Protection (Preservation) Working Circle

Forests of Dibrugarh Division are under tremendous pressure from encroachment, illicit felling, grazing besides other anthropogenic activities. As per Land use change analysis, significant forest area has been lost during last couple of decades. From the view point of forest protection, this Working Circle includes all

the forest area compartments of Joypur Reserved forest with forest cover above 70%. Such areas shall be preserved by providing highest degree of protection. These areas should be seen as the ones which sustain the flow of ecosystem services to the non forest areas. Hence, it becomes absolutely essential to keep the core of the forest areas/ representative ecosystems intact and free from human disturbances. After many years in future, when the ecosystem starts functioning again at its peak productivity, sustainable extraction from these forests may be allowed. Till that time, these forests shall function as nature's laboratories, which will keep on imparting insights about the functioning of the nature, to a keen observer.

Map showing compartments of Forest Protection (Preservation) Working Circle is in figure 4.1 and Area details is in table 4.6.

Justification for constitution of Forest Protection (Preservation) Working Circle: Status and health of dominant, predominant and associated species have been impoverished during last couple of decades. Number of mother trees per hectare are has become deficient. It is not feasible to prescribe harvesting in any part of the forest. It is of utmost necessity to preserve these trees for another span of 10-20 years. It is therefore decided to constitute Forest Protection (Preservation) Working Circle with the objectives mentioned in Chapter 4.

1.4.4 NTFP (overlapping) and Bamboo Working Circle

The NTFP Working Circle includes all areas allocated to the JFMC Working Circle. These are the forest areas or such other areas, which are fit for extraction of a particular NTFP at a rate, prescribed by the DFO that does not lead to the long term decline of the biological diversity so as to maintain its potential to meet the needs and aspirations of present and future generations. Appropriate steps such as closure of an area for the collection or extraction of particular forest produce for a specified period (closed area); restricting or banning the collection or extraction of any forest produce for certain period or periods of a year (closed season); limits on quantities of any forest produce to ensure sustainable harvesting for the future (sustainable harvesting limits); sustainable harvesting/ collection practices etc. NTFPs shall be managed on JFMC areas, fringe forest areas, community forest areas with the help of community after imparting proper training to them regarding time of harvesting, grading and storage for sustainable management and value addition etc. This working circle will be an overlapping working circle covering all the areas where NTFP can be profitably managed in a sustainable manner through scientific managerial. The Main NTFP products that are being extracted are bamboo, Canes, Rattans etc. The collection of the materials from forest areas is proposed to be undertaken as per rules in vogue. Medicinal plant products are presently collected by the people freely from the forests which are not recorded and regulated by the department. All the potential NTFP which have marketable value should be surveyed and their protection and improvement works should be prescribed for sustainable management.

Map showing compartments of NTFP (overlapping) and Bamboo Working Circle Working Circle is in figure 5.1 and Area details is in table 5.6.

Justification for constitution of NTFP (overlapping) and Bamboo Working Circle: NTFP which includes bamboos, cane, rattans, various medicinal plants, vegetables, that are some livelihood needs of local people living in and around forests. To cater the need of these people production of NTFP is necessary. As such constitution of NTFP (overlapping) and Bamboo Working Circle is justified.

1.4.5 Soil and Water Conservation (overlapping) Working Circle

The effective soil conservation measures along with the catchment and watershed management are the pre conditions for a sustainable forest management. The forests are also sources of water (surface, sub-surface and ground water). Over exploitation of the ground water resources results in a decline in ground water levels; there is an urgent need to augment the ground water resources through suitable management interventions. It is desirable to have forest management practices dovetailed with the principles of watershed based development approach especially in the source areas of water. Such areas should have restrictions on tree felling but there should be operations to improve the water regimes and natural regeneration. Many water streams originate from the RF.'s of the Division and many streams and rivers originated from other states pass through the RFs of this Division. There are few wetlands, such as Missimi beel, etc. and many small water bodies within the Reserved forests of the Division. Special provisions shall be made in the working plan to sustain water resources and to address the livelihood issues of the people living in and around the natural inland water sources. Further, areas susceptible to soil erosion such as steep slopes and areas in the vicinity of perennial streams shall be focused for soil and water conservation using mechanical or vegetative control measures.

Map showing compartments of Soil and Water Conservation (overlapping) Working Circle is in figure 6.1 and Area details is in table 6.6.

Justification for constitution of Soil and Water Conservation Working Circle: Being the entire forest area of the division is flood prone; it is susceptible for soil erosion. Soil conservation in forest is a prerequisite for management of forest so far as growing of crops are concerned. On the other hand over exploitation of the ground water resources results in a decline in ground water levels. There is an urgent need to augment the ground water resources through suitable management interventions. As such the Working Circle namely Soil and Water Conservation Working Circle is constituted.

1.4.6 Wildlife Management and Biodiversity Conservation (overlapping) Working Circle

This will be on overlapping circle to cover all the areas of the Division. The plan should prescribe measures for wildlife habitat conservation and identification of corridors for movement of elephants and their protection and management for reducing man-animal conflict. Further this Division comprises a part of Dihing Patkai Wildlife Sanctuary and also a part of Elephant reserve- Dihing Patkai Elephant reserve- a sizeable population of Asiatic elephants exists in the said elephant reserve. Even increasing man-elephant conflict is a serious issue for the planners. There is a strong need of developing wild elephant habitat in almost all the RFs and civil areas of the Division to reduce man-elephant conflict. Rising population and shrinking habitat has led to increase in man – animal conflict and also resulted in maximum depredation to

paddy and other agriculture crops raised by the people living near the forests. There is also necessity to bring some areas with water bodies and peripheral land mass into some special management under wet land conservation for proper management under this circle.

Biodiversity represents diversity of life forms. It includes diversity within species, among species of an ecosystem and among ecosystems. The contribution of individual species to the overall diversity within a community or ecosystem varies to a great extent. The coexistence of organisms that differ widely from each other contributes more to overall diversity than the co-existence of very similar species. Functional diversity is considered to be one of the main factors determining the long-term stability of an ecosystem and its ability to recover from major disturbances. Assessment of status of plant and faunal species and their periodic monitoring can be helpful in formulating strategies for conservation, maintenance and enhancement of overall biodiversity through sustainable management and use practices. Assessment of biodiversity especially the lower forms of life (algae, fungi, lichens, epiphytes, parasites, etc.) of a forest Division must be made an on-going programme with the support from State Biodiversity Board as it may be difficult for the working plan officer (WPO) to do it within the time allotted for writing the plan.

Map showing compartments of Wildlife Management and Biodiversity Conservation (overlapping) Working Circle is in figure 7.1.

Justification for constitution of Wildlife Management and Biodiversity Conservation (overlapping) Working Circle: Forest of Dibrugarh Division is very rich in biodiversity harbouring highest varieties of flora and fauna. Wild animals are very much prone to hunting and poaching besides facing survival challenges due to habitat loss. Human animal conflict is another concern to be addressed. There is urgent need to protect the wild animals from such threats. As such this Working Circle namely Wildlife Management and Biodiversity Conservation (overlapping) Working Circle is constituted.

1.5 Period of working plans and necessary for intermediate revision

The period of working plan will be for 10 years i.e. from 2022-2023 to 2031-2032. A midterm review of the working plan should be undertaken for mid-course correction by the consultative committee under the chairmanship of PCCF (HoFF) with representation from DDGF, MoEFCC. Similarly, based on the performance of the WP prescriptions the plan period may be extended up to 5 years beyond the stipulated plan period by designated authority on the recommendations of the standing consultative committee authorized for this purpose.

1.6 Compartment-wise area distribution in various Working Circle:

Compartment-wise area distributions in various Working Circles are given in the following table.

Table 1.6a: Statement of areas under various working circles (WC)

Divisional area Statement (Compartment-wise area distributed in various Working Circles) :

Range	Name of the RF	Compt No	Area (Ha)	Perimeter (m)	Sapling /Ha.	Growing Stock cu.m/Ha	JFMC WC	Plant WC	NTFP WC	Soil & Water WC
Dibrugarh	Jokai R F	1	82.058	4137.46	98	222.03	82.058	-	82.058	-
		2	120.491	4831.33	108	121.54	80.00	120.491	120.491	-
		3	211.545	7988.42	-	1.36	100.00	211.545	-	211.54
		4	251.463	8281.64	71	69.14	100.00	251.463	-	-
		5	160.036	6784.39	-	15.52	100.00	160.036	160.036	-
		6	181.152	7114.17	68	14.55	90.00	181.152	181.152	181.15
		7	178.475	6485.70	85	97.36	100.00	178.475	178.475	-
		8	167.731	5544.84	105	65.57	100.00	167.731	167.731	-
		9	254.951	8752.27	59	47.69	-	254.951	-	254.951
		10	240.108	7339.77	12	2.18	-	240.108	-	240.108
	Telpani R F	1	1332.288	27921.80	6	2.08	600.00	1332.288	1332.288	1332.288
Khowang	Dihingmukh	1	3614.282	35287.60	18	0.64	1800.00	3614.282	3614.282	3614.282
		2	1515.420	19976.60	12	0.03	-	1515.420	-	1515.420
		3	749.338	12713.40	-	2.17	-	749.338	-	749.338
Jeypore	Jeypore RF	1	205.291	6541.93	714	630.23	205.291	-	205.291	205.291
		2	267.467	6852.05	582	383.32	-	-	-	267.467
		3	143.238	6148.33	366	274.40	143.238	-	143.238	-
		4	217.355	6268.41	333	271.59	-	-	-	217.355
		5	187.846	6262.08	267	364.06	-	187.846	-	187.846
		6	142.204	5612.37	129	305.44	-	142.204	-	142.204
		7	164.969	6067.78	314	247.71	-	-	-	-
		8	218.965	6489.36	117	63.24	-	-	-	218.965
		9	279.080	10211.60	299	175.68	279.080	-	279.080	279.080
		10	252.739	7900.24	310	331.50	-	-	-	-
		11	250.805	7669.94	402	419.17	-	-	-	-
		12	284.828	7754.04	316	478.06	-	-	-	284.83
		13	365.030	8179.57	232	392.09	365.030	-	365.030	365.03
		14	300.012	13469.30	236	485.01	-	-	-	-
		15	85.924	4267.16	-	388.54	-	85.924	-	-
		16	221.856	6540.32	254	190.91	-	221.856	-	-
		17	144.156	5181.13	-	368.37	-	-	-	144.156
		18	163.099	6169.84	91	317.38	163.099	-	163.099	163.099
		19	192.350	5790.81	82	355.69	-	-	-	192.350
		20	220.986	6958.06	167	290.05	-	220.986	-	220.986
		21	180.564	6124.80	171	328.85	-	180.564	-	-
		22	186.514	6602.22	181	1688.00	-	-	-	-
		23	153.768	5444.84	451	168.68	-	-	-	-
		24	83.252	4212.65	-	372.82	-	-	-	-
		25	108.897	4356.67	-	322.03	-	-	-	108.90

Working Plan of Dibrugarh Division

		26	183.183	7530.59	132	429.15	-	-	183.183	183.18
		27	110.334	4901.26	189	1792.61	-	-	110.334	110.33
		28	363.133	11464.50	151	326.86	-	-	-	363.13
		29	310.331	8011.70	462	114.22	-	-	-	-
		30	365.142	8633.67	406	376.86	-	-	-	-
		31	188.489	7038.86	181	374.06	-	-	-	188.49
		32	198.200	6094.53	176	454.84	-	-	-	198.20
		33	114.682	4427.25	125	229.75	-	-	-	114.68
		34	265.278	6631.72	145	409.46	-	-	-	265.28
		35	144.712	7016.01	378	273.17	-	-	-	-
		36	231.194	6889.50	337	200.27	-	-	-	-
		37	158.819	7757.26	462	2.22	-	-	-	158.82
		38	176.738	5655.09	205	242.16	176.738	-	176.738	176.74
		39	226.502	7608.83	20	515.52	-	-	-	226.50
		40	128.028	5086.05	-	350.87	-	-	-	128.03
		41	102.171	4245.53	140	386.91	-	-	102.171	102.17
		42	140.074	5430.36	181	388.54	-	-	140.074	-
		43	231.781	6658.50	123	300.66	-	-	-	-
		44	113.414	4749.62	-	757.58	-	-	-	-
		45	141.806	4890.96	468	43.26	-	-	-	-
		46	137.845	5216.34	432	140.54	-	-	-	-
		47	335.695	10206.10	771	270.47	-	-	-	335.70
		48	301.131	7060.34	32	425.60	-	-	-	301.13
		49	431.198	9794.62	105	201.33	-	431.198	-	431.20
		50	298.279	7814.44	195	384.57	-	298.279	-	-
		51	115.047	4480.99	586	388.54	-	115.047	-	-
	Jeypore 1 st add		198.20	5604.38	432	367.78	-	-	198.20	-
	Jeypore 2 nd add		144.00	4811.98	336	345.77	-	-	144.00	-
Khowang	Namdang	1	1858.63	29818.30	10	0.47	1200.00	1858.63	1000.00	1840.32
Total of the Division			21794.648	-	-	-	5684.534	12719.815	9046.951	16240.00

CHAPTER 2

Joint Forest Management Working Circle

2.1 Name of the working circle:The name of the working circle is Joint Forest Management Working Circle. Map showing the compartments of this working circle is shown in Figure 2.1.

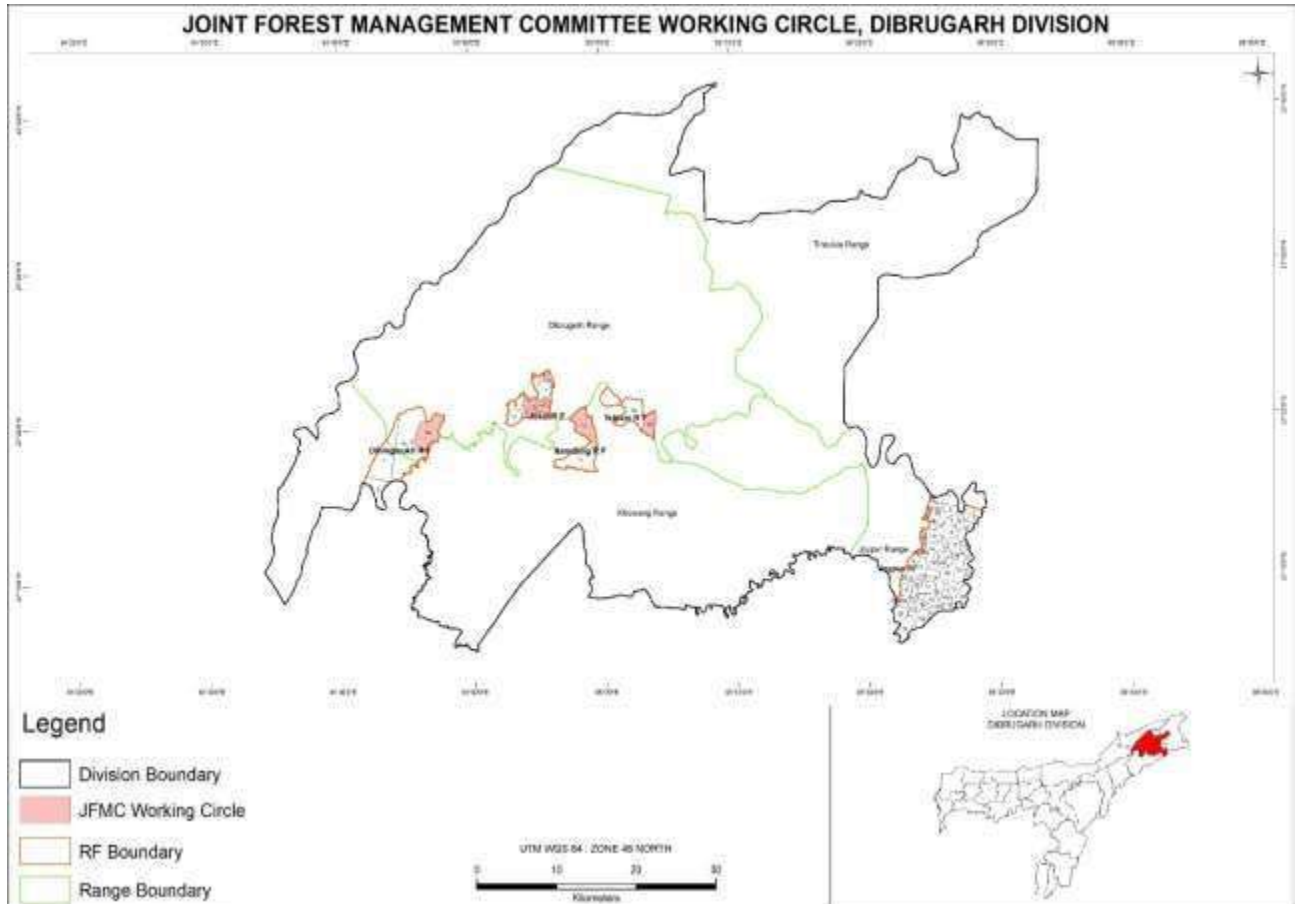


Figure 2.1: JFMC working circle of Dibrugarh division

Joint Forest Management (JFM) involves regeneration and conservation of forests through involvement of village communities in association with the state forest departments. It involves a contract specifying the distribution of authority, responsibility and benefits between villages and State Forest Departments with respect to land allocated for Joint Management. Under this programme, local communities are involved in the management and restoration of degraded forests. The major purpose of the JFM is to protect the forests from encroachments, grazing, theft and fire and also to improve the forests in accordance with an approved Joint Forest Management Plan. In return, the members of these communities are entitled to intermediary benefits like non-timber forest products such as firewood, fodder, etc. The policies and objectives of Joint Forest Movement are detailed in the Indian comprehensive National Forest Policy o

1988 and the Joint Forest Management Guidelines of 1990 of the Government of India. Joint forest management is concept of developing relationships between fringe forest groups and forest department on the basis of mutual trust and jointly defined roles and responsibilities for forest protection and development. The JFM programs are found to have succeeded where the initiative comes from the people's side and it usually fails where it is forced from Forest Department. Villagers themselves are required to voluntarily participate in the program or should be very much interested. JFMC is to be formed in the villages considering forest protection strategy. Each JFMC constitutes a Managing Committee consisting of members elected from general body and ex-officio members representing concern Govt. Deptt. at village level and with local forester as the member secretary. The managing committee is responsible to implement the decision of general body with regard to the execution of JFM works in partnership with Forest Deptt. Memorandum of Understanding (MOU) is signed between Forest Deptt. and managing committee clearly specific the duties and responsibilities of both parties. Entitlement of JFMC members to the share in forest produce is subject to the fulfillment of conditions of MOU.

2.2 General constituents of the working circle: Fringe Villages located within a span of 200m to 500m from degraded, and/or open forests areas of Joypur, Jokai, Namdang, Telpani and Dehingmukh RFs are included in the JFMC Working Circle. In accordance with The National Forest Policy, 1988, local population that intrinsically depends on forest resources for their sustenance participate actively in protection and development of forest from which they derive benefits through the JFMCs. The areas allocated under this working circle adhere JFM principles as outlined by Govt. of Assam vide Notification No. FRW,8/93/75 dated 10th November 1998, protection, maintenance and creation of plantations, by forming Forest Protection and Regeneration Committee of the willing villagers of the adjacent villages.

2.3 General characteristics of Vegetation: The forest type of the working circle as per the classification made by Champion and Seth in their survey of forest types of India - Type IB/C1 Assam Valley Wet Evergreen Forest (*Depterocarpus*) or more commonly known as Upper Assam *Depterocarpus- Mesua* formation. It forms a part of the world heritage of tropical/subtropical wet evergreen forests, multi storied in structure and rich in biodiversity; more popularly known as Rain Forests. The forests of the allocated areas were characterized by multistoried layer of canopy. The forest in this working circle is under pressure and the canopy cover is less than 10 percent. There are movement of straying wildlife into the areas. There are movements of livestock grazing inside the Reserved forest. The common flora are the remnant trees of *Artocarpus* spp., *Toona* spp., *Duabanga* spp., *Cassia* spp., *Mangifera* spp., *Dendrocalamus hamiltonii* and weeds like *Mikania* spp., *Lantana* spp., *Eupatorium* spp., on the open areas. The signature species are generally found inside the Reserved forest and very trees of *Dipterocarpus retusus*, *Shorea assamica*, *Michelia champaca*, *Mesua ferrea*, *Magnolia* spp., *Canarium bangalensis*. *Artocarpus chaplasi*, *Altingia excelsa*, *Ailanthus grandis*, etc. are found in the area under this working circle. In some portion, in patches however two storey canopy cover can be seen. The undergrowth that forms the second canopy comprises of *Myrsine capitellata*, *Osbeckia* spp., *Michenia scandens* - an exotic which invades the forests, suppressing all shrubs and advance growths of trees and intercepting free falling seeds from reaching the ground. However, in all the other areas wide canopy gaps exist.

2.4 Special objectives of Management:

Economic objective: JFMC is a production farm where cultivation of various forestry crops is practiced. This Working Plan will allow practice of horticulture crop, agriculture cash crop, animal husbandry, bee keeping etc. for economic development of rural people. The land for growing such crops shall be shared by the forest department.

Social objective: Uplifting socio-economic condition of rural people by providing employment and catering their need for firewood, timber, NTFP etc. sharing forest management practices and empowering village community shall be other agenda.

Conservation objective: Ensuring involvement of rural people in JFMC programmes will give a positive impact on forest conservation. The usufruct benefits gained out of farming in forest land is reciprocated by the rural villages in the form of helping hand for forest conservation.

The broad objective of this working circle is to protect forest and biodiversity along with socio-economic development of fringe forest villagers. Specific objectives include -

- a) To motivate and convince local people about the moto of the forest department to protect the forest and simultaneously to uplift socio-economic condition of the people and thereby ensure involvement of local people for protection, conservation and management of forests.
- b) To carry out detailed socio-economic surveys in every JFMC/fringe village to accurately assess the dependency of people over forests in terms of timber and other NTFP. And to provide income support to JFMCs by helping them in raising intercrops of naturally occurring, marketable varieties of various medicinal and aromatic plants within the allotted JFMC areas.
- c) To empower village communities to play a crucial role in forest resource conservation and enable them to resolve their issues and problems. People shall be made aware about the benefits of conserving and improving the quality of their plantations against the backdrop of climate change negotiations, particularly, REDD+.
- d) To reclaim the degraded forests by promoting natural and artificial regeneration (through plantation activity) with active participation of the villagers.
- e) To document the indigenous traditional knowledge and incorporate the same in the micro-plans of the JFMCs.
- f) To assess the possibility of converting these areas into production areas in the long run, as envisaged by the NWPC, 2014.
- g) To associate the people of JFMCs with identification, documentation and implementation of ecotourism activities.
- h) To analyse the past working of JFMC and suggest suitable policy modifications required for more effective functioning of JFMCs.
- i) To win over people so that they become willing partners in protection of forests both within and outside the JFMC areas.
- j) People interested in taking up plantations that are commercially viable in their private lands would be given technical guidance as well as seedling support to raise such plantations.

2.5 Blocks, compartment and JFM areas: Blocks, compartment and the area to be covered in this working circle is provided in Table 2.6a. Further, Table 2.6b provides the list of JFMCs and Table 2.6c shows number of beneficiaries in each JFMC.

Table 2.5 a: Village-wise Area details under JFMC working circle

Range	Name JFMC	Name of RF/PRF/Compt	Area allotted in present WP
Dibrugarh	9 Gharia Koibarta F.V., 36	Jokai R F,Compt- 1	82.058
		Jokai R F,Compt- 2	80.00
	Gharia Koibarta F.V., 20	Jokai R F,Compt- 3	100.00
	Gharia Kachari F.V., 31	Jokai R F,Compt- 4	100.00
	Ghoria Kumar F.V., 27	Jokai R F,Compt- 5	100.00
	Ghoria Kaibarta F.V. and 12	Jokai R F,Compt- 6	90.00
		Jokai R F,Compt- 7	100.00
	Ghoria Borbam Tangia F.V.	Jokai R F,Compt- 8	100.00
	Telpani F.V., No. 2	Telpani	200.00
	Rajgarh Vill.	Telpani	200.00
Nagaon Village	Telpani	200.00	
	Range Total		1352.058
Khowang	Tinsukia Madhupur F.V., No. 2	Dihingmukh, Compt- 1	200.00
	Modhupur Deori F.V., No. 1	Dihingmukh, Compt- 1	200.00
	Modhupur DeoriF.F	Dihingmukh, Compt- 1	200.00
	Paraliguri F.V.	Dihingmukh, Compt- 1	200.00
	Modhupur Nepali Vill	Dihingmukh, Compt- 1	200.00
	Gorudhoria Village	Dihingmukh, Compt- 1	200.00
	Medela Modhupur Nahoroni F.V.	Dihingmukh, Compt- 1	200.00
	Modhupur 12 Ghoria Mishing F.V.	Dihingmukh, Compt- 1	200.00
	Thekarapukhuri F.V.	Dihingmukh, Compt- 1	200.00
	Jariguri F.V.	Namdang	200.00
	Majbam F.V.	Namdang	200.00
	BhogalipatharF.V	Namdang	200.00
	Pandhuwa Borhula F.V.	Namdang	200.00
	Borbil Konchgaon F.V.	Namdang	200.00
	Natun Bharali F.V.	Namdang	200.00
	Range Total		3000.00
Jeypore	Abhoypur Village	Jeypore, Compt- 1	205.291
	Kacharipathar Village	Jeypore, Compt-3	143.238
	Tantipathar Village	Jeypore, Compt-9	279.080
	Lebangkula Village	Jeypore, Compt-13	365.030
	Hamukjan Pungjan (Saikya Gaon)	Jeypore, Compt-18	163.099
	Panichukia F.V.	Jeypore, Compt-38	176.738
	Range Total		1332.476
	Division Total		5684.535

NB: Considering requirement and feasibility, DFO may increase, decrease or alter the area of JFMCs to the maximum of 15% in respect of area or location.

2.6 JFMCs in Dibrugarh Division:

2.6.1 Background:The National Forest Policy 1988 envisages massive people's movement for conservation of forest resources. The Govt. of India issued directions to all the State Governments vide letter no. 621/89-PP dated 1st June 1990 regarding framework for creating massive people's movement through involvement of village communities in the protection and management of degraded forest lands. The Ministry of Environment & Forests of Govt. of India issued circular no. 22-8/98-FPD dated February 11, 2000 and no. 22-8/2000-JFM (FPD) dated February 21, 2000 in which detailed guidelines are incorporated for the Joint Forest Management Programme. The Govt. of Assam also issued guidelines to constitute "JFM Committees realising the fact that forest protection cannot be achieved without active participation and cooperation of local people. The quality of forests is degraded near human habitations and protection of these areas cannot be achieved unless there is people's participation and cooperation. The villagers with homogenous population and forest areas having sizable population of SC and ST and other economically dependent people shall be given preference to be included in JFM.

2.6.2 Need for Implementation of JFM:In consonance with National Forest Policy 1988, special emphasis is given to JFM due to increasing biotic pressure, depletion of soil due to soil erosion and degradation of forests. Demand is increasing for timber and fuel wood. Heavy grazing pressure, diversion of forest land for agriculture, industries, housing and irrigation projects etc are putting strain on forests. To check further loss of forest cover and forest area and to regenerate the degraded forests, the below mentioned aspects are given thrust while implementing JFM Programme.

- (1) Protection and management of forests by developing a sense of ownership and belongingness of forests among the local people, to regenerate degraded forest areas with the active participation of local people.
- (2) Increasing the vegetation cover and to carry out soil and moisture conservation works with the active co-operation of local people.
- (3) Involving local people in forest protection and to provide tangible and intangible benefits in lieu of their cooperation in forest protection.

2.6.3 Socio-economic conditions:The population of the Division primarily depends upon agriculture. Some are in Government job including School Teacher.

2.6.4 Status of JFM:In Dibrugarh Forest Division the JFM was started in 2002-03 The details of JFM implementation are given in the table 8.1 (part-I)

2.6.5 Details of villages under JFM in Dibrugarh Forest Division: Number of JFM committees in Division is 30. Area allotted for protection Plantation area 395 hectare. The population depends on agriculture and allied activities for the livelihood and most of the SC, ST population are land less and work as agricultural labourers. The population adjoining forests mostly depend upon forests for day to day needs, naturally causing pressure on forests. The cattle population also causes lot of pressure on forests for grazing. The local people in this area hardly utilize for stall feeding of their cattle. In some pockets grazing by sheep and goats is noticed and they cause extensive damage to the regeneration. Apart from local cattle, migratory cattle also exert pressure on forests in this Division. The most important factor for the implementation JFM is willingness of the local people to participate in these activities. In this regard the guidelines stipulated in “The Assam Joint (Peoples Participation) Forestry management Rule-1998” shall be followed. At present out of 30 committees constituted in the Division, forest area of 395 hectare allotted for taking up plantations and other activities. Any deviation shall be required sanctioned from the competent authority. The participation of woman in JFM shall be encouraged.

2.6.6 Compartments and felling series: Implementation of the prescriptions under this WC is completely voluntary and it is based on willingness of the villagers, therefore neither compartments are allotted nor felling series are formed. It is an overlapping WC which encompasses a good forest area of the Division. The microplans prepared for the area allotted to a particular village of JFM committee shall be in consonance with the prescriptions given for that area under this working plan. Any deviation from the plan requires permission of the competent authority.

2.6.7 Principles and ethics: Certain principles and ethics should be as follows as per guidelines for the implementation of JFM in any village.

- (1) Eco-system conservation and sustainable use of resources is the goal of resource management.
- (2) To enable development of strong institutional system in the long run for JFM implementation it is necessary to have participatory and democratic structure.
- (3) Open communication system and gender equity is of the prime concern.
- (4) Management responsibility and benefit sharing in relation to traditional usage should be ensured.
- (5) The community shall take the responsibility to maintain the system.
- (6) Effective conflict resolution should be ensured.
- (7) Traditional rights and uses shall be respected and rational approach should be adopted in accepting or rejecting same.
- (8) Discrete jurisdiction and proper terms of agreements should be ensured.
- (9) Effective monitoring and appraisal systems should be adopted.

2.7 Treatment prescribed for JFM: In the system of JFM the forest staff must know the principles and approach of JFM. The first and foremost thing is to convince the local people about the importance of forestry and their role in meeting daily needs of them. The villagers who are willing to take part in JFM programme a memorandum of understanding shall be signed. DCF of Dibrugarh Division shall prepare Microplans for the area to be assigned to concerned JFM Committee as provided in the The Assam Joint

(Peoples Participation) Forestry management Rule-1998 and guidelines issued by Govt. of India from time to time.

- The microplan prepared for the particular village shall be in consonance with the prescriptions contained in Working Plan, the microplans shall be sanctioned by competent authority.
- The assigning of forest area to JFM committee and execution of works shall be strictly in accordance with the guidelines issued by Government of India as well as Government of Assam.
- MOU shall be signed regarding forest area assigned to JFM Committee and there should not be any ambiguity in terms and conditions.
- The area allotted to JFM committee should be shown on the map and incorporated in the memorandum of understanding.
- The Micro Plan should be prepared with active involvement of members of JFM Committee on scientific lines and the site specific estimates shall be prepared for the works which would be taken up and sanctioned by competent authority before implementation.

2.7.1 Activities to be taken up: JFM Committees should be involved to take up the under mentioned activities in the area assigned to them.

- (1) Stringent protection of forests allotted to JFM committee.
- (2) Active participation of members of JFM committee in protecting, improving and developing forests.
- (3) Protection of forests from illegal felling, grazing and encroachment, collection of NTFP on scientific lines or non- destructive collection methods.
- (4) Helping forest officials in patrolling and enforcement of law for forest protection. For protection of forests from grazing, integrated efforts should be taken to improve the breed of cattle so that, the income may be increased with less number of cattle. In this regard the Rural Development and other departments should be requested to help the JFM committees. The forest officials will have to play the role of facilitator for implementation of various development works. Necessary legal and moral help should be provided to members of JFM Committee for the protecting forests from illicit felling, encroachment, grazing, fire protection etc.

2.7.2 Active cooperation and participation of people: It is the duty and responsibility of forest officials to create awareness among the members of Forest Protection Committee as well as villagers about the importance of forests, its intangible benefits and protection of the forest from fire, illicit felling, encroachment, grazing, etc. The active participation of local people must be encouraged in management, protection and developmental activities of the forest assigned to them. For achieving effective results in this regard it is required to take up regular efforts like conducting meetings, workshops and visits to successful areas shall be arranged to explain about the protection of forests and achievements in other

villages. A comprehensive fire protection scheme shall be prepared and explained to JFM members for prevention and protection of forest from any destructive factors. The Forest Protection Committee's members shall be made to aware of their duties and responsibilities to have their active participation in the protection and management of the forests. The produce obtained from the assigned areas will play an important role for the improvement of economy of JFM members as well as restoration and improvement of the forest area.

2.7.3 Role of Forest Officials:The role of forest officials in implementing of JFM is as the facilitator as given below.

- (1) Providing technical inputs and support for the activities under JFM and ensure implementation of scientific forest management.
- (2) Creation of awareness amongst the members of JFM Committee about the role and various benefits available.
- (3) The forest officials shall act as facilitators for implementation of various development activities by other departments.
- (4) The responsibility and benefit of local people should be thoroughly briefed by forest officials. JFM requires strong institutional capacity to make collaborative efforts for forest protection and make it successful in getting the economic returns and regeneration of the forests. Therefore the forest officials have to take adequate measures and precautions in formalising participatory management.

2.7.4 Sharing of benefits:Usufruct sharing mechanism under this working circle will include as per the following govt.rules:

- a) Full share of NTFP collection.
- b) Full share in the harvest of timber in plantation raised by JFMC
- c) Share in proportion to the period of management in high forests managed by JFMC
- d) 50% of net revenues to be reinvested in forestry works - a step towards sustainability of JFMCs.

2.7.5 Proposed activities under JFMC working circle:

1. Raising of grafted fruit plants in forest areas, nearby fringe villages.
2. Raising of fast growing timber yielding species such as Azar, Titasopa, Kadam, Bandordima, Hatipoliya, etc. endemic to the division.
3. Raising of firewood species - Kadam, Simalu.
4. Development of nurseries for local forest species with technical guidance from the forest department.
5. Training on bamboo and cane based skill development training for providing employment opportunities.
6. Developing participatory catchment area treatment plans in area under Dibrugarh Division along the catchment of those rivers. DFO should conduct field investigations and initiate watershed

development projects. Looking at the socio-cultural conditions in that area promotion of fishery, poultry with compulsorily forestry activities in the JFMC villages be initiated under the watershed projects.

7. Developing medicinal plants saplings and its plantation on their homesteads.
8. As entry point activities promotion of improved cooking mechanism - biogas, improved chullas, solar lamps etc.
9. Eco-tourism activities shall be developed in the Eco-tourism spots mentioned in Para 8.6 (Part-I).

2.7.6 Additional Prescriptions under JFMC working circle:

- i) Forest department staffs with active participation of JFMC conduct PRA exercises and develop microplans for the socioeconomic upliftment and livelihoods development of the local people. This microplans needs to be submitted to DFO for technical feasibility for final approval of the microplan as per the available government schemes and any other funder's norms. Before implementing the project Government orders, any amendments to be strictly followed.
- ii) There should be monthly review meeting of the JFMCs under the Chairmanship of JFMC president. Range Forest Officer should attend meeting atleast quarterly.
- iii) NTFPs to be collected and sustainably harvested from forest fringe areas under the JFMC and shall be sold by the concerned JFMC.
- iv) Continuous efforts should be made to create and sustain the JFMC movement by creating required awareness among the people and the staff through training programmes.
- v) Agroforestry plantations should be carried out in the encroached areas through the JFMC. In between tree lines ginger, turmeric and other medicinal herbs should be cultivated.
- vi) JFMC areas to practice minimum tillage, organic formulations.
- vii) As entry point activities, development of roads, community hall, culverts, fibre boat/machine boat as per the technical feasibility, for carriage and transportation, construction of drinking water facilities, if mentioned in the microplans.
- viii) System of rice intensification ensures higher productivity with optimum utilizing the resources, may be promoted in JFMC cultivated paddy fields to increase productivity.
- ix) Establishment of biogas plant as an entry point activity based on the microplans.
- x) JFMC plantation assistance will be released as per the standard government norms, funder norms based on the survival of the plants.
- xi) The forest areas and plantations under the control of Joint Forest Management Committee (JFMC) should be mapped out clearly and necessary records maintained in the Beat, Range and DFO office. While doing so, the provisions of guidelines and resolutions of Govt. of Assam may be followed strictly.
- xii) It is considered necessary that the requirements of the members of JFMCs relating to fuel wood, fodder, bamboo, thatch and other non-wood Minor Forest Products is to be met from the forests free of cost as per govt.circular.
- xiii) It is felt necessary that a leadership should be developed from amongst the committee members for

Joint Forest Management. Assistance from local NGOs (if available) may be obtained. Each JFMC should closely interact with the village Panchayats in the interest of forest protection and for all round development of the land resources.

- xiv) JFMC members may be consulted in choosing the species to be planted, keeping due regard to the biodiversity of the area and silvicultural suitability.
- xv) It is necessary to start a publicity campaign for motivating the people for JFM. It is necessary that in DFO's office a separate section may be opened for monitoring the JFM activities in the Division. For better exchange of ideas between different committees a co- coordinator may be appointed by the DFO from amongst the staff for holding experience sharing meeting. Local NGO's, club may be involved in this process.
- xvi) It is considered necessary that the skills of local committee members are required to be harnessed for different arts and handicrafts techniques. Arrangements for necessary training for the beneficiaries may be undertaken through link up with other departments.
- xvii) Soil and land development works may be undertaken in forest areas. Water harvesting structures may be constructed for soil and water conservation and fisheries.
- xviii) The committee members should interact frequently with each other in order to share their experience. Team of JFMC of each division should visit other successful works done in other areas.
- xix) Whereas, demand of planting trees on private land is increasing, the JFMC members may be allowed Social Forestry benefits on their individual land.
- xx) Whereas, the involvement of women in the functioning of those committees is necessary, more & more women should be encouraged to become member of the committees.
- xxi) Whereas, it is felt that the population pressure on forests is increasing and it is desirable that the JFMC members should be mobilized for adopting small family norms. JFMC may be supplied with medicines and other family planning devices.
- xxii) The JFMC members should have a meeting place. A community hall may be constructed for use of the JFMC members.
- xxiii) The Micro Plan is to be prepared for each of the areas covered under JFMC by involving Executive Committee and other members of the JFMC. The Micro Plan' would contain all the prescriptions for management, development of the concerned area including flow of usufruct benefits from NTFPs and short rotation timber species to the beneficiaries. The Micro - Plan should be in conformity with National Forest Policy and Forest Conservation Act.
- xxiv) After formulation of the aforesaid Micro-Plan, it is to be approved by concerned JFMC General Body meeting and also by competent authority of the Forest Department. After approval and adoption of concerned Micro Plan, the prescriptions contained in the Micro- Plan would be deemed to have super ceded the Working Plan of that area to that extent.

xxv) A Divisional Level Review Committee (DLRC) may also be constituted with DFO as the Chairman and concerned Forest Range Officers and Beat Officers as members to review the working of different JFMC under their jurisdiction.

xxvi) No new human settlement in any part of the Reserved Forest should be undertaken, whether under JFM or village grouping or under jhum control scheme or any other scheme except after obtaining clearance under Forest (Conservation) Act 1980.

2.8 Appraisal of functioning of JFMCs

2.8.1 Gradation of JFMC

All existing JFMCs should be graded as per gradation criteria proposed below:

1) Proposed Criteria for Gradation of JFM (Adapted from Forest Dept West Bengal):

Grade A: Regeneration of forest with revival of species, both flora and fauna, that were at the verge of extinction, Crown density above 0.8, No illicit felling, No encroachment/or eviction of encroachment by the JFMC members, Active Participation of JFMC in fire control, if any. JFMC received share out of timber produce as a part of their contribution for forest protection for at least two times. Coordination among JFMC and FD for implementation of forest development Works

Grade B: Regeneration of forest with Crown density between 0.6 - 0.8, Active participation of JFMC members in controlling illicit felling, fire, encroachment, received timber share for minimum one time. Coordination with forest department for implementation of forestry related works.

Grade C: Regeneration of forest with crown density between 0.4 -0.6 Occurrences of illicit felling, fire and or encroachment with lesser involvement of JFMC members to control them, Received timber share for one time only or not. FD faces difficulty in implementing forestry related works by involving the JFMCs.

Grade D: Not much of change in the status of forest from Pre JFM condition crown density less than 0.4 Regular occurrences of Illicit felling Passive role of JFMC in fire and or encroachment control did not receive any timber share. FD faces problem to involve JFMCs in implementation of forestry related works.

2) Based on gradation of JFMC, there should be different approach towards each JFMC

Grade A: Documentation of JFMC work needs to be done and other JFMCs members can be brought here for training and exposure visit. Issue ID cards for JFMC Executive members. Involve them in Anti depredation duties and Forest Protection Duties. Encourage ROs to compulsorily use only JFMC members in operations inside forest.

Grade B: Forest Staff needs to intensify involvement with JFMC and Livelihood training programmes, income generation activities etc. can be done here. ID cards can be issued to JFMC Executive members.

Grade C: Identify community leaders and send them to other States, districts and JFMCs for training programme. Conduct frequent workshops, seminars. Steps towards Capacity building of JFMC members need to be taken. There is need to put in extra effort for rapport building between Villagers and Forest Staff.

Grade D: Identify community leaders and send them to other States, districts and JFMCs for training programme. Conduct frequent workshops, seminars. Increased effort to reach out to the Villagers

2.8.1.1. 360 Degree Assessment Survey: Questionnaire based survey can be done by Range Officer through concerned Beat Officer and the entire findings should be summarized. Such findings should be taken into consideration before gradation of the JFMCs.

Selection of JFMCs shall be based on scoring parameters suggested below. Maximum Score shall be 80. JFMCs scoring below 80 should not be get preference.

Table 2.8.1.1: Scoring pattern for selection of JFMC in Dibrugarh division

Sl. No.	Criteria	Parameters	Score	Source of Information
1	For Existing JFMC	Completion of planned, attendance at meeting, accounts keeping, group cohesion etc	50	Evaluation by DFO and local representative of local NGO based on questionnaire based survey and office records*
2	Level of Poverty	50% & above HH are BPL	10	SECC Data/ Census Data
		40 to 49% HH are BPL	8	
		30 to 39% HH are BPL	5	
		Below 29% HH BPL	1	
3	Level of dependency of the community on forest resources	Forest dependency high(proxy indicator as 50% or more of the total village population is marginal worker)	5	SECC Data/ Census Data and Forest Offence Records and report from RO/BO
		Forest dependency medium(proxy indicator as below 25% and 50% of the total village population is marginal worker)	3	
		Forest dependency medium(proxy indicator as below 25% of the total village marginal worker)	1	
4	Incidences of cattle on humans, crop raiding by wild animals	High	5	HEC or Human Animal Conflict data and Questionnaire based survey
		Medium	3	
		Low	1	
5	Cases of illegal tree felling, poaching etc	High	5	Based on report from RO and BO
		Medium	3	
		Low	1	
6	Relative Location of Village	Common boundary shared with RF is more than 2km	5	Data assembled from Division office Toposheet
		Common boundary shared with RF is less than 2 Km	3	
		Village is located 500 meter away RF boundary	2	

2.8.1.2 ASSAM PROJECT ON FOREST AND BIODIVERSITY CONSERVATION SOCIETY (APFBCS)

Annex JFMC AND EDC OPERATIONAL MANUAL as in Annexure in Vol-II shall be adopted as manual for the JFMC administration and Management which shall guide the JFMC members for carrying out different tasks. The handbook will guide them during managing the JFMC and administer their power and processes. The JFMC Manual shall be 'binding instrument' for the entire Plan period and the JFMC areas unless otherwise mentioned in the rules, Government Orders and instructions issued by Assam FD and GoA will be applicable.

This manual is meant for the JFMC members and Forest Staff. The JFMC members are selected from amongst the beneficiaries who are known as "Forest User Groups. The manual will guide them to create knowledge base, educate and perform.

2.8.2 Need to Establish Maintenance Fund for JFMCs: A majority of forest development activities in the State are undertaken with the support of externally or internally supported projects. After the completion of the Project, special arrangement for maintenance of assets created under the Project are not available. It is therefore, necessary to create a fund that can be used in the post project period for the maintenance of project assets, and also help in the implementation of the statutory working plans including micro plans. The JFM program seeks the support of local communities for conducting and managing forest development activities.

Maintenance Fund: This Maintenance fund is created for the upkeep and conservation of assets created under schemes for the purpose of JFM. Since the JFM program is based on the support of local people for conducting and managing forest development activities, the Maintenance fund is created out of contributions/grants by the local villagers or laborers. The amount to be voluntarily contributed towards this fund is decided by the Gaon Panchayat with mutual consent. This fund can also be created in the name of Corpus Fund, provided there is certain amount of the project set apart from the beginning for use in subsequent upkeep of the created assets of the project, when project ceases to operate. Sometimes it is entirely borne from project and sometimes borne partially from the project and partially out of the cash/voluntary labor contributed by the project beneficiaries. The objective is the same in both the cases.

2.8.2.1. Operation of Corpus/Maintenance Fund: The JFMC will create this fund out of grant or contribution by the local residents/laborers. In case this Fund is created by voluntary contribution by laborers, it will be mandatory for the other villagers who have not made labor contribution, to provide financial contributions. The total fund amount collected by the JFMC will be deposited in bank/post office in the form of a Fixed Deposit. The term period for this fixed deposit will be same as the remaining period of the Scheme. In the post project period, this fixed deposit may not be utilized until necessary. This fund can be utilized after the approval of the Executive Committee for works related to conservation of assets only. After the expense has been made, it will be necessary to get the approval of the JFMC and gram sabha. The expense accounts of the Maintenance fund should be properly recorded and the account should be operated as per the provisions of the Government order.

2.8.2.2. Corpus Fund: This is a special fund which should be created by JFMCs for management and operationalization of income generating activities. The amount for this fund will be deposited in a nationalized bank near to the area and the account for the same will be opened in the name of the JFMC.

2.8.2.3. Operation of Corpus Fund: This fund will be used as per the provisions of the MoU signed between the JFMC and the Forest Department. The fund will be used for the maintenance of JFM activities under the technical guidance of the forest department. These works may be included in Micro Plan. It will be necessary to follow the rules for incurring expenses out of this fund and it cannot be utilized for any purpose other than those specified. The minimum majority of the Executive Committee can decide the utilization of the Corpus fund amount. This expense would have to be approved by the general assembly of the JFMC.

The necessary expenses to be incurred from the fund can be withdrawn only with the joint signatures of the JFMC member secretary and treasurer/ President. The Member Secretary will maintain the accounts for the fund.

2.8.2.4. Audit of Corpus Fund: The first audit of the corpus fund account records will be conducted by the Internal Committee set up by the JFMC for this purpose. The DFO can also form a committee for the purpose of this audit. This committee may include representatives from the forest department, local NGO and JFMC. During the internal audits of the forest divisions there is a provision for auditing the account of 5% of the total JFMCs.

2.8.3. Income Generation Activities and Formation of Self help Groups: JFMCs can decide for several income-generation activities for alternative livelihood particularly low income group of community. They can make Self Help Groups (SHGs) and the front line staff of the forest department can assist them to form the groups.

Villagers living in and around forest areas are mostly from poor and backward communities. Mostly these people are from SC, ST and other backward classes; mostly these people live in Kachha houses where facilities such a potable drinking water and sanitation are not adequately available. Only one member of the household is earning. One member of the family is addicted to alcohol or is suffering from chronic ailments. For such a family it is difficult to arrange two meals a day. Therefore, their livelihoods, living style and petty requirements are made through freely available forest resources. Thus, these people are responsible for degradation of forest resources. In order to reduce dependence of these people on forest resources by ensuring them alternate livelihood, SHG groups are formed so that they can earn money to meet their daily requirements by pursuing some economic activity. SHGs also help them to inculcate habit of savings for bad days from own savings rather than incurring loan from money lender and being in a perennial debt trap.

2.8.3.1. Self Help Groups (SHGs): The guidelines in “A Handbook on Forming Self Help Group, National Bank for Agriculture and Development” may be unscrupulously followed for formation and

regulation of SHGs. The SHGs show us how unity is strength. They show us how self-help could be the best help. It is useful if we can encourage and help poor people to form SHGs. They save very small amounts of money. They lend these small amounts to each other in the SHGs. They also try to solve many of their problems together.

2.8.3.2. Role of forest front line staff in formation of SHGs: Forest frontline staff could explain benefits of forming a group to the villagers. He could help in mobilizing members and organizing initial meetings provide guidance and motivation to president and other members of the groups Help/ assist group in forming formal/ informal rules and maintenance of books of records if required, Help linking the group with other government organizations working in the area for motivation and guidance. Rotation of leadership among different members in each of the meeting is required to ensure active participation of all the members. Help from social development officials could be taken for forming women self-help groups. Ensure adequate marketing system for produce of the group. Continuous review of the activities undertaken by the group and guidance from the specialized is required.

2.8.3.3 Convergence with Govt of India and Govt of Assam Schemes: Efforts may be taken by DFO to tie up with National Rural Livelihood Mission for formation of SHGs and impart skill trainings for rural youths.

2.8.3.4 Training on various alternative livelihood activities for the JFMCs: Once the JMFC is formed they should be exposed to different training programmes to enhance the skill and capacity of the members for the holistic development of the area. The different capacity building training programmes which the JFMC members should undertake would be as follows:

1) Introduction of alternative energy sources: The fuel wood dependency both for bonafide domestic use as well as for commercial sale to semi-urban areas has played havoc with the regeneration of the forests. This resulted in conversion of productive fringe forests into highly degraded state. Therefore, it is very well understood that until the alternate fuel resources are made available to JFMC members for their bonafide requirements it is just impossible to stop fuel-wood collection from the forests. To reduce the consumption of fuel wood in JFMCs households improved biomass chullas (with roughly 48% fuel efficiency), 5 liter pressure cookers, rice husk based bio-briquette machines could be introduced by the forest department.

2) Hands on training: Hands on training on cultivation of MFPs, medicinal plants, pasture development for fodder and plantation of fruit trees/ orchards the economy of the JFMCs is very much depended on the collection as well as sale of the medicinal and aromatic plants. The forest area allotted to the JFMCs with blanks available for the afforestation. Thus in order to boost the economy of the JFMCs an afforestation scheme of high-tech MFP/ Medicinal Plant Plantation could be introduced in the degraded forest area of different states. Under this scheme, plantation could be raised with grafted amla, hilika and baheda and many other locally available species. In case of successful plantation many JFMCs could be benefited.

3) Training on Animal husbandry and poultry farming: A number of programmes are available in the state animal husbandry department for improvement of the cattle and poultry farming. The State forest Department could coordinate with the state animal husbandry department for training and capacity building of the JFMC members on animal husbandry and poultry farming. This could enhance their scope for the additional income and better livelihood opportunities. The prospective training for the JFMCs on this sector could be as follows: Focus on reducing scrub cattle and stall feeding to reduce grazing pressure on the forests, introduction of Azolla fodder to each household. Rice husk in each household should be urea treated. Artificial insemination, vaccination and castration need to be done in collaboration with Veterinary Department. Loan from CF Revolving Fund for providing milch cattle; Training on dairy development and skill development of SHGs in preparation of milk products and management of their own society. JFMCs could be trained on dairy development since almost all the JFMC members possess livestock.

4) Training of other activities: Other activities like weaving, knitting, printing, book binding (if communities have interest/ have traditional practice), Spices preparation unit sewing, tailoring, spinning and weaving unit, Doll and toy making Rope making, bamboo basket making and other products Grain bank Handloom and small scale enterprises etc., making of jam, jelly, processed juice from available fruits Value added products from NTFPS like amla and, medicinal plants at a higher price.

5) Training on Ecotourism: Training involving SHGs/ JFMCs Ecotourism is a form of tourism that involves visiting natural areas- in the remote wilderness or rural environments. According to the definition, ecotourism is responsible travel to natural areas that conserves the environment and improves the well-being of local people. There are seven main characteristics of ecotourism, which involves travel to natural destinations, minimizes impact, builds environmental awareness, provides direct financial benefits for conservation.

(Adopted from Joint Forest Management A Handbook For Front Line Staff of Forest Department & JFMC members, Published by Ministry of Environment & Forests Under JICA funded project "Capacity Development for Forest Management & Training of Personnel", ID-P199)

2.9 Targets of achievements:

Targets of achievements are-

1. To establish 5 nos. community forest nurseries having 1,00,000 seedlings each
2. Area to be protected by JFMC is 5684.535 hectare
3. Plantation 2100 hectares as production forest.
4. Maintenance of 2100 hect for five years.
5. Maintenance of 1648 hect. of existing Plantation.
6. JFMC training and awareness programmes (*4 programs twice a year for ten years, each programme 30 persons*).

- a)40 training.
- b)40 awareness programme.
- c)2400 beneficiaries target.

7. Ecotourism activities in Jokai RF and Namdang RF (*Jeep safari of captured and released wild animals*)

Year-wise physical target of achievement:

Prescribed activity	Physical target over a period of ten years									
	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Estd of 5 nos. community forest nurseries having 1,00,000 seedlings	1	-	1	-	1	-	1	-	1	-
Plantation 2100 hectares as production forest.	210	210	210	210	210	210	210	210	210	210
Joint Forest Management Working Circle (Maintenance) 5040 hect.	-	210	420	630	630	630	630	630	630	630
JFMC training and awareness programmes (4 programs twice a year for ten years, each programme 30 persons). a) 40 training. b) 40 awareness programme. c) 2400 beneficiaries target.	8	8	8	8	8	8	8	8	8	8
Ecotourism in Jokai RF and Namdang RF (<i>Jeep safari of captured and released wild animals</i>)	2	2	2	2	2	2	2	2	2	2

NB: Compartment wise specific location to be decided as per microplan prepared for this purpose.

2.9.1 Proposed activities under JFMC working circle

- a) Raising of firewood species namely Am, Ajar, Toona, Sam, Simalu, Siris, Kadam, Sam kathal, Poma, Toona, Sopa..
- b) Raising of grafted fruit plants namely Mango, Jackfruit, Guava, Amla, Tamarind, Silikha, Bhomora, Arjun in the allotted forest areas.
- c) Development of nurseries for endemic forest species like Hollong, Mekai, Nahar by the JFMC members.
- d) Training on sustainable harvesting of NTFPs and collection, grading, value adding of NTFPs and its marketing.
- e) Developing planting materials of existing (native/naturally occurring/endemic) medicinal and aromatic plants.
- f) Raising of medicinal and aromatic plants in areas allotted for the JFMCs.
- g) Training on bamboo and rattan crafting skill development.
- h) Training on mushroom cultivation.
- i) Promotion of improved cooking mechanism - biogas, improved chullas, solar cooking stoves.
- j) Training on promotion of ecotourism activities.

2.9.2.1: Plantation Models for Fuelwood Plantation and Medicinal Plantations

S.No.	Particulars of works
A	ERECTION OF FENCING
	(a) Erection of full Chain-linked Goat Proof fencing (4' ht. with 10 Gauge, 3" dia link) to be fitted on

	Pre-cast RCC pillars* at 1.8 mt. apart including transportation of fencing materials to site
B	ADVANCE WORK
	Site selection, surveying, demarcation, jungle cutting, burning etc
	Preparation and acquisition of polypot saplings in the field nursery for planting 1100 Nos. Seedlings/ ha at the rate of spacing 3m X 3m
	Preparation of polypot saplings in the field nursery for vacancy filling while planning for raising nursery the mortality should be accounted.
	a) 25% mortality expected during 1st year (to be planted in the field during the 2nd year) ,i.e., 277 Seedlings/ ha
	b) 20% mortality expected during 2nd year (to be planted in the field during the 3rd year) ,i.e., 222 Seedlings/ ha
	c) 15% mortality expected during 3rd year (to be planted in the field during the 4th year),i.e., 166 Seedlings/ ha
	d) 10% mortality expected during 4th year (to be planted in the field during the 5th year),i.e., 111 Seedlings/ ha
	Line alignment, carriage of stacking materials and fixing the stacking
C	CREATION & 1st YEAR MAINTENANCE
	Soil working, carriage of stumps, polypot seedling and planting at the plantation site including, dibbling of seeds wherever necessary to complete raising of plantation with all necessary operation @ 40 DLs/ ha
	Provision for 5 weedings, mulching and fire protection works
	Upkeepment of plantation, and making of inspection path, repairing of fence etc. on day to day basis
D	2nd YEAR MAINTENANCE
	5 weedings, fire protection works
	25% Vacancy filling by 1 year old seedlings from nursery
	Upkeepment of plantation, and making of inspection path, repairing of fence etc. on day to day basis
	Maintenance and protection of field nursery and watch and ward for the plantation area
E	3rd YEAR MAINTENANCE
	4 weedings, fire protection works
	20% Vacancy filling by 2 year old seedlings from nursery
	Protection work, cattle watching, upkeepment of plantation, and making of inspection path, repairing of fence etc. on day to day basis
	Maintenance and protection of field nursery and watch and ward for the plantation area
F	4th YEAR MAINTENANCE
	4 weedings, fire protection works @ 15 dls/ha/weeding
	15% Vacancy filling by 2 year old seedlings from nursery
	Upkeepment of plantation, and making of inspection path, repairing of fence etc. on day to day basis
	Maintenance and protection of field nursery and watch and ward for the plantation area
G	5th YEAR MAINTENANCE
	Climber cutting, weeding & other silvicultural works and fire protection works

	10% Vacancy filling by 2 year old seedlings from nursery
	Maintenance & fencing post replacement
	Upkeepment of plantation, and making of inspection path, repairing of fence etc. on day to day basis
	Watch and ward for the plantation area

2.9.2.2. Medicinal Plants Plantation: Plantation Techniques for Bel, Outenga

a) Bel:

It is a small to moderate sized tree ; branches armed with strong axillary spine 1-3 cm long. Bark dark grey, slightly corky, leaves alternate, 3- foliate, rarely 5- foliate. Flowers greenish-white, sweet scented. Fruits globose, grey or yellowish, shell woody. Seeds numerous, oblong, compressed, with a woolly mucous testa, embedded in a clear mucilage and a mass of yellow or orange-coloured sweet aromatic mealy pulp.

Mode of propagation: Seeds and vegetative. The seed does not retain viability for long and regeneration by root-suckers appears to be the chief mode of propagation in nature.

Seed Collection: The seeds should be obtained from fruits collected off the trees and not from the ground. Ripe fruits are collected during March-May. The rind is opened to release seeds. Separated seeds are washed thoroughly until the mucilage is completely removed and then dried in the sun for a few days.

Sowing Method: The seeds being perishable and recalcitrant, cannot withstand storage for long and have to be sown immediately, after collection, in raised or flat beds. Seeds can also be soaked in water for about 12 hours and then dibbled into poly bags or beds.

Germination: Germination is initiated in 10 to 15 days and lasts for about 20 days.

Germination Percentage: About 56 to 80 %

Nursery Duration: It takes 3 to 12 months to be come plan table size.

Transplanting and after care: The seedlings are ready for planting out in the next season. As the growth is slow in the seedling stage, it may be desirable to retain seedling with undergrowth for another 1 to 2 years, if necessary. Entire planting is done in pits of convenient size. Protection should be provided against cattle and goats grazing and also against certain insect larvae, which bore and breed in the fruits of defoliated trees.

Medicinal uses: Fruits, roots and leaves are used . Ripe fruit pulp is laxative and is reported to be good for the heart and in dyspepsia. Unripe fruits are reported to be useful in diarrhea, dysentery and stomach algia. Roots are reported to be useful in cases of seminal weakness, uropathy, swellings, intermittent fever and gastric irritability in infants. Root bark is reported to be useful in hypochondriasis, melancholia and palpitation of heart and stomach pain. Leaf juice extract is applied externally in abscess.

Harvesting: The Bel will be managed both for roots as well as fruits and leaves. The fruits will be collected from 150 ha area from tress planted at 4m x 4m spacing. The collection of fruit will be done annually after fruiting starts. The leave collection will be done both from all the Bel plants.

Root extraction will be done in one third of area planted with Bel in 1m strip after third year onwards by uprooting the plants. This will lead to age gradation of three years after one rotation.

b) Paruli:

A large deciduous tree with a spreading canopy growing to a height of 9-18 m. It is identified by gray bark with light yellow blaze. The leaves are 30-45 cm long with 7-9 leaflets, petiole and young leaves are bluish violet in colour. Flowers are yellowish with red veins and are in branches. Corolla pale or dark purple, puberulous lobes rounded, crisped crenate pods are about 20 cm long. Curved, pendulous and brown when ripe. Seeds are many and possess membranous wings.

Mode of propagation:Seeds.

Seed collection:Fruits mature in March-May. Fruits are plucked from the trees before dehiscing and then dried in the sun. The fruit dehisces to release the membranous seeds. Ripe seeds are collected and dried in the sun and the seeds are separated. Seeds can be stored in paper packets, but loses viability completely after one year of storage. Seeds number 27,000 per kilogram.

Pre treatment: Seeds are soaked in water for 24 hours.

Sowing Method: Seeds are dibbled in raised beds 15 x 15 cm apart. Sowing in the nursery is done in April-May. The seeds are to be lightly covered by a layer of soil. The beds should be watered sparingly. Germination duration: Germination starts after 12 days and is completed in 15 days.

Germination percent:Germination percent is about 60 or even 70 percent.

Transplanting and aftercare: Seedlings are transplanted after they attain a height of 5 cm, in the month of July. One year old seedlings are planted in the field in 45 cm³ pits.

Medicinal uses: Parts used: Root, Flowers and Root Bark. The roots of this species are known as *Paarulmool* in trade. It is reported to be used to treat intermittent fevers, inflammatory affections of the chest, affections of the brain, dropsy and dyspepsia. The root bark is a constituent of the well known Ayurvedic formulation "Dasmula". Flowers are reported to be given with honey to control hiccup.

Harvesting: This species will be managed for roots . Root extraction will be done in one third of area planted with this species in 1m strip after third year onwards by uprooting the plants. This will lead to age gradation of three years after one rotation.

c) Bhatgilla:

Mode of propagation:Seeds and vegetative,Seed propagation: Seed collection: Ripe pods are collected from December onwards, before they dehisce. Seeds are separated from the ripe pods, after drying in the sun.

Pretreatment: They are soaked in water for 24 hours before sowing. Sowing: Seeds are dibbled in raised beds. Germination: Germination takes place in 5 to 7 days. Germination percentage: Germination is 80 to 90 %

Transplanting and aftercare: The seedlings are ready for transplanting after 3 months. The planting can be done in 45 cm³ pits at a spacing of 6 x 6 m. The root suckers which have started sprouting well are transferred to the field.

Medicinal uses: Parts used: Roots, seeds and Fruits. Roots are reported to be used to treat rheumatism, diarrhoea and dysentery. Seeds are reported to be used as a purgative. The leaves made into a decoction is reported to be given in stomachache and rheumatism and are used externally for enlarged spleen. Tender fruits are refreshing and stomachic. It is one of the Dasmoola drugs.

Harvesting: This species will be managed for roots. Root extraction will be done in one third of area planted with this species in 1m strip after third year onwards by uprooting the plants. This will lead to age gradation of three years after one rotation.

d) Hilika:

Tree 10 -15 m. tall. It is identified by dark brown bark exfoliating in irregular woody scales and presence of pair of large glands at the top of the petiole. Leaves pubescent, ovate-oblong, obtuse at apex, rounded at base. Flowers greenish - white, fragrant in terminal spikes. Fruit greenish- yellow, ovoid Stone is very thick, bony, rough, grooved with gum vessels on the wall.

Mode of propagation: Seeds and vegetative. Ripen fruits are seen between January and March. Yellow fruits are collected, seeds are dried in shade and stored in gunny bags for a year.

Pretreatment: Freshly fallen ripe fruits are collected and allowed to ferment in cow dung lurry for two weeks or more till the seeds show signs of germination. Another method is to de-pulp as soon as fruits are collected, the seeds are then soaked in tepid water for 4-6 days.

Sowing Season: Seeds are either sown in nursery beds in March -April or directly sown on the field in June-July. March-April (Nursery) & June -July (Direct).

Sowing Method: Pretreated seeds are sown on the nursery beds in lines of 20 cm apart and seeds 5 cm apart lines. Direct sowing in the garden can also be taken. The seeds are dibbled at 1 m. apart and covered with soil about 1-1.5 cm. deep. Nursery be well shaded against the sun.

Spacing: 20 25 cm.

Germination percentage: about 60 %.

Germination: Seeds take 10 to 30 days to germinate.

Transplanting and aftercare: Transplanting in case of nursery raised seedlings or saplings is done in June-July when the plants are about one year old. Transplanting of seedling or planting stumps is done in pits of 45 cm³ or crow-bar holes at a spacing of 10 2 10 m after the start of rains About 18 percent of the transplants established themselves. Regular watering is necessary.

Medicinal uses: The fruits are laxative and reported to be for treating wounds, ulcers, inflammations, gastropathy, flatulence, jaundice, skin diseases, leprosy, intermittent and cardiac disorders. The fruit pulp is used in dentifrices.

Harvesting: The fruits are collected biannually.

e) Bhomora:

A lofty tree often with buttresses. Bark smooth, yellowish-brown with shallow vertical fissures. Branches monopodial. Leaves crowded towards at the end of branchlets, alternate, broadly elliptic, to obovate, obtuse, thick, coriaceous, glabrous Flowers greenish-yellow, sessile on slender, axillary short,

pedunculate spikes. Fruit is a fleshy drupe obovoid or sub globose with grey velvety wooly hairs and a hard thick wall. One seeded and surrounded by a green tissue.

Soil: It grows on a wide range of soils provided moisture in the soil is not deficient. Best growth is seen in deep ,moist ,sandy loam with good subsoil drainage.

Mode of propagation: Seed and vegetative.

Seed Collection : Light green or white flowers with a strong odour of honey appear between April-June, Fruits ripen between November to February .Fruits are collected from healthy trees, depulped seeds are dried in sun and stored .Seeds are viable for a year but their germination percent will be reduced to 40 or 50 percent.

Pretreatment: Seeds are soaked in water for 24 hours for better germination. Fermentation or cow dung slurry treatment for two weeks or more until the seeds show sprouting is also recommended. As a pretreatment ,immersion in hot water (80° to 100° C) and then allowing it to cool followed by soaking for 24 hours is also employed.

Sowing Season:March-April (Nursery) & June-July (Direct).

Sowing Method:Direct sowing of seeds or by planting out nursery raised seedlings.Soaked seeds are sown on the nursery beds in lines of 20 cm apart and seeds 5 cm apart lines. Direct Sowing in the garden can also be taken up in June-July at the start of rains. The seeds are dibbled at 1 m apart and covered with soil about 1 cm-1.5 cm deep.

Spacing: 20 x 25 cm.

Germination: Germination takes about 10 to 40 days.

Germination Percentage:65 to 70%.

Transplanting and aftercare:Transplanting in case of nursery raised seedlings or saplings is done in June-July when the plants are about 3 to 4 months old. About 52 % plant establish successfully. Regular weeding and watering is necessary. When seedlings are 3 to 5 cm tall they are shifted to polybags.

Medicinal uses:The fruits are used as a purgative. The oil extracted from the seeds is applied to the hair and for rheumatic swellings. The fruit pulp finds use in ophthalmia. The fruits are useful in cough, bronchitis, insomnia, vomiting, skin diseases, leprosy, fevers, ulcers and general debility. The mature fruit and dry fruit is constipating and is useful in diarrhea and dysentery

Harvesting: The fruits are collected annually

f) Giloy

Tinospora Cordifolia Miers. Family- Menispermaceae. A large extensively spreading, perennial woody climber with succulent stems. Leaves simple, alternate, cordate-ovate; flowers unisexual dioecious, yellow. Fruit of 3 shortly stalked subglobose drupes.

Common Names:Guduchi, Amrita, Gurach, Tinospora.

Part Used: Stem.

Nursery Raising and Planting: The plant is cultivated by stem cutting in the month of May-June. It requires some support preferably Neem and Mango trees, such plants are supposed to possess better medicinal values.

Manures, Fertilizers and Pesticides: The medicinal plants have to be grown without chemical fertilizers and use of pesticides. Organic manures like, Farm Yard Manure (FYM), Vermi-Compost, Green Manure etc. are proposed to be used as per requirement of the species. To prevent diseases, bio-pesticides would be applied (either single or mixture) from Neem (kernel, seeds & leaves), Chitrakmool, Dhatura, Cow's urine etc.

Harvesting/Post Harvesting Operation: Mature plants are collected, cut into small pieces and dried in shade.

Yield: Approximately 8-10 q./ha.

2.9.2.3. Firewood Plantation: Choice of Species for Firewood Plantation: *Albizia lucida*(Siris) and Firewood Plantation, NTFP and Medicinal plants cultivation can be undertaken by JFMC members. Firewood plantation shall meet their demands for fuelwood.

2.9.2.4 Entry Point Activities: Entry point activities like community halls, improvement of village road, well, extension of Village School and Solar lighting facility, Solar elephant proof fencing etc. can be proposed.

2.9.2.5 Capacity Building through Alternative Livelihood Programmes(as mentioned above): Training programmes for Mason, Electrician, Heavy Machinery Drivers, Beauty Parlours, Computer Training for desktop publishing etc. can be organised for youths. Skill development programmes can reduce pressure on forest.

2.9.2.6 Other Miscellaneous Regulations: Preparation of microplan. Active participation to be encouraged in preparing the micro-plan, which emphasizes the local needs and demands. Proper implementation of microplan after approval must be ensured.

2.9.2.7 Training Programmes and formation of SHGs: The SHG formation shall be as per Guidelines issued by NABARD and linked up with various Government welfare schemes. Local Block Development officials or project managers of Govt Schemes shall be involved.

2.9.2.8 Management of JFMCs as per APFBC Manual for JFMC: As mentioned earlier the entire operation and management of JFMCs shall be as per the APFBC manual.

2.10 Revenue Projection: As the Working Circle deals with creation of plantations and nursery and no harvesting prescriptions are given except NTFP for fulfilling domestic need of local population, there is no scope of revenue collection.

CHAPTER 3

Plantation and Regeneration Working Circle

3.1 Name of the Working Circle: Plantation and Regeneration Working Circle. The detail map of this working circle is shown in Figure 3.1a.

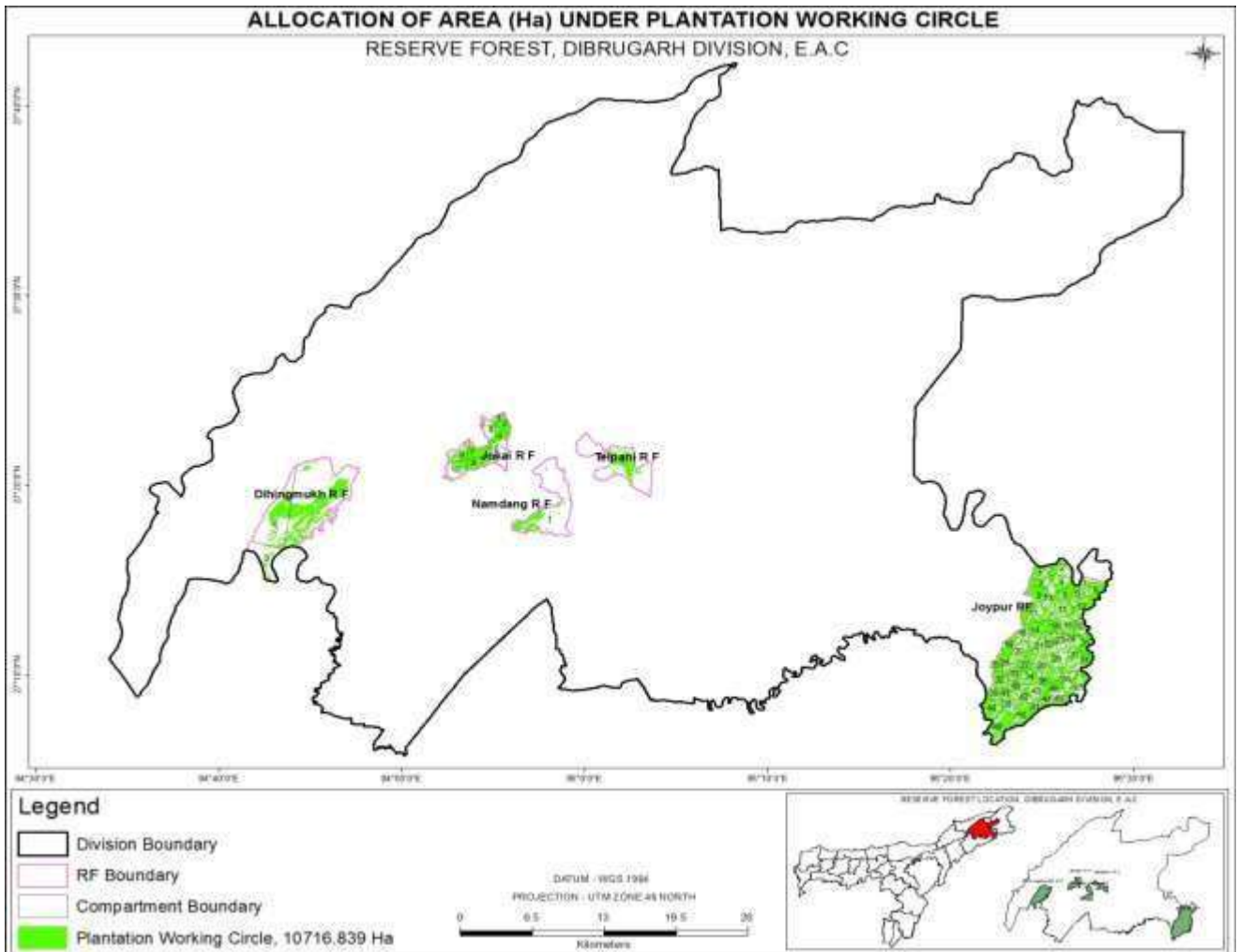


Figure 3.1.a: Map of plantation and regeneration working circle as per the existing working circle.

3.2 General Constitution of the working circle: All the areas of forest with density 10% to 40% and 40% to 60% will be covered under this working circle. The main emphasis is to improve the forest cover and cover all these areas with endemic tree species. For regeneration especial emphasis will be given to improve the status of Hollong, Mekai and Nahor growing areas in the Division.



A forest nursery of Dibrugarh Division

The multi-storeyed forests characterised, with dominant species as Hollong (*Dipterocarpus retusus*) reaching a height of 40 metres and girth up to 4-5 metres. Mekai (*Shorea assamica*) also occupy the top canopy along with Hollong over limited localities, especially on slightly higher elevations with good drainage and found to occur in patches. Other species which are found to occur in the top canopy sporadically are Sopas, Dhuna, Sam, Jutuli, Amari, Barpat, etc. Hollong prefers well drained soil and its best expressions are found in old alluvium of river.

The plan is focused to enhance the growing stock through this working circle with an aim to sequestrate significant amount of carbon and improve the flow of ecosystems services and also improve the socio economic conditions of the fringe populations. Through this plantation and regeneration working circle to cover existing plantations done by the department, blanks and under stocked areas not suitable for ANR, clear felled areas, road side, river side, railway side areas and lands under compensatory afforestation etc. which are suitable for plantations will be identified and allocated to different years of plan period along with prescription of sustainable management. Every effort shall be made to restore the ecology of such areas to their previous status. All the plantation areas shall focus on enhancement of the carbon stocks. Effort shall be made to register such plantations under REDD+. Periodic monitoring of carbon stocks in such areas would require support from the state government in the form of instruments and subject matter experts.

3.3 General characteristics of vegetation: The forest in this Division is rich in biodiversity. The forest type of the overlapping working circle as per the classification made by Champion and Seth in their survey of forest types of India – Type IB/C1 Assam Valley Wet Evergreen Forest (*Depterocarpus*) or more commonly known as Upper Assam *Depterocarpus* – *Mesua* formation. It forms a part of the world heritage of tropical/subtropical wet evergreen forests, multi storied in structure and rich in biodiversity; more popularly known as Rain Forests. The predominant species namely *Dipterocarpus retusus* reaches a height of 50 metres and above and girth up to seven metres. *Shorea assamica* is also visible in the top canopy along with *Dipterocarpus retusus* over a limited locality especially in slightly higher elevation with good drainage. Other species which are found covering the place in the top canopy are *Michelia champaca*, *Mesua ferrea*, *Magnolia* spp., *Canarium* spp., etc. The middle storey is dominated by

Messua ferrea. Other species found in this canopy are *Terminalia chebula*, *Syzygium cuminii*, *Sapium baccatum*, *Dysoxylum binectariferum*, etc. In some areas, there occurs a third storey occupied by *Dendrocalamus hamiltonii*, *Livingstonia jenkinsonii*, etc. The undergrowth comprises of woody shrubs like *Myrsine capitellata*, *Osbeckia* spp. *Laportea crenulata*, Shrubs like *Phrynium placentarim*, *Alpinia allughas* etc. Climbers are numerous and found growing profusely, common among them are *Thumbergia grandiflora*, *Bauhinia vahlii*, etc. wherever there is an opening *Michenia scandens* – an exotic, invades the forests, suppressing all shrubs and advance growths of trees and intercepting free falling seeds from reaching the ground.

3.4 Compartment under Plantation Working Circle: Compartment and the area to be covered in this working circle is provided in Table 3.4.

Table 3.4: Area details under Plantation working circle of Dibrugarh Division, Assam

Range	Plantation & regeneration Series.	Name of RF/PRF/Compt	Total area (Ha.) of the WC	Area earmarked for plantation
Dibrugarh	Jokai Plantation Series	Jokai R F,Compt- 2	120.491	40.491
		Jokai R F,Compt- 3	211.545	111.545
		Jokai R F,Compt- 4	251.463	151.463
		Jokai R F,Compt- 5	160.036	60.036
		Jokai R F,Compt- 6	181.152	91.152
		Jokai R F,Compt- 7	178.475	78.475
		Jokai R F,Compt- 8	167.731	67.731
		Jokai R F,Compt-9	254.951	254.951
		Jokai R F,Compt-10	240.108	240.108
			Telpani Plantation Series	Telpani
	Range Total		3098.24	1828.24
Khowang	Dihingmukh Plantation Series 1	Dihingmukh C-1	3614.282	1814.282
		Dihingmukh C-2	1515.420	1515.420
		Dihingmukh C-3	749.338	749.338
	Namdang Plantation Series	Namdang C-1	1858.63	658.63
	Range Total		7737.67	4737.67
Jeypur	Jeypur Plantation Series	Jeypur C-5	187.846	187.846
		Jeypur C-6	142.204	142.204
		Jeypur C-15	85.924	85.924
		Jeypur C-16	221.856	221.856
		Jeypur C-20	220.986	220.986
		Jeypur C-21	180.564	180.564
		Jeypur C-49	431.198	431.198
		Jeypur C-50	298.279	298.279
		Jeypur C-51	115.047	115.047
	Range Total		1883.904	1883.904
	Division Total		12719.815	8449.815

3.5 Objectives of the Working Circle: The broad objective of this working circle is to reclaim the degraded forests of this Division through massive plantation works. Specific objectives are given below –

- a) Plantation immediately after eviction of encroached areas with native species.
- b) Improve the tree cover and density class by plantation in areas presently with less than 10%, 10% - 40% canopy cover.
- c) Assisting natural regeneration especially in 40 – 60% canopy cover areas.
- d) To maintain the terrestrial ecosystem in and around the wildlife habitat areas.
- e) To initiate researches on the growth patterns, carbon sequestration.
- f) Initiate research on tree improvement and genetic resources studies to enhance growth of the forest tree species.

3.6 Activities proposed to be undertaken are-

1. Plantation and regeneration works = **8450.00** hectares
2. Maintenance of plantation = **8450.00** hectares x 5 years

3.7 Strategy: Block plantation will be promoted in open forest areas and assisted natural regeneration shall be promoted in moderately dense forest areas. The regenerative capacity of the endemic species, species that wildlife prefers shall be enhanced. A total ecosystem conservation concept will be adopted for raising the plantations. An effective naturalization plan needs to be devised based on principles for maintaining natural diversity. To enrich the low diversity areas, efforts may be made to restore native complementing natural species rather than planting as many different kinds of trees as possible without looking into the natural regeneration and the needs of the natural fauna of the site. Further, introduction of exotic species in the area will be restricted and plantation of both, slow and fast growing native species of herbs, shrubs, and trees may be promoted.

the forest and fringe villages in plantation and regeneration activities to be ensured so that local population Involvement of local communities especially youths, women from participate in maintaining the forest and avoid any illegal activities which can cause further forest degradation. The efforts therefore are to impose restrictions on local populations through participation in purview of legal and allow traditional practices to continue to ensure their long-term success. For this purpose capacity building programs may be taken up.

3.8 Method of treatment: Hollong being a shade bearing species in the early stage prefer diffused light and moist conditions with well-drained soils. Two storeyed high forest silvicultural system is to be followed where the crop will be obtained by under planting a high forest after it has been opened up removing the matured trees above some girth limits remaining the balance as advance growth. The general performance of Hollong, Mekai, Nahor in this tract is presently not very encouraging perhaps due to the changing climate, anthropogenic disturbances and may be alteration of the hydrological regime. Regeneration and growths achieved except in few patches are not satisfactory, besides, almost all the areas are considered suitable earlier. Hence further planting of the species by clear felling of forest is not

prescribed, though it may be raised along with other species in open and well-drained areas where it performs better. Series for plantation and regeneration that will be formed is described in Table 3.10.

3.9 Rotation and conversion period: The performance of *Depterocarpus retusus* (Hollong), *Shorea assamica* (Mekai), *Terminalia myriocarpa* (Hollock), *Mesua ferrea* (Nahor) is not satisfactory in the Division except in selected patches. In previous working plan, a girth limit of 1.80 m was considered to be the optimum size for exploitation. The growth conditions for Mekai being almost similar, both species can have the similar rotation. Existing data on the age-dia (*over bark*) curve of Hollong, Mekai, Nahor, in the Division reveals that Hollong accumulates a volume of 0.15 cubic meters, Mekai 0.10 cubic meters while the others species including Nahar, Hollock, Sam, Sopa ranges from 0.03 to 0.03 cubic meters. However, changes in environmental conditions quickly outdate yield tables, static models, and standard silvicultural prescription measures, which assume a closed system character and constant or steady-state site conditions. So the growth data especially the increment is to be reworked.

The purpose is to increase the growing stock of the Division with an aim to enhance carbon sequestration, Hollong and Mekai being categorized as a vulnerable species, its fruits irregularly with varying seed yield, good stocked stands should be well maintained. Any plantations will only be properly tended and protected until their harvest. During this plan period, plantations are to be thinned to required density of the results are to be assessed in future years and fresh look has to be taken regarding rotation age accordingly. The value of endemic plants from the perspective of their capability to sequester carbon has been increasing unabated. Therefore, such valuable plantations deserve much attention than what they have received so far.

3.10 Thinning:

Thinning is considered as principal tending operation. The aim of thinning is to achieve appropriate stand density and enhance diameter growth. In Dibrugarh Forest Division, there is provision for thinning in each compartment of Plantation Working Circle. The thinning is targeted for sapling, pole and young trees within the compartments. Proper method for thinning operation is lacking in the Division. The spacing between the stems depends upon the size of stem to be retained after thinning. Number and average size of stem need to be assessed to fix the required number of stem in compartment. For this objective, the condition of pole and sapling in each compartment requires further assessment.

Year wise thinning sequence is not prescribed to give DFO flexibility in the field. Though, broadly 'A' grade thinning (Light Thinning) has been prescribed; thinning operations will depend upon the density of the crop. Therefore, marking and thinning operations will require much care in the field. It is therefore, kept in the discretion of DFO to select the area. However, in one year 1/10th of the total area of this WC will be taken up. The prescribed rules for marking officer should be followed properly. Thinning operation will be done only once during the plan period in normal conditions in a particular area. However, if an area needs special attention; it can be revisited in the fifth year after proper deviation is sanctioned prior to working in the area.

3.10.1 Principle of Thinning to be Followed: In order to carry out thinning, the field foresters should have a clear idea of trees which are leading in the struggle for existence and are promising from the point of view of future growth, the potential growing capacity of a site and the optimum number of trees that should be retained to make full use of the site. In Irregular crops "ordinary thinning" is carried out. In this case felling starts from the lower most canopy or crown classes and progress gradually to higher canopy or crown classes. So, it is called "low thinning" or German thinning or 'thinning from below'. But now the more commonly used term for such thinning is ordinary thinning.

In the past, thinning was not done in the Plantation as there was no approved Working Plan. Thinning is prescribed in the plantations by taking into account the average site quality class of the area. Under this Plan, only four thinnings are prescribed. The first two thinnings are mechanical cum silvicultural and other two are silvicultural thinning. Significant number of trees are to be retained after the first thinning so as to compensate towards damages caused by wild elephants, which is quite common in this area. The details of the thinnings regime recommended are given below:-

- i. First mechanical cum silvicultural thinning at the 10th year by retaining about 70% of the total trees by marking the stems silviculturally in the alternative diagonals.
- ii. Second mechanical cum silvicultural thinning at the 20th year by retaining about 50% by marking the trees silviculturally in the alternate lines.
- iii. First silviculture thinning at the 30th year (leaving about 35% of the balance trees).
- iv. Second silviculture thinning at the 40th year (leaving about 15 % of the balance trees).

3.10.2 Guide for Thinning:

Thinning are to be carried out comparing the growing stock with that given in yield table for certain age and specific site quality for ordinary C grade thinning.

- i. Site quality may be ascertained first by measuring top diameter and height of crop.
- ii. Age of the plantation to be ascertained from record or from age/dia curve drawn from yield table.
- iii. The basal area of the stock of plantation is to be determined using Wedge Prism or Relascope.
- iv. The basal area figure/ha thus obtained should be compared with yield table figure against the crop age and for that particular site quality class. Care should be taken not only to compare the number of trees/ha as per yield table but also the basal area as per the age of the crop.

Thus requirement of thinning for a particular plot may be ascertained and to be followed by marking.

- v. In between marking and felling recheck is to be made in similar method as to whether the marking is proper or not. Over thinning must be avoided.
- vi. The exercise must be done by an officer not below the rank of Assistant Conservator of Forests for thinning.

3.10.3 Marking Rules for thinning: The following instructions are included for guidance of marking for thinning.

- A. In older plantations where growth differentiation has already set in, follow the steps given in Para

3.10.2 and for silvicultural thinning marking may be done as follows.

- i. Mark all dead, top broken, mid broken, uprooted and suppressed trees.
- ii. Mark all mal-formed or crooked trees provided no large gaps are created.
- iii. Mark all stems of inferior species interfering with dominant commercial species.
- iv. Rare, endangered and threatened tree species, if any, should not be marked.
- v. In case of any doubt regarding removal or otherwise of a tree, decide in favour of retention.
- vi. Care should be taken that no permanent opening of the canopy should result due to the thinning

B. In younger plots without crown differentiation-

- i. Where material spacing is 2.00 m x 2.00 m, the first thinnings from 10th year thinning is to be carried out. If the spacing of plantation is 3.00 m x 3.00 m or more, the first thinning may be skipped or may be done at the discretion of the DFO after taken up due care and calculation as given in Para 3.10.2.
- ii. Remove dead, top broken, mid broken, uprooted and suppressed trees.
- iii. The spacing out should be done mechanically by removing alternate stem in each thinning.

Importance is given to retain a definite number of trees with appropriate basal area after the thinnings. This is to ensure that any subsequent variation in the number of trees in the plantation at the time of thinning should not result in excess thinning of plantation.

The prescriptions laid down above should be followed in all the plantations where regular thinnings have been carried out in the past. But in case the thinning regime as given in the previous plan has not been followed in the past it is not desirable to reduce the number of stems as per these prescriptions at one stroke as such action may cause opening of canopy and consequently invasion of weeds and also make the stand susceptible to wind damage. In such cases, gradual reduction of excess number of stems during the next thinnings or over a period of time will be desirable. Modified thinnings in such plantations are proposed from this point of view. In case if more number of trees are found in certain pockets of the same plantation where overall number of trees per ha. is less in that case desirable number of trees may be felled to remove the congestion after verification and marked by the Deputy Conservator of Forests and/or Chief Conservator of Forests. Care should be taken so that sufficient number of trees per ha. is retained to fulfill the requirement of prescribed thinning regime for the particular closely spaced trees.

C. For guidance of thinning in congested patch and in areas where plantation (regeneration) details are absent, to follow Laurie's Formula.

Laurie's Formula: $S = 1.5 (d + 3)$ {Where S = average spacing in feet in triangular spacing; d = average crop diameter in inches} may also be used for this exercise.

By using this formula, the desired triangular spacing for a given plantation is estimated to work out the number of plants to be retained. This formula is very useful when one does not have the history of past thinning of a plantation. The guiding principle is the number of trees with better crown, stem-form and free from the attack of pests and diseases, to be retained with even spacing. The number of sound trees retained after any thinning should be as per the number worked out by using Laurie's formula. This

method of thinning has merits as well as some constraints. It is easy to fix the required distance, more objective, technically standard and reduces the personal error but it demands relatively more skilled human resource for enumeration and measurement especially for identifying stems to be retained with the help of GIS.

- ii. The spacing and desirable number of trees per hectare by diameter (BH) are given in table 2.6.11.a. However, the number of trees to be retained may be increased considering local conditions, threats etc. as found fit by the DFO.

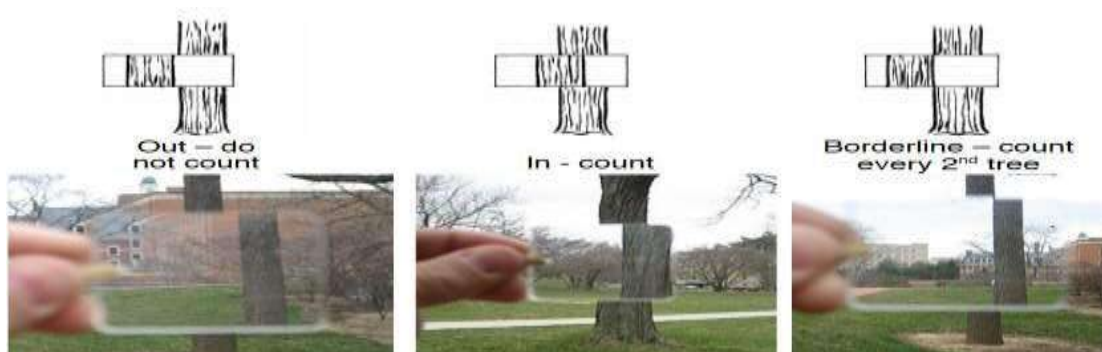
Table 3.10.3a: The designed method for thinning

Diameter	Spacing	Minimum No of trees to be retained/hect	Considering local conditions may be increased upto 10% or more
10 cm	3.15 m	1170	+ 120
15 cm	4.00 m	725	+ 80
20 cm	5.00 m	460	+ 50
25 cm	5.86 m	340	+ 40
30 cm	6.81 m	250	+ 30
35 cm	7.66 m	195	+ 20
40 cm	8.64 m	155	+ 20
45 cm	9.46 m	129	+ 15
50 cm	10.36 m	108	+ 10

Measure Basal Area using Wedge Prism

1. Hold prism (not your eye) over the selected point at a comfortable distance from the eye, with the long side horizontal. Hold prism with right hand by lower part of the thicker edge.
2. With one eye closed, point with the upper part of the prism so as to divide the tree in question at breast height. Refraction of light through the prism will cause the portion of the tree below breast height to appear separated. Count as 1 all of the trees whose figures are superimposed, as 1/2, or measure for accuracy those which touch only at the edge. If they do not touch each other they are not counted.
3. Turn in a circle, checking each visible tree, making sure not to count the same tree twice.
4. The number of trees counted, multiplied by basal area conversion factor of prism gives us the basal areaper stand acre.

$$BA/Acre = (Total\ number\ of\ trees\ counted \times BAF\ of\ prism) / (Number\ of\ samples)$$



3.10.4 Subsidiary Silvicultural Operation: These will be done in the year following the thinning and consist of: Cutting back of all damaged stems of Sal and its associate species provided there is over head light and there is, otherwise, hope of obtaining better stems; Climber cutting of exotic species only. Careful disposal of refuse & fire control measures to be ensured. Grazing should be strictly prohibited in the regeneration areas. Pole, firewood etc. derived from thinning operation may be given to the JFMCs on priority basis. The area check of plantation areas and periodical inspection of plantation forms and journals must be maintained for each plantation plots.

3.11 Felling Cycle: No felling cycle has been prescribed for this working circle.

3.11.1 Exploitable Girth: No exploitable girth is proposed for this working circle since no felling is prescribed for the plan period. It may be decided in the subsequent revision of the plan. However, removal of dead, dying and decayed trees may be done after its examination by the DFO.

3.11.2 Calculation of Yield: No annual yield is prescribed under this working circle during the plan period. However, yield from removal of dead, wind fallen trees will be only operated on prior approval of the Circle Conservator judiciously as per the silvicultural procedures. Considering that various fast growing species will be harvested at financial rotation of 20 years and other hardwood species at 40 years the average rotation is assumed at 30 years. Therefore, for sustainable harvesting of plantations, entire area of working circle is supposed to cover under afforestation within 30 years.

3.12 Regeneration:

3.12.1 Sequence of regeneration: Allotment of area in different plantation series of the Reserved Forests for sequence of annual regeneration is presented in Table 3.12a.

Table 3.12a: Sequence of regeneration proposed (Year-wise Plantation activities in Compartments)

Plantation Series.	Name of RF/PRF/Compt	Area allotted in WC	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Jokai P. Series	Jokai R F,C- 2	40.491	21	-	-	-	-	-	-	-	-	20
	Jokai R F,C- 3	111.545	25	25	25	-	-	-	-	-	25	12
	Jokai R F,C- 4	151.463	25	25	25	25	25	27	-	-	-	-
	Jokai R F,C- 5	60.036	-	20	20	-	20	-	-	-	-	-
	Jokai R F,C- 6	91.152	-	-	-	-	-	20	20	20	20	11
	Jokai R F,C- 7	78.475	-	-	-	-	-	-	20	20	20	18
	Jokai R F,C- 8	67.731	-	-	-	20	20	28	-	-	-	-
	Jokai R F,C-9	254.951	25	25	25	25	25	25	25	25	25	30
	Jokai R F,C-10	240.108	20	20	20	25	45	30	30	20	20	10
PS Total		1095.952	116	115	115	95	135	130	95	85	110	101
Telpani P. Series	Telpani	732.288	50	100	100	100	100	100	50	50	50	32
PS Total		732.288	50	100	100	100	100	100	50	50	50	32
Dihingmukh P. Series	Dihingmukh C-1	1814.282	150	200	200	200	115	150	200	200	200	200
	Dihingmukh C-2	1515.420	150	150	150	200	100	200	115	150	150	150
	Dihingmukh C-3	749.338	75	75	75	75	75	75	75	75	75	75

PS Total		4079.04	375	425	425	475	290	425	390	425	425	425
Namdang P. Series	Namdang C-1	658.63	70	70	70	70	70	65	65	65	65	49
PS Total		658.63	70	70	70	70	70	65	65	65	65	49
Jeypur P. Series	Jeypur C-5	187.846	20	20	20	20	20	20	20	20	15	13
	Jeypur C-6	142.204	15	15	15	15	15	15	15	15	12	10
	Jeypur C-15	85.924	10	10	-	10	10	-	10	16	10	10
	Jeypur C-16	221.856	25	25	25	25	-	22	25	25	25	25
	Jeypur C-20	220.986	25	25	25	25	21	-	25	25	25	25
	Jeypur C-21	180.564	20	20	20	16	20	20	20	15	15	15
	Jeypur C-49	431.198	45	45	45	45	35	36	45	45	45	45
	Jeypur C-50	298.279	30	30	30	30	30	30	30	30	30	28
	Jeypur C-51	115.047	15	10	10	10	10	10	10	10	15	15
PS Total		1883.904	205	200	190	196	161	153	200	201	192	186
Division Total		8449.815	816	910	900	936	756	873	800	826	842	793

NB: Considering feasibility, existing stock and priority with respect to necessity of restocking immediately to avoid possible encroachment, DFO may allow deviation to an extent of 25% in terms of location/area.

Table 3.12b: Year-wise Plantation and maintenance activities prescribed (Whole Division)

Activity	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Plantation	816	910	900	936	756	873	800	826	842	793
Maintenance		816	1726	2626	3562	4318	4375	4265	4191	4097

3.12.2 Prescriptions: The following prescriptions are recommended for the Working Circle –

- Identification of good seed bearers and collect information on seed year.
- Select mother trees, collecting the geo-coordinates and marking those.
- Before a heavy seed fall, cleanings can be made beneath fruiting trees to form natural nurseries, which can be used later to plant forests with low natural regeneration or in secondary vegetation.
- Transplantation of naturally regenerated seedlings which are 45 centimeters to 55 centimeters, and 6 to 8 months old.
- For seeds raised in nurseries, it is advisable to sow seeds as soon as it falls, since it loses its viability very quickly. It is to be raised in biodegradable poly bags.
- All areas that are having gaps are to be planted with native tree species.
- Planting schedule to be followed is presented in Table 3.10.7b.

Table 3.12.2a: Overview of month-wise work to be undertaken by Plantation and Regeneration Working Circle

Period	Works to be done
August September	Survey & demarcation of areas under annual coupes, preparation of maps
October	Marking of annual coupes
November February	Timber operation and disposal
March	Advance work for plantation, nurseries

April - May	Seed sowing/ transplanting
June	1st Rain weeding
July	2nd Rain weeding
Aug-September	3rd Rain weeding
November - December	Winter weeding

Table 3.12.2b: Planting schedule to be followed in Working Circle

Sl.No.	Items of Work	Operation to be completed
1.	Survey & Demarcation	31 st October
2.	Clearance of undergrowth i/c climber cutting, removal of unwanted tree species	31 st January
3.	Laying of line, clearance of line, Ranging, staking, pit digging & hoeing of soil, etc.	15 th March
4.	Planting out.	25 th March
5.	Direct sowing of seeds	25 th March
6.	Fire line cutting	25 th March
7.	Making of Inspection path	25 th March

3.13 Nursery Technique of Important forest species

1) Mekai (*Shorea assamica* Dyer)

English Name: White Meranti.

Distribution: Mostly found in Mixed deciduous, Evergreen, and Semi evergreen forest of India, Malaysia, Myanmar, Thailand. In Assam it is widely distributed in the forest of Upper ASSAM.

Description - Large deciduous tree grows up to 50 m tall, girth up to 7m. and straight bole.

Uses: Wood used in Poly wood industry and also in making boats, truck bodies and paper pulp etc.

Flowering Time: August to September

Seed collection time: March-April .

Seed viability: 7 days

Germination Period: 7 to 10 days .

Germination Percentage: 70 - 80 % .

No of seed per kg: 215 - 230 no's (Dry) Approx.

NURSERY TECHNIQUE: Seeds does not require any pre- treatment but it shows good germination if it is soaked in water for 7 to 8 hours before sowing. Seeds are sown in mother bed or in poly bag. Soil preparation is done by mixing the top forest soil with cow dung, organic compost etc. in 1:1:1 ratio. Healthy seeds shows rapid germination. In case of seeds sown in the mother bed, the seedlings are required to shift in to the poly bag immediately after one week of germination because the roots grows very rapidly in to deep soil hence the seedling may get injured if shifting is delayed. The poly bag size 6 x 8 cm or 8x12 cm is preferable.

The poly potted seeding are kept in moderately sunny area and do watering regularly. Seedling more than three month old can be kept in fully sunny area and they become ready for planting in the field in between six to one year of age.

NATURAL REGENERATION: The natural regeneration percentage of Mekai is moderate.

FIELD OBSERVATION: In recent times, Mekai regeneration has decreased immensely due to natural as well as over exploitation. During field visit it was observed that wild Parakeets thrive on the pre-matured seeds by eating the sap and the soft tissue of seeds, which damages the seeds and they fall down before getting matured. There are very few mother trees available.

2) *Dipterocarpus macrocarpus* (Hollong):

Healthy seeds are to be collected in the month of March and April. The clipping of the wings with a small scissor enables carriage of more seeds in gunny bags. These seeds are then spread thickly under shade of trees in moist conditions. Moist conditions should be maintained until the seeds germinate within 10 to 15 days. Germination percent is usually 80 to 90%.

Germinated seeds are kept in polythene sleeves of 10 inch x 6 inch (100 gauge both sides open) filled with humus rich forest top soil. Polythene sleeves are kept in row in sunken nursery beds where shade is provided by putting Jengoo leaves' on bamboo structures. As the seedlings attain a height of about 6 inches gradually shade is to be reduced. By June/July it attains a height of about 12 inches. It is kept in the nursery till next year, by then it attains about 3 - 4 feet height. They are transplanted in pits before onset of monsoon.

Artificial regeneration: Hollong is a shade bearer in its early stage. Hollong requires shade right from the seed fall till the seedling attains a height of about 6 inches. This period is very critical; and here it is highly susceptible to intense light. After that it is considered capable of withstanding sunlight and rather seen to grow faster if shade is reduced gradually.

For planting Hollong in open areas, before transplanting of the Hollong seedlings, seeds of cover crops such as *Crotalaria juncea*, *Tephrosia spp.*, *Indigofera spp.*, etc. should be broadcasted in thallis, so that by the time the Hollong seedlings are transplanted, the cover crop can provide sufficient shade and prevent Mikania infestation.

3) *Toona ciliata* M. Roem.:

Toona ciliata also known as Red Cedar, is a forest tree in the family Meliaceae which grows throughout Tropical Asia, Southern China, Himalayas to Australia. *T. ciliata* is a fast growing deciduous tree with large branches that create a spreading crown. It grows to between 10 m - 30 m in height. The rough bark is grey – brown and cracks into squares. *T. ciliata* is famous for its fragrant red wood that is much sought after for use in furniture making, building and ornamental wood work. The soft wood is easily worked and polishes to a rich red that is enhanced with age. Flowers are white, fragrant in a large pyramidal panicle at the ends of the branchlets. Individual flowers about 5 mm long. Flowering period is in spring. Leaves are alternate, pinnate, consisting of five to seventeen leaflets. Leaflets opposite or irregularly alternate, ovate – lanceolate, 4-13 cm long, often drawn out to a long point at the tip, unequal at the base. The

fruits are green capsules that turn brown with age and split open into star shape, to release seeds. The seeds are small and winged. In India , the climate of the natural habitat comprises rainfall from 1100 -4000 mm per year and temperature range from about 0 -35°C. In Assam *T.ciliata* occurs in moist deciduous forests with *Tetrameles* species and *Stereospermum* species ; other common associate tree species *Albizia procera*, *Amoora wallichii*, *Artocarpus chaplasha* and *Pterygota alata* (Champion and Seth, 1968).

Toona ciliata is widely planted as a shade tree and for timber because it is fast growing. It is also drought tolerant. The timber is easy to work and very highly valued.

Method of propagation: *Toona ciliata* reproduces by seed. It is a prolific seed producers and establishes readily.

Propagation through seeds: Planning process to raise a nursery from seeds has to be initiated well ahead of fruiting season, which starts from May to June , so that good quality planting material can be obtained.

Seed collection and processing:

- a) When the fruits (capsules) on the mother trees become brown in colour , it is right time to collect them for the extraction of seeds.
- b) Fruits are collected by lopping of matured capsules bearing branches.
- c) From the lopped branchlets, the fruits can be plucked by and filled in gunny bags and transported without delay to the nursery site for processing.
- d) Drying ripe capsules can be pounded in mortar to remove seeds .Beating the capsules in sacks or big tray with stick can also be applied to extract seed.
- e) Each capsules with five valves and thin walls, typically 20-30 x 8-12 mm. There are around 5 seeds per locules, each 10-20 x 3-5 mm, light brown and membraneously winged at one or both ends.

Seed collection period - May and June

Number of seeds/2.1gm - 1000

Seed viability - one month only

Germination percentage - 90-100%

Pre-sowing treatment - Not required

Sowing method - Mother beds

Moisture content of seeds - 18.65%

Germination period - 10 to 15 days

Nursery management - Care should be taken at the time of sowing of seeds and

Watering the beds as there are chances of damage due to very light weight of the seeds.

Nursery establishment:

Seed sowing in germination bed –

- a) Raised standard nursery beds of measuring 10 m x 1.2 m size can be used for raising seed-lings.

- b) It prefers a rich, deep, water- retentive soil and does not do well on wet compacted or poor sandy soils.
- c) pH of the soil range 5.5 - 8.0.
- d) Fill the raised beds with pure river sand and Seeds are sown at the depth of 0.5 cm to 1.0 cm in mother beds or trays.
- e) Keep the beds moist all the time by regular watering. Watering is done carefully so that seeds are not washed away.
- f) Make provision for shade over the beds (using agro shade nets or any other locally available material).
- g) The germination starts after 7 to 15 days of sowing and continues up to about three weeks.
- h) Due to low viability period seed should be sown immediately after collection. Depending on quality of fresh seeds and time of collection, over 90 -100% germination can be achieved.

Pricking out to polybag/ woven bag: Germination takes 7 -15 days. After about 45 days of sowing, seedlings are transplanted when they have sprouted and have at least two set of leaves and they become about six inches tall. Bags are filled with a mixture of soil, sand and compost in 1: 1: 1 ratio as potting media for potting the seedlings. Keep the soil continuously moist and never let it dry out. Seedlings are sensitive to lack of water (drought), fire and weed competition. Seedlings should be protected in partial shade to avoid bleaching of leaves. With good nursery practices the seedlings become ready for plantation after about 5 to 6 months of transplanting.

Plantation establishment:

How to prepare the field for planting-

- a) Select a suitable moist deciduous forests area to field plant the seedlings of *T. ciliata*.
- b) Weed the area to remove undergrowth and ground flora.
- c) Align the plot at a spacing of 2m x 2m. or more.
- d) Take pits of 30cm x 30cm x 30cm size for planting the seedlings.

How to field plant seedlings –

- a) Field plant the poly - potted seedlings, maintained in the nursery by the onset of pre monsoon showers in May - June.
- b) Remove the polythene covers without damaging the root system of the seedlings.
- c) Provide little terracing around the field planted seedlings to avoid stagnation of water.

Disease and pest management: Only one pest recorded on the Poma tree. One moth, shoot- borer, *Hypsipylarobusta* is a pest which eats out the new shoots pith. This moth larva is particularly a problem on juvenile trees and will cause premature branching out.

No major disease problems are recorded in the field planted seedlings of *Toona ciliata*.

Management of the disease:

- a) Plantation of saplings from the diseased nursery should be avoided.
- b) Removal and burning of infected leaves and twigs can be important in plantation by reducing residual inoculum level of the pathogen.
- c) The management practices like genetic selection of trees, proper scheduling of pruning and thinning, silvicultural manipulation to improve tree form and stand hygiene can be employed to minimize the damage.
- d) Attack by Moth larva can be controlled by the application of 0.03 % Roger 20 EC.

Plantation maintenance and growth of seedlings:

- a) Almost 80 per cent of the field planted seedlings survive during the first six months after planting.
- b) After plantation seedling should quickly start growing and sending out suckering root to form a clump.
- c) It grows quite quickly but can take up to ten years to get to its full height.
- d) Trees planted in open localities may flower and produce seed after 6 years.
- e) It coppices well and produces plentiful root suckers.
- f) The tree has a spreading superficial root system which may have adverse effect on the growth of Agricultural crops.
- g) The tendency to become branchy, it should be controlled by close initial spacing .Thinning is required from the 4th year and thereafter every 5 year are reported in the plantations of the species.
- h) Grazing to be prevented in the plantation.

4) *Michelia montana* Blume. (Pansopa):

Michelia is a historical genus of flowering plants belonging to the *Magnolia* family (Magnoliaceae). *Michelia* comprises about 30 species of evergreen trees and shrubs native to tropical and subtropical climate and is distributed in East and South- East Asia from India and Sri Lanka eastwards to southern Japan and Taiwan and southeastwards into Indonesia (not in Sulawesi and New Guinea). Today it is regarded as a synonym of *Magnolia*. The leaves, flowers and form of *Michelia* resemble *Magnolia*, but the blossoms of *Michelia* generally form clusters among the leaves, rather than singly at branch ends as *Magnolia* does.

Michelia montana (Pansopa) is a medium sized , ever green tree with a clean cylindrical stem growing in wet mixed forests of Joypur RF, Uper Dihing RF, Bogapani RF , Lakhpathar RF , of Dibrugarh, ,Digboi and Doomdoma division and scattered elsewhere under wet evergreen forests. *M. Montana* tree, becoming over 40 m tall and over 2 m diam. Young twigs glabrous. Terminal buds hairy at the apex only. Leaves glabrous, spirally arranged more or less elliptic , 9-30 (-35) by 4-13 (-20) cm; apex shortly acuminate, often obliquely folded when dry; margin entire; base alternate, decurrent on the petiole with two (faint) ridges for its entire length; nerves in 9-15 pairs, conspicuous, curved upwards and meeting in a rather conspicuous intra marginal vein, reticulation dense, prominent on both surfaces. Petiole thickened towards its base, without stipular scars, 15-35 mm long. Flowers 1 (or 2) terminal on a short axillary shoot (branchyblast), rarely terminal on the main twig. Branchyblast 5-20 mm, glabrous to (rarely) densely

pubescent, with 1-3 stipular scars with or without a petiolar scar, when 2 scars the middle scar more or less halfway up; length of nodes 3-12 mm, pedicle 0.5 – 4 mm, silky or rarely glabrous. The flower bud surrounded at least by an outer and an inner spathaceous bract respectively inserted on the last 2 nodes below the pedicle; these bracts glabrous except the margins towards the apex. Stamens c. 10-13mm long including the c. 2mm long connective appendage; anthers lactose, brownish or orange in vivo. Carpels 1-4 together with the 4-8 mm long gynophore. Fruiting carpels free, 1-4 fleshy, lenticelled 2.5 – 6.5 by 1.8 - 4 cm, pink or dirty purple in vivo dorsally dehiscent and the falcate dorsal nerve often finally becoming separate when the carpels disintegrate by rooting.

Soil and Climatic Requirement: In general *M. montana* grows well in deep, moist, shady, loamy or sandy loam, well drained, acidic fertile soils. It does not stand water logging. Tropical and sub tropical climate altitude ranging from 500 -1500 m with rainfall ranging from 2000 mm to 5000 mm.

Light requirement: It requires mean annual temperature (exposure) ranging from 7°C to 38°C. Though it is moderate light demander, it prefers shady site at early stage (seedling and sapling). The best location for *M. montana* is the place where it receives direct and ample sunlight in early morning but partial light for the rest of the day.

Flowering and fruiting: The flowers are protogynous and are pollinated by beetles, which feed on the stigmas, pollen, nectar and secretion from the petals. Flowers appear from May to June, fruiting occurs in August or later. Fruits should be collected in early September. *M. montana* is thought to hybridize with *Michelia champaca* giving rise to *M. alba* which rarely produce fruits and is unknown in the wild.

Uses: *M. montana* (Pansopa) growing up to 40 metres tall. The tree is harvested from the wild for its valuable timber. The dark yellow- brown to dark brown wood is light, fine grained and durable. It is used for house construction and buildings.

Method of propagation:

Natural Regeneration - Certain amount of natural regeneration comes up especially in the moist regions of the forest and fairly well in evergreen forests; in spite of the seed being destroyed by birds, mice and rodents in large quantities.

Artificial Regeneration- The most successful method of propagation of *M. Montana* artificially is by seed.

Propagation through seeds: Planning process to raise a nursery from seeds has to be initiated well ahead of fruiting season, which starts from August to September, so that good quality planting material can be obtained.

Nursery Practice: The pulp of the fruit around the seed should be removed before sowing because de pulped seeds give significantly higher percentage of germination compared to seed sown with pulp. Seeds are mixed with red-oxide to prevent its damage by the rodents. Seeds are sown soon after collection in August –September in shaded nursery beds (nursery beds of measuring 10 m x 1.2 m size) either broadcasted or drilled in 8-10 cm apart with a thin layer of earth sprinkled over the seeds. Due to low viability period seed should be sown immediately after collection. Germination starts after 15 to 20 days of

sowing and continues up to 45 days. Seed should be sown in shades; which should be removed after germination.

Seed collection period - August and September

Seed viability - one month only

Germination percentage - 70%

Pre-sowing treatment - Seeds are mixed with red-oxide to prevent its damage by Insect, rodent etc. before sowing.

Sowing method - Mother beds.

Germination period - 15 -20 days

Nursery management - Germination of seed is generally poor and they should be treated with insecticide.

Pricking out to polybag/ woven bag: When the seedlings attain a 2 to 4 cm height. May also be picked into plastic tubes or container with a soil and cow dung mixture (3: 1) and left to grow for one year in the nursery. Keep the soil continuously moist and never let it dry out. Seedling can be out planted when they become 30 to 40 cm in height. They are kept in shaded bed under initial stage. Seedlings become ready for planting in the field by next rainy season.

Plantation establishment:

How to prepare the field for planting:

- a) Select a suitable evergreen forests area to field plant the seedlings of *M. montana*
- b) Weed the area to remove undergrowth and ground flora.
- c) Align the plot at a spacing of 2m x 2m. or 3m x 3m.
- d) Take pits of 30cm x 30cm x 30cm size for planting the seedlings.

How to field plant seedlings:

- a) The most successful method of propagating *M. montana* is by planting out nearly one year old seedlings at the break of the monsoon of the following year.
- b) Planting out with ball of earth or with naked roots though success chiefly depends upon congenial planting weather.
- c) The ball of earth being 7.5 to 10 cm in diameter and 15 cm long.
- d) Weeding will not be required after the second or third year as the plantation closes up rapidly.
- e) The first thinning is well- stocked plantation will normally be required in the 5th year if the spacing is about 2m x 2m.
- f) Stump planting is not suitable because it produces profuse number of shoots which, need to be pruned.
- g) Winter planting in November - December is also practised mainly to replace casualties.
- h) *M. montana* can be planted singly or along with the others as mixed plantations with suitable tree species (*Chukrassia tabularis*, *Schima wallichii*, *Artocarpus chaplasi*, *Terminalia myriocarpa*) of same growth rate.

Disease and pest management: During heavy rains some fungus attack are noticed in germination beds. The disease caused by *Rhizoctonia solani* appears in the rainy season and causes severe damage

in the seedlings .Controlling this disease by using appropriate sanitation and cultural method is recommended. Disease can also be successfully controlled by spraying of Copper oxychloride fungicide.

3.14 Control records

The following records are to be maintained –

Control Book: This should be maintained annually as prescribed in the Form 3 and Form 4. These forms show the thinning prescription of this plan, the work actually carried out and yields obtained.

The record of works: This will be a record of all operations carried out in accordance with the working plan in connection with the management of Teak plantation. Care must be taken in recording each item carefully every year in the Form.

The Plantation journal: All the operations carried out in the plantations from time to time should be entered there, as it is a permanent record of the history of a plantation from its formation up to its final exploitation.

The Control map: It will be maintained in GIS layers, duly showing the plantations where various operations as prescribed in the plans are carried out.

CHAPTER 4

Forest Protection (Overlapping) Working Circle

4.1 Name of the working circle: Forest protection working circle. The detail map of this working circle as per the recasted watershed based compartment is shown in Figure 4.1.

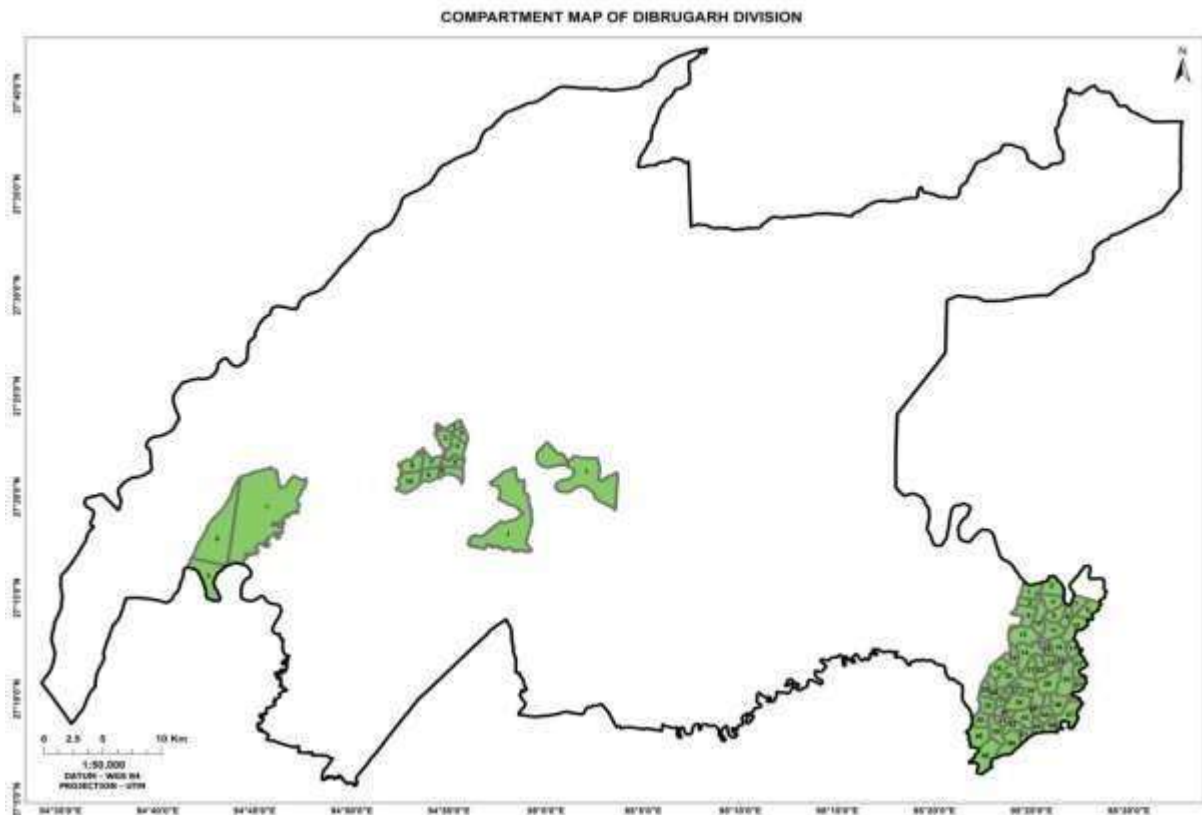


Figure 4.1: Map showing the forest protection (overlapping) working circle

4.2 General constituents of the working circle: The forest protection is one of the most important and difficult aspects of forest management. Degradation of forest has already been taken place to the greatest extent due to human activities and increased cattle population. Land use change diverting of forest land for human habitation, cultivation, irrigation projects, industries etc. has resulted in shrinkage of forest area. This situation has created huge gap in demand and supply of forest produce. From the view point of forest protection, this working circle shall include all the forest areas under the division. Emphasis will be given to the forests with over dense forest cover and grassland of Joypur RF and Jokai RF. It becomes essential to preserve the dense forest areas as long time carbon sink. Forests will be kept intact and free from anthropogenic activities/human disturbances. In future, when the ecosystem starts functioning again at its peak productivity, sustainable extraction from these forests may be allowed. Till that time, these forests shall function as nature's laboratories, which will keep on imparting insights about

the functioning of the nature, to a keen observer. These forests include areas of unique flora and fauna with rich biological diversity and genetic resources. The forest also provides as a germ plasm of the endemic species. Therefore, these areas will be protected with intensive care to sustain forest productivity, flow of ecosystem services and also protect from floods. In encroached areas, ejection is prescribed under this working circle. The ecological and environmental role of forests has precedence over all other roles one can think of. Forests are the natural resources which are to be passed on to the posterity with least disturbance to the natural processes they are being subjected. Keeping this mandate in view, the protection working circle is carved out.

4.3 Objectives of the working circle: The broad objective of this working circle is to protect the forest and to improve the stocks of the forest by regeneration and plantation. Specific objectives are given—

- a) To protect the forests of the division with emphasis to the forests under dense canopy cover.
- b) Maintain the ecological balance wherever it has been disturbed.
- c) To determine the status of existing boundaries/boundary pillars of forests of various categories and to digitise the locations of existing boundary pillars and to locate the missing boundary pillars on ground using distance and bearing values provided in RF/PRF/PF notifications.
- d) Plan for ejection of encroachers from the Reserved forest shall be accorded highest priority. Efforts shall be made to restore the evicted areas to their pre encroachment status. Eviction and Post-eviction plans shall be meticulously prepared. Positive efforts shall be made to rehabilitate evicted families.
- e) To make efforts to improve forest health by periodically measuring the nutrient status of soils in the forest and by identifying and selecting superior individuals as a source for resistance against various types of disease.
- f) To identify and evaluate lesser known tree species for their biochemical profiling including bio-pesticide properties so that an effective, eco-friendly, economical and easily available source for pest/disease management can be developed.
- g) To diminish the area infested by weeds. If human disturbance and forest fragmentation can be reduced to a minimum, this problem will be tackled to a large extent. Targeted interventions at replacing the weed infested areas with the natural vegetation can further improve the situation.
- h) To completely shift grazing, lopping, shifting cultivation and other forms of forest degrading activities to the fringe forests or JFMC working circle areas.
- i) To carry out fire frequency and burnt area mapping for fire vulnerability on one hand and operational fire monitoring in real time/near real time using MODIS data for effective response on the other.

4.4 General condition of flora and fauna: The forest in this Division is rich in biodiversity. The forest type of the overlapping working circle as per the classification made by Champion and Seth in their survey of forest types of India – Type IB/C1 Assam Valley Wet Evergreen Forest (*Depterocarpus*) or more commonly known as Upper Assam *Depterocarpus* – *Mesua* formation. It forms a part of the world heritage

of tropical/subtropical wet evergreen forests, multi storied in structure and rich in biodiversity; more popularly known as Rain Forests. The predominant species namely *Dipterocarpus retusus* reaches a height of 50 metres and above and girth up to seven metres. *Shorea assamica* is also visible in the top canopy along with *Dipterocarpus retusus* over a limited locality especially in slightly higher elevation with good drainage. Other species which are found covering the place in the top canopy are *Michelia champaca*, *Mesua ferrea*, *Magnolia* spp., *Canarium* spp., etc. The middle storey is dominated by *Messua ferrea*. Other species found in this canopy are *Terminalia chebula*, *Syzigium cuminii*, *Sapium baccatum*, *Dysoxylum binectariferum*, etc. In some areas, there occurs a third storey occupied by *Dendrocalamus hamiltonii*, *Livingstonia jenkinsonii*, etc. The undergrowth comprises of woody shrubs like *Myrsine capitellata*, *Osbeckia* spp. *Laportea crenulata*, Shrubs like *Phrynium placentalim*, *Alpinia allughas* etc. Climbers are numerous and found growing profusely, common among them are *Thumbergia grandiflora*, *Bauhinia vahlii*, etc. wherever there is an opening *Michenia scandens* – an exotic, invades the forests, suppressing all shrubs and advance growths of trees and intercepting free falling seeds from reaching the ground.

The wild animals noticed in the tracts of the proposed area of the overlapping working circle include The Asian elephant, Tiger, The clouded leopard, Field mouse, Fruit bat, Wood rat, The jungle cat, The Rhesus monkey, Pangolin, Sloth bear, Indian civet, Sambar, Bamboo rat, Mole, Tree shrew, Himalayan Black Bear, Small civet, The leopard, The common langur, Giant squirrel, Hare, The slow loris, The Assamese macaque, The fishing cat, Muntjac, Hog deer, The mongoose, The Goral, Porcupine, The jackal, Wild boar, Common Otter. Different species of birds namely Drongos, pheasants, Jacanas, Orioles, Eagles, Hornbills, Owl, Minivets are found in the waterholes, water bodies located inside the Division.

4.5 Blocks, compartment areas: Forest protection working circle comprises all the forest area of Dibrugarh Division comprising 21,794.648 hectare.

4.6 Strategy for forest protection: The strategy to be adopted to protect forest is of integrated approach and it shall be applied at various fronts by undertaking collective measures based on situation and time. The strategy shall be direct / field oriented in a participatory manner with active involvement and co-operation of local people specially members of JFM Committees. Total villages around Reserved forests of this division are 802 whereas 108 Forest Guards are placed at various places to protect forests. Therefore there is a need to seek the co-operation of local people in forest protection. The main components of strategy are given below.

- (1) Existing forest needs to be well protected and developmental works like soil and moisture conservation measures, natural and artificial regeneration works and other cultural operations shall be carried out in order to increase productivity of forests.
- (2) Regulation of grazing and controlling fire.
- (3) Seeking co-operation and active participation of local people in all operations of forest management and employment generation to local people during lean period.
- (4) Fulfilling the demands of local people for forest produce.

- (5) Effective utilization of existing infrastructure, strengthen and updating infra-structural facilities, improvement in communication facility and mobility of the forest staff.
- (6) Installation of new Check posts at hyper sensitive and sensitive points.
- (7) Patrolling sensitive forest areas along with the local people/ JFM Committee members.
- (8) Intelligence gathering including introducing Rewards, Awards and informer system and making forest offences high risk low gain process.

4.7 Protection measures:

4.7.1 Inspection in transit: Though there is no check gate to control and regulate transit of forest produce, yet the DFO may arrange to check transit of forest produce. Section 40 of Assam Forest Regulation (Amendment) Act'1995 is to be enforced strictly.

4.7.2 Patrolling: To control illicit felling, regular patrolling is essential in sensitive and hyper sensitive beats where illicit felling takes place. Separate day and night patrolling around the sensitive, highly sensitive areas and on roads leading from jungle to High way shall be carried out. Record or register should be kept in Range Office regarding patrolling. ACF should supervise this type of patrolling and also he should participate in such patrolling at least once in the month. Smart patrolling initiatives may be designed. GPS based patrolling to be introduced so that effective monitoring is possible. Every Range shall have a mobile squad under leadership of a Deputy Ranger or senior Forester. Forest offense register should be maintained and Offence Registered should be pursued in proactive manner to ensure conviction.

Protection Squad: The Protection Squad of the Division is very much weak. It shall be strengthened with posting of one Range Officer, at least 8 foresters, 12 forest Guards and one section of armed Assam Forest Protection Force (AFPF) battalion. Two vehicles including one Mini truck shall be at the disposal of Protection Squad. Jurisdiction of the Protection Squad shall be the entire Dibrugarh Forest Division. The rank and status of the Protection Squad shall be equivalent to other Range Officer. He will perform protection duties independently and report day to day performance to the DFO. Sufficient fund shall be provided for mobilizing the Squad day and night. Head Quarter of Protection Squad shall be at Division Head quarter (Dibrugarh). The DFO should closely monitor the work of Protection squad and should obtain weekly reports to monitor the protection activities.

4.7.4 Wireless network: Presently there is no wireless network in this Division. In the present day society offenders possess modern communication systems like mobile phones while committing forest offences and transporting forest produce. Cellular phones may be provided to the entire staff for effective protection of the forests.

4.7.5 Mobility of staff: In Dibrugarh Forest Division Government vehicles are provided to DFO, and RFOs. With the existing road network by using modern speedy vehicles, the forest offenders easily transport the illicit material. It is necessary to provide Bolero or other SUV vehicles to the territorial RFOs and ACFs for effective forest protection. Each Range should have at least two good conditioned vehicles.

AFPF battalion shall be posted in each Range and in vulnerable Beats. Vehicles that would be required for proper management of the forests once the area is made free from the encroachment:

Table 4.7.5: Number of vehicles required for implementation of the ejection plan

Name of Range/Beat	Mini Trucks required	Small vehicle required	Tractors required
Dibrugarh Range	1 No.	--	--
Khowang Range	1Nos.	--	--
Joypur Range	1 No.	--	--
Total:	3Nos.	--	--

4.7.6 Provision of Arms: Sometimes offenders use modern weapons like fire arms in committing forest offences. For forest staff without modern weapons, it is difficult to tackle those offenders from committing forest offences. With a view to combat such attempts by illegal doers and for self defence, Forest personnel are to be equipped with weapons. Every Range Officer including Protection Squad Range Officer and ACF should be sanctioned Government pistol/revolver and at least five rifles to be issued to each Range. Fire arms may also be provided even to the lower rank staff those who involve in forest protection duty. Fire arms should be handled carefully following all protocols.

4.7.7 Territorial Inspections: Beat checking: It is necessary that the staff is required to carry out patrolling in their respective jurisdictions and the officers concerned will exercise effective supervision and control at all levels. It is necessary to report every forest offence promptly as per directions given in the standing order. For effective protection of forest the following prescriptions are made.

- (1) Review the offence cases beat wise, every month.
- (2) To enforce the provisions of Assam Forest Regulation 1891 (Amendment) Act'1995 strictly.
- (3) Forest Offences in arrest cases should invariably be submitted to the court within the prescribed time. Delay in the submission of charge sheets in the courts is viewed seriously.
- (4) Use IPC provisions for the effective control of the illicit felling.
- (5) The data related to offence cases shall be analyzed with the help of computers using available software.
- (6) Monitor the occurrence of all the offence cases daily through wireless.
- (7) Identify and list all the paths used for the transportation of illicit material.
- (8) Place effective patrolling squad at all important routes to prevent the transportation of illicit material.
- (9) Emphasis shall be made to arrest and prosecute the offenders rather merely seizing the material.
- (10) Plan in such a way to have young guards in the hyper sensitive areas.
- (11) History sheets of all the offenders along with their photo and bio-data are maintained at Range and Division level.
- (12) Prepare list of offenders, showing the offence cases involved by him, against each offender. (13) Use Cr.P.C. 110 provisions with respect to habitual offenders.
- (14) Provisions of IPC 395 shall be used by registering the complaint in the police station for the offences wherein five or more than five offenders are involved. The DFO shall co-ordinate with the Superintendent of Police to see that stringent sections of IPC will be used in the F.I.R.

- (15) Every Beat shall maintain a register of stumps in a specific format. Every stump is registered by a serial number followed by and year, for example, if tree number is 129/08. Here 129 is tree number and 08 is year. Every year from January 1st, onwards start the new series. After one year all the high stumps be dressed to ground level to obtain good coppice. The supervisory officers, during the beat inspection, verify the registered stumps and unregistered stumps. The beat officer shall be held responsible for non-registering the illicit stumps.
- (16) Every range and division office shall maintain the Xerox copies of the judgement of all forest cases for the guidance and improvement purposes.
- (17) Court Guard duties be assigned to a special duty FG for each Range Office and as well as Division office to monitor the dates and for timely communication to the witnesses.
- (18) All officers including DFO, ACF, RFO, Deputy Ranger, Forester and Forest Guards are to submit fortnightly diary mentioning their performance and activities.

4.7.8 Fire protection:The areas of Kamrup West Forest Division are prone to fire due to heavy biotic pressure and due to deciduous nature and the dry climate. Fire caused damage to the forest specially regeneration, forest growth, ground flora, soil organisms and the soil productivity. Prevention of fires and effective control of fires as prescribed in the plan is essential for forest development. The leaf litter on the ground and highly combustible under growth of grasses etc. catch fire and spread instantly. In summer high speed of winds spread fire easily before it could be brought under control. Fire line with appropriate width as per the guide lines shall be maintained and patrolled by fire watchers.

4.7.9 Grazing Control:Grazing causes lot of damage to regeneration due to trampling. The incidence of grazing is high in and around the forest areas where the villages are situated and the impact of grazing, illicit felling, fire encroachment is also tremendous around the villages. Therefore the forest areas around villages are deprived of regeneration. In many places especially areas around villages, the ground story is completely missing. To control grazing, grazing units are to be formed in the division. The number of cattle heads per each unit are to be fixed as per the carrying capacity of the area. Grazing shall be allowed as per the carrying capacity of each class of forests.

4.7.10 Role of Joint Forest Management:JFM committee will contribute to a large extent in protection of the forest from illicit felling, encroachment, fire, grazing, etc provided if the forest staff has a constant dialogue with the JFM committees and involve them for joint patrolling, management and development of the forests. The JFM committees shall be entrusted with specific area earmarked for the protection, management and development of the area. The JFM committee members need to be given training in technical matters of protection at the same time they should be provided with gainful employment by taking up management and developmental activities. Visit of JFM Committee members to successful areas in the state may be undertaken.

4.7.11 Capacity Development and training of frontline staffs: Government policies in personnel management for professional Foresters, while aiming at optimum utilization of their professional skill,

would endeavour to enhance their status attracting qualified and motivated personnel, keeping in view particularly the arduous nature of duties performed, often in remote and inhospitable areas. Frontline staffs should be deputed for undergoing training for capacity development. They should be exposed to various successful States to inculcate modern techniques and to generate love to the forest bringing attitudinal change. Apart from deputing staffs to the SFTIs, training to field staff shall be organised by DFO from time to time on the issues of various Acts, preparation of offence cases, tackling assault on staff, framing charge sheets, filing court cases, recording evidence etc. For this purpose help of police officers, ex- army men, advocates, forest officers should be sought to train field staff. Three trainings are proposed in one year for a batch of 25 Foresters and Forest Guards. Necessary budget provision shall be organised for training.

4.7.12 Use of GIS/GPS: Geographic Information System (GIS) and Global Positioning System (GPS) technologies have important applications in forestry. A GIS Centre for monitoring of forestry activities need to be established in the Division.

4.7.13 Legal Cell: In order to have speedy disposal of forest offences to file and pursue court cases, a legal cell headed by one Forest Prosecutor may be constituted at Dibrugarh Division with supporting staff.

4.7.14 Provision of lock-ups: Some forest offences are of non-bailable nature and for prosecution of offenders it is necessary to provide lock-up cells at every Range head quarter. It is prescribed that lock-up cells shall be established at every Range head quarter and will be manned with two Forest Guards in three shifts.

4.7.15 Collection of intelligence and information: The RFO/ Beat Officers should frequently interact with villagers to collect information regarding illicit felling, encroachment, poaching, illegal grazing etc. through its intelligence network and keep that information, suggestions in a register in his personal custody. Through the intelligence network, village wise record of habitual offenders must be prepared by RFO in consultation with Beat Officers and Round Officer in the proforma are given below and this register must be updated regularly. A secrete fund to gather intelligence and information is proposed to setup under the control of DFO.

4.7.16 Publicity and awareness: Adequate publicity materials are to be prepared and meetings are to be arranged particularly in the fringe areas of the RFs to create awareness among the common people to get their support in the endeavour.

4.7.17 Register of habitual offenders: Name & address of the offender, previous record POR No./qty/Action taken Modus-operandi and Photograph if available shall be collected.

4.7.18 Rewards: The existing provisions of rewards to subordinate staff for exemplary work in detection and prevention of offence cases need to be reviewed. The reward amount may be enhanced and maximum amount may be granted. It is proposed that the scheme may be extended to gazetted officers also.

4.8 Infrastructure:

4.8.1 Camps/Barracks: Camps/Barracks in different locations are to be constructed. Standard norms to be adopted is one camp in each 4 sq km area. Thus the total camp that would be required 6 for encroached area is provided in table 4.8.

Table 4.8.1: Infrastructure details for ejection plan

Name of Range	Name of RF	Total existing camps	Total new camps required	Total camps
Dibrugarh Range	Jokai RF	2 Nos. (1 Beat Office another Forest Camp)	1 No.	3 Nos.
	Telpani RF	1 No. (Beat Office)	1 No.	2 Nos.
	Dehingmukh RF	1 No. (Beat Office)	1 No.	2 Nos.
Khowang Range	Namdang RF	1 (Beat Office)	2 Nos.	3 Nos.
Jeypore Range	Jeypore RF	1 (Beat Office)	1 No.	2 Nos.
	Total:-	6 Nos.	6 Nos.	12 Nos.

4.8.2 Road Network: Roads is necessary for carrying our effective ejection. Maintenance of existing roads is necessary and new pools and bridges is to be constructed for implemting the ejection plan in Dibrugarh division. Details are furnished in table 4.8.2.

Table 4.8.2: Maintenance and new construction of road for ejection plan

Maintenance of Road	New construction of Road approx.	New pools and bridges approx.
30	-	12 Nos.

4.9 Requirement of Staff/Security personnel/Barrack for security forces: To manage the camps the total requirement of forest staff (minimum 4 staff/camp) and requirement of security personnel and barrack for their accommodation, would be required as follow-

Table 4.9: Requirement of Staff/Security personnel/Barrack for security forces

Range	Staff required in camp	Staff required in Range/Beat	Total staff required	Security personnel required in camp	Security personnel required in Range/Beat	Total security personnel required in the camp	New security barrack required
Dibrugarh Range	12	16	28	3 Sec	3 Sec	6 Sec	6 Nos.
Khowang Range	8	4	12	2 Sec	1 Sec	3 Sec	3 Nos.
Joypur Range	4	4	8	1 Sec	1 Sec	2 Sec	2 Nos.

4.10 Encroachment:

The National Forest Policy 1988 in para 4.8.1 envisages that-

“Encroachment in forest land has been on the increase. This trend has to be arrested and effective action taken to prevent its continuance. There should be no regularization of existing encroachment.”

The problem of encroachment is common in almost all the areas specially the forest areas located adjoining human habitations. Out of total 68124.892 hectare of forest land in Kamrup West Division 20734.977 hectare (30.44%) of forest land are under encroachment. However the figure is inclusive of the areas inhabited by Schedule Tribes and other forest dwellers. Population increase and requirement of land for agriculture and settlements besides greed of land hungrys are the main cause of encroachment. The problem aggravated because of apathy and laxity of forest staffs. Morale of frontline Staffs had gone down because of the fact that even after assaulting number of staffs including Range Officer of Protection Squad, no punitive action was taken against timber smugglers and offenders. The morale of staffs is so ruined that, except few, staffs donot own the forest. Though the encroachment is a clandestine and gradual process, resisting and reporting of such encroachment had never been distinguished. In order to mitigate the problem, it is essential to take up survey and demarcation works on top priority. Boundary pillars shall be erected after the survey is over which can be completed in a phased manner. Table 5.10 reflects the status of encroachment in Dibrugarh Division.

Table 4.10: Statement showing RF-wise encroached area (Ha) under different landuse

SL/NO	Name of R.F.	Area (Ha.)	Encroachment (Ha.)		Area Evicted during 2002-2003 (Ha.)	Remarks
			Pre - 1980	Present Position		
01.	Jokai R.F.	1848.01	216.00	131.00	85.00	Human habitation & cultivation
02.	Telpani R.F.	1332.288	204.00	109.00	95.00	
03.	Dehingmukh R.F.	5879.04	586.97	504.97	82.00	
04.	Namdang R.F.	1858.63	900.00	700.00	200.00	
05.	Joypur R.F.	10876.68	1.00	0.00	0.00	Seasonal Cultivation by Arunachali
	Total	21,794.648	1907.97	1445.97		

4.10.1 Eviction of encroachment:All encroachments are to be evicted as early as possible. The following instructions shall be followed regarding encroachments.

- (1) Eviction of encroachers from forest land as per the provisions of Rules framed under section 72(c) of the Assam Forest Regulation' 1891 is a normal duty of the Forest Department, which should be carried out regularly by the Department as and when required subject to availability of logistic support. The procedure laid out in the The Assam land and revenue Regulation'1886 together with Section 434 of IPC and Section-7, 24, 25, 59, 61 and 66 of Assam Forest Regulation 1891(Amendment) Act1995 shall be followed.
- (2) All external boundaries shall be demarcated with concrete pillars. All sensitive and important boundaries and wherever disputes are there, be surveyed and concrete pillars be laid immediately. Multy-strand concertina (Rajor) wire fencing 2.00 meter high with precasted 150 mm x 150 mm RCC posts 2 meter apart shall be erected in strategic places so as to prevent human trespass into the forest.
- (3) All encroachments shall be listed with their names, age, residence, profession whether belongs to SC, ST, OBC/NT, extent of encroachment, sl.no. and location of encroachment. Offence Report

- (OR) shall be drawn against such encroacher and be sent to Court for prosecution. Repeated drawing up of offence reports will definitely discourage encroachment.
- (4) Eviction drive should be a big operation comprising staffs from entire division and nearest divisions.
 - (5) If the encroachments in a village are more in number, police protection be obtained for the operation. Use of Cr. P.C. provisions like section 106 and 110 be used to smoothen the eviction operations as well as to prevent the tendency of future encroachments.
 - (6) For the encroachments on the un-classed forests, FIR shall be lodged in the concerned police station for the prosecution.
 - (7) To prevent the tendency of encroachments, improved crop techniques be propagated in the problematic villages to enhance the crop productivity with the help of Agricultural Department.
 - (8) After the listing of all encroachments, sample verification shall be carried out by all supervisory officers to detect unregistered encroachments.
 - (9) In the month of May, a drive for encroachment prevention be taken up in all the sensitive areas by taking meetings in the villages and by distribution of leaflets and posters.
 - (10) Keep a watch on all the sites meant for debris cleaning, plugging etc., in the month of May, so that encroachments are removed even before the sowings. In the recent past the tendency for encroaching forest land for cultivation increased the actual encroached area is higher than that of recorded one.
 - (11) The causes of forest encroachments shall be examined thoroughly and corrective measures shall be taken.
 - (12) All necessary support should be extended to evict the encroachments as early as possible. The boundary management and standard administrative guidelines will help to control the encroachment.
 - (13) RFO must inspect at least 50% of the boundary demarcation, ACF at least 10% of the boundary demarcation, DCF at least 2% of the boundary demarcation. RFO Mobile Squad shall check 2 % of the boundary demarcation.
 - (14) Non reporting of encroachment by any officer/staff under his jurisdiction shall be deemed as abatement in encroachment.
 - (15) All encroached areas, after result oriented eviction operation shall be undertaken under massive plantation.

4.10.2 Ejection Plan for Dibrugarh Division:

Objective 1: To determine the encroachers and encroached land: To achieve the objective the following strategies/actions are proposed.

Strategy / action	Time required	Remarks
Survey the encroached area with GPS demarcation.	30 days	Subjected to law and order situation and good weather conditions.
Preparation of GPS based demarcation maps in kml format.	05 days	Subjected to law and order situation.
Enumeration of encroachers	60 days	Subjected to law and order

Options: Referral of the General Demographic Census report / preparation of a list of encroachers' households village-wise, with the help of Ranges and Civil support through Socio Economic Survey		situation. Response / receipt of report from the concerned Departments in time.
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Objective 2: To make the area free from encroachment: In order to achieve the objective, in due accordance with Sec 72 of the Assam Forest Regulation 1857, amended upto 1995, the following strategies are proposed.

Strategy / action	Time required	Remarks
Through Ejection operations (U/S 72 of AFR' 1995)	Time limit to be set after the initial survey of households to be ejected	For ejection operation, separate budget allocation shall be required and to be prepared and for effective execution of the ejection operation.
Domination over the ejected area	During course of ejection process	Immediately after the ejection operation, camping of adequate security personnel would be essential to dominate over the area, in order to avoid further encroachment recurrence.

Objective 3: Restoration of ejected land: To achieve the objective, the following strategies/ action are proposed.

Strategy / action	Time required	Remarks
Building up of infrastructures such as camps/barracks	During course of ejection process	<ol style="list-style-type: none"> 1. Adequate numbers of camps and barracks are to be constructed once the ejection process is effected. 2. Repairing of existing roads and construction of new roads will be most essential. 3. Vehicles shall be required for effective patrolling duties and surveillance. 4. A budget needs to be prepared separately for effective execution.
Posting of staff and security personnel, creation of new forest Beat offices	Immediately after the ejection process	Posting of additional staff and armed forces shall be essential in each camp/barrack. In order to accommodate new forest beat offices/camps, new requirement of staff is a prerequisite.
Creation of Nurseries and plantations	5 Years	<ol style="list-style-type: none"> 1. Adequate nurseries will have to be created in different locations for plantation. 2. Plantation will be created engaging labour and local people. 3. Maintenance of the plantations will be essential at least for 5 years. 4. Separate budget will be required for these activities and demand for releasing fund will be placed accordingly in time.

4.10.3 Analysis for Ejection period: For carrying out ejection operation, a tentative work programme as below is prepared based on the information/ data available. Encroachment position based on information available in this office maintained is given in Table 4.10.3.

Table 4.10.3.a: Encroachers/Encroached land in Reserved Forests of Dibrugarh Division

Name of RF	Total encroachers household	Area (Ha.) under Encroachment in the form of cultivation (Paddy cultivation and seasonal crops)	Per day average ejection	Total days required for ejection
Jokai R.F.	---	131.00	15 Ha. (during peak season)	9 Days
Telpani R.F.	83 Nos. (109 Ha)	109	40 Nos.	2 Days
Dehingmukh R.F.	---	504.97	15 Ha. (during peak season)	33 Days
Namdang R.F.	---	700.00	15 Ha. (during peak season)	46 Days
Jeypore R.F.	---	1 (Seasonal Winter Crop) along the inter state boundary of Assam and Arunachal Pradesh		1 Day

Table 4.10.3.b: Logistics that would be required in each ejection operation

Truck for Labour	Truck for seized materials	Bus for Security personnel	Small vehicle for Staff	Ambulance with Medical Team	JCB	Kunki / Elephant	Labour	Remarks
1		1	2	1	1	1	50	1 JCB and 1 No. Kunki/elephant and a truck for seized materials are to be required to facilitate smooth eviction drive at Telpani R.F. for 2 Days.

Table 4.10.3.c: Tools and Equipment

Daggers / Chisels	Hammers	Spade	Saw / Power Saw	Ropes	Measuring
10	10	2	2	50 Kg	2

4.10.4 Post ejection/eviction measures: Posting of security personnel would be essential after the eviction operation to dominate the area for which tents and accommodation would be required.

4.10.4.1 Plantation: Plantations in the ejection areas are to be carried out immediately. For which Nurseries are to be created in four different locations under Dibrugarh Division.

Table 4.16: Number of nursery for raising planting materials for ejected areas

Total area for Plantation	Area of each nursery	Total nursery proposed
1440.00 Ha.	1.5 Ha	4 Nos.

4.10.5 Rehabilitation of Encroachers:

Objectives of Self Rehabilitation: The objectives of the Chapter on Rehabilitation are

- To motivate every encroacher family to vacate the illegally occupied RF/PRF areas in lieu of an economic package.
- To remove all manmade devastation like encroachment which have stood as impediments in regeneration and reclamation of the forest areas.
- To create large scale plantations on the vacant land so created.
- To en-role the members of the Encroacher family in JFMC/EDCs and in management of the NTFPs, Eco-tourism etc with an aim to create livelihood opportunities.
- To survey the boundaries of RF/PRFs in order to consolidate them by fixing permanent boundary pillars.

Grant of Economic Package: It is observed that there are many built up areas within the Reserved Forests/Proposed Reserved Forests in addition to unauthorized cultivation. The grant of such package is a sort of 'Agreement' by the Forest Department with the unauthorized occupants and the dealing is more of a 'Humanitarian approach'.

It is apprehended that forceful ejection may not be successful because of the prevailing socio-economic condition and above mentioned constrains and there is every chance of coming back of the encroachers and damage of the plantation leading to wastage of money, energy and time. Therefore, the second option which is the 'Rehabilitation by way of granting economic package' and proper assessment of the extent of cultivation and infrastructure such as House etc. by an 'Authorized Committee' seems to be more appropriate and promising. The package will depend on such assessment on the ground and the financial grant will be determined as per 'Compensation' laid down in the Assam Land and Revenue Regulation, 1886. It is to be noted that no alternate land will be provided to the encroachers and they have to take away their properties such as building materials and remove the crops of their own.

Evacuation of encroached land: 'Economic Package' will be offered to 2309 encroacher Families @Rs.1.00 Lakh to 20.00 Lakh per family in the initial two years. No alternate land will be provided to them as the package will be purely 'Self rehabilitation'. It will be purely an 'Economic Package' and each encroacher family has to vacate the RF/PRF land immediately and remove all the cultivation and structures built by them. If the family does not vacate the RF land, the family as well as unauthorized cultivation, building etc. will be ejected from that piece of RF land under Section 72 (C) of the Assam Forest Regulation, 1891. Further, the family will not be considered eligible for the economic package.

One-time cashless financial assistance: Each effected encroacher family having dwelling house and cultivation, will be entitled to be awarded with "One-time cashless financial assistance" of an amount as the **District Level Assessment Committee for Awarding Economic Package** proposed as below decides which will be of minimum Rs.1.00 Lakh and maximum Rs.20.00 Lakh per family. The said District

Level Assessment Committee for Awarding Economic Package is required to be approved and notified by the State Government in due course of time, preferably within 2 months.

Self-relocation and Entitlement: An encroacher family is eligible for the package from only one location where it normally resides. Each encroacher family will be motivated for 'Self relocation' within a period of 1 (One) year to vacate all the twenty number of Reserved Forest and Proposed Reserved Forest land which they have been occupying. In this respect, the Order passed by the Hon'ble Supreme Court in Case No. Writ Petition 202 of 1995, T.N. Godavarman Vs. Union of India and Ors. is reproduced below:

"Encroachment on forest lands has been on the increase. This trend has to be arrested and effective action taken to prevent its continuance. There should be no regularization of existing encroachers. The Hon'ble Supreme further observed that the importance of conserving and managing existing natural forests and forest soils, which are very large stores of carbon, has been emphasized as it will significantly reduce greenhouse gas emissions. To develop and protect forests, a scientific management is necessary so as to enhance productivity, density and health. Forestry projects have to lay emphasis on management and rejuvenation of natural forests. The fragile eco-systems should be properly managed in order to safeguard the livelihood of millions of people".

Though the said Court Order is silent about rehabilitation, it is observed that presently the Judiciary is more concerned about infringement of human rights and hence, immediate rehabilitation of the encroachers is suggested instead of eviction. In consonant of such a feeling, a more humanitarian approach will possibly be to constitute a 'District Level Assessment Committee for Awarding Economic Package' which will decide for awarding a monetary package to each encroacher family as per latest Assam Revenue Rules and Regulations. Further no alternate Forest land will be offered to such families as directed by the Hon'ble Supreme Court. Thus, every encroacher family, on giving upon an undertaking to the District Collector/Magistrate to the effect that they will never encroach any Reserved Forest Land or National Park/Sanctuary in future, and will remove all their belongings such as seasonal crops (after harvesting), tea cultivation, houses, buildings or any built up etc., will be entitled to receive the "One-time cashless economic package" as decided by the Committee after due field enquiry. But no such economic package or compensation will be granted to any encroacher family for re-establishment of any commercial farm, industry or activity. The grant of the package will be decided on land holding, nature of the dwelling house, trees planted by the encroacher family etc. as per sanctioned rate/norms notified by the State Government from time to time. The economic package will include a certain percentage of incentives (may be 20%) to develop and maintain an amiable relationship with the Forest Department. Accordingly, the encroacher families will rehabilitate themselves with the package money and as per their choice. Further, upon receiving the 'One-time cashless economic package', each encroacher family will relinquish all claims to the Reserved Forest land and will support the Forest Department in regaining the wildlife habitat there was once.

4.10.6 Consolidation of Boundary: It is imperative that the status of existing boundaries/boundary pillars of forests and missing boundary pillars on ground using distance and bearing values provided in RF notifications needs to be surveyed.

4.10.6.1 Maintenance of boundaries and Pillars: To avoid legal disputes in the future, maintenance or boundary pillars is necessary especially the state boundaries. Inspection path of 3 m wide all along the boundary should be prepared for inspection and protection. The boundary pillars must be numbered and written. The distantly located pillars may be connected to one another by digging lines, which should be regularly cleared. Boundary registers should be maintained. The records will be prepared in triplicate and kept in Range, Division and Circle Offices. The Range Officer should check the boundaries once a year and record a certificate to that effect on the Boundary Register. The Beat Officer should check the entire boundaries of the forest under his charge and send the necessary report to the Forest Range Officer. The Beat Guards should keep the records of boundaries of their beats in the Beat Book. The programme of repair of Boundary Pillars should be followed as given in the Protection Working Circle. The dimensions of Main Pillar and Sub Pillar shall be as per estimates prescribed by Assam Forest Department. The estimated costs is as per prevailing rate of wages and cost of construction material (in 2019) and approved estimate. Such estimate shall be revised as and when felt necessary.

The following proposal is prescribed based on the need to maintain Pillar after every 3 years period. Cost of maintenance is 25 % of cost of creation of Boundary Pillar.

Table 4.10.6.1.a: Total number of pillars proposed to be constructed

Total no Pillars to be Constructed (10 year)						
SL No	Item	External Boundary Area of All Reserved Forests in Dibrugarh Division (km)	No of Pillars (per km)	Total No of Large pillars required	No of Pillars existing at present in the division	Required no of pillars to be established (10 year)
1	Main Pillars	168	3	504	-	504
2	Sub Pillar Pillars	168	8	1344	-	1344

Apart from Boundary Pillars, fencing, of the design of border fencing, should be erected in strategic places to check biotic pressures inflicted on plantation and nursery, to check illegal felling and to check encroachment. Estimates for construction/erection of such fencing shall be prepared with the help of competent engineer and shall be materialized.



CHAPTER 5

Non Timber Forest Produce (Overlapping) and Bamboo Working Circle

5.1 Name of the Working Circle: Non Timber Forest Produce and Bamboo (overlapping) Working Circle. The detail map of this working circle is shown in Plate 5.1a to 5.1e

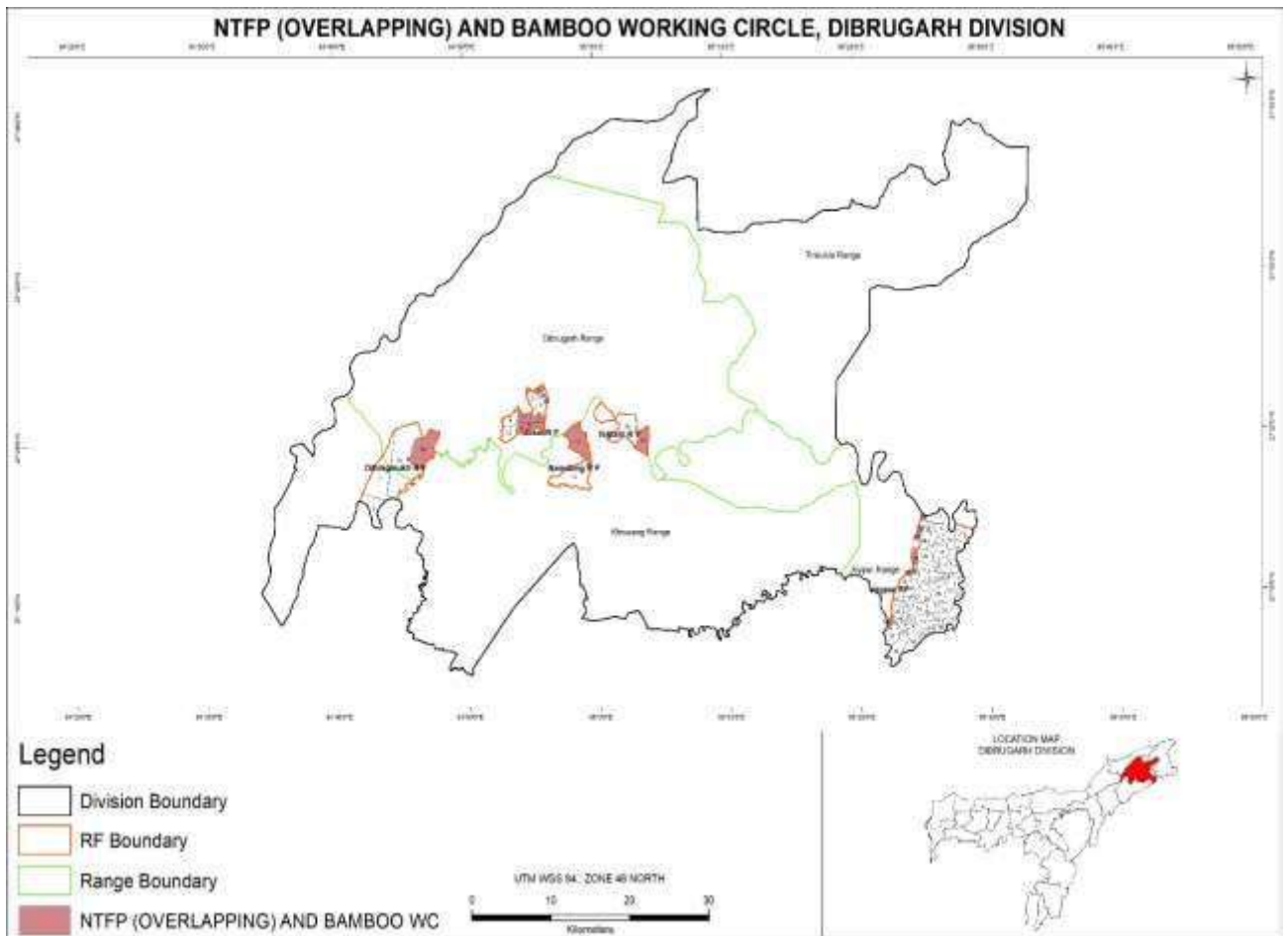


Figure 5.1: Map showing NTFP (overlapping) and bamboo working circle of Dibrugarh division

5.2 General constituents of the Working Circle: The NTFP Working Circle shall comprise largely of fringe forest areas or such other areas, which are fit for extraction of a particular NTFP at a rate, without disturbing the biological diversity so as to maintain its potential to meet the needs and aspirations of present and future generations. Methodology of closure of an area for the collection or extraction of particular forest produce for a specified period (closed area); restricting or banning the collection or extraction of any forest produce for certain period or periods of a year (closed season); limits on quantities of any forest produce to ensure sustainable harvesting for the future (sustainable harvesting limits);

sustainable harvesting/ collection practices etc. will be adopted. NTFPs shall be managed on JFMC areas, fringe forest areas, community forest areas with the help of community after imparting proper training to them regarding regeneration, time of harvesting, grading and storage for sustainable management and value addition etc.

5.3 General condition of flora and fauna: The forest in this Division is rich in diversified flora and fauna. Details of flora and fauna recorded for this Division is given below.

The forest type of the overlapping working circle as per the classification made by Champion and Seth in their survey of forest types of India - Type IB/C1 Assam Valley Wet Evergreen Forest (*Dipterocarpus*) or more commonly known as Upper Assam Dipterocarpus - Mesua formation. It forms a part of the world heritage of tropical/subtropical wet evergreen forests, multi storied in structure and rich in biodiversity. *Shorea assamica* is also visible in the top canopy along with *Dipterocarpus retusus* over a limited locality especially in slightly higher elevation with good drainage. Other species which are found covering the place in the top canopy are *Michelia champaca*, *Mesua ferrea*, *Magnolia* spp., *Canarium bangalensis*, *Artocarpus chaplasi*, *Altingia excelsa*, *Ailanthus grandis*, etc. The important NTFPs available in the Division are –

- Edible Fruits: Outenga, Kol, Silikha, Bel, *Emblica officinalis*, *Artocarpus* spp., *Syzygium* spp., *Mangifera indica*, *Zizyphus* species, Poniyal, Jalphai, Leteku, Kachu, Kath alu,
- Other NTFPs: Dalchini, dhuna, Monisal, Jengu, Tokou, Bah, Bet
- Animal products: Honey, wax
- Medicinal plants: Bhedailata, Dhekia, Kochu, Kathalu, Manimuni, Jamlakhuti.

5.4 Blocks, compartment and JFM areas: Blocks, compartment and the area to be covered in this working circle is provided in the table below.

Table 5.4.a: Area details under NTFP working circle of Dibrugarh Division

Range	Compt No	Area (Ha)	Area under NTFP WC	Area earmarked for NTFP plantation	Area earmarked for Bamboo plantation	Remarks/
Dibrugarh	Jokai Comp-1	82.058	82.058	20	20	
	Jokai Comp-2	120.491	120.491	25		
	Jokai Comp-5	160.036	160.036	25		
	Jokai Comp-6	181.152	181.152	25		
	Jokai Comp-7	178.475	178.475	25		
	Jokai Comp-8	167.731	167.731	25		
	Telpani Comp-1	1332.288	1332.288	50		
Khowang Jeypore	Dihingmukh C- 1	3614.282	3614.282	50		
	Jeypore Comp-1	205.291	205.291	25	20	
	Jeypore Comp-3	143.238	143.238	25	20	
	Jeypore Comp-9	279.080	279.080	25	25	
	Jeypore Comp-13	365.030	365.030	10	25	

	Jeypore Comp-18	163.099	163.099	15	25	
	Jeypore Comp-26	183.183	183.183		25	
	Jeypore Comp-27	110.334	110.334		20	
	Jeypore Comp-38	176.738	176.738	25	20	
	Jeypore Comp-41	102.171	102.171		25	
	Jeypore Comp-42	140.074	140.074		25	
	Jeypore 1 st add	198.20	198.20		25	
	Jeypore 2 nd add	144.00	144.00		25	
Khowang	Namdang	1858.63	1000.00	25	25	
Total of the Division		21794.648	9046.951	395.00	325.00	

Total area under NTFP W.C. is 9046.951 hect out of which area earmarked for NTFP plantation is 395 hect. and area earmarked for Bamboo plantation is 325 hect.

5.5 Objectives of the working circle: The broad objective of this working circle is to create a Bank of Non timber forest produce to cater the needs of local population as well as to pave the way forward towards revenue collection for the State. Specific objectives are given below:

- a) To protect and improve the quality and productivity of various non-timber forest produce.
- b) Sustainable use of forests through sustainable collection, harvesting of NTFP adopting sound silvicultural principles.
- c) To involve communities working in JFM areas or community forests for sustainable management of NTFPs with an aim to increase the yield of NTFPs by encouraging massive regeneration and supplementing with artificial regeneration by intensive cultivation.
- d) To motivate and train the forest dependent communities in protection, improvement, harvesting and disposal of NTFPs including nondestructive collection, processing value addition and marketing of products.
- e) To provide livelihood to the forest dwellers by proper valuation of NTFPs and providing proper processing, storing and marketing facilities.
- f) To identify and conserve locally available medicinal plants and raising endangered or threatened medicinal species on a large scale by involving village forest committees and research organisations.
- g) Initiate research on medicinal plants and other NTFPs.

The Bamboo Working Circle aims at the production and harvesting of high quality bamboo on a sustainable basis. All the poorly stocked bamboo bearing areas, particularly in the fringe areas, shall be restocked with indigenous and commercially viable species. Efforts shall be made to extract bamboo from the difficult to work areas included as parts of prescribed felling series. The working circle should not only meet the demands of Tuli Paper Mill, Households, Crafts and Cottage Industries but also provide proper facilities for processing, storing and marketing of the bamboo. It is needless to mention that bamboo can replace timber in most of its uses. The main objectives of this working circle are –

- To improve the bamboo forests of the Division by adopting sound silvicultural system.
- To obtain maximum sustained yield of bamboo to meet the requirements of cottage industries and domestic use.
- To harvest the mature bamboo in the felling series by coupe system.
- To raise plantations of bamboo and other high yielding pulpwood species for reduction of pressure on the reserved forests.

5.6 Activities proposed to be undertaken are-

- Creation of NTFP Plantation = 395 hect.
- Maintenance of NTFP Plantation = 395hect. for 5 years
- Creation of Bamboo Plantation = 325 hect.
- Maintenance Bamboo Plantation = 325 hect for 5 years

Table 5.6a: Sequence of regeneration (NTFP) proposed (Year-wise Plantation activities)

Plantation Series.	Name of RF/PRF/Compt	Area allotted in WC	Area earmarked for NTFP plantation	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Jokai P. Series	Jokai Comp-1	82.058	20	10	-	-	-	-	-	-	-	-	10
	Jokai Comp-2	120.491	25		10	-	-	-	-	-	-	15	-
	Jokai Comp-5	160.036	25		-	15	-	-	-	-	10		-
	Jokai Comp-6	181.152	25		-	-	15	-	-	10	-	-	-
	Jokai Comp-7	178.475	25		-	-		15	10	-	-	-	-
	Jokai Comp-8	167.731	25		-	-	15	-	-	10	-	-	-
PS Total			145	10	10	15	30	15	10	20	10	15	10
Telpani P. Series	Telpani Comp-1	1332.288	50	10	-	10	-	10	-	10	-	10	-
PS Total			50	10	-	10	-	10	-	10	-	10	-
Dehingmukh P. Series	Dihingmukh C- 1	3614.282	50	10	-	10	-	10	-	10	-	10	-
PS Total			50	10	-	10	-	10	-	10	-	10	-
Namdang P. Series	Namdang	1858.63	25		15	--	-	-	-	-	10	-	-
PS Total			25		15	-	-	-	-	-	10	-	-
Jeypur P. Series	Jeypore Comp-1	205.291	25		-	15	-	-	10	-	-	-	-
	Jeypore Comp-3	143.238	25		-	-	15	-	10	-	-	-	-
	Jeypore Comp-9	279.080	25	15	-	-	-	-	-	-	-	-	10
	Jeypore Comp-13	365.030	10		-	-	-	-	-	-	-	-	10
	Jeypore Comp-18	163.099	15		15	-	-	-	-	-	-	-	-
	Jeypore Comp-38	176.738	25		-	-	-	-	-	-	15	-	10
PS Total			125	15	15	15	15		20		15		30
Division Total			395	45	40	50	45	35	30	40	35	35	40

Table 5.6b: Sequence of regeneration (Bamboo) proposed (Year-wise Plantation activities)

Plantation Series.	Name of RF/PRF/Compt	Area allotted in WC	Area earmarked for bamboo plantation	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Jokai P. Series	Jokai Comp-1	82.058	20	5	-	5	-	5	-	5	-	-	-
PS Total			20	5		5		5		5			
Namdang P. Series	Namdang	1858.63	25		5	-	5	-	5	-	5	-	5
PS Total			25		5		5		5		5		5
Jeypur P. Series	Jeypore Comp-1	205.291	20		-	5	-	5	-	5	-	5	-
	Jeypore Comp-3	143.238	20	5	-	5	-	5	-	5	-	-	-
	Jeypore Comp-9	279.080	25		5	-	5	-	5	-	5	-	5
	Jeypore Comp-13	365.030	25	5	-	5	-	5	-	5	-	5	-
	Jeypore Comp-18	163.099	25		5		5		5		5		5
	Jeypore Comp-26	183.183	25	5	-	5	-	5	-	5	-	5	-
	Jeypore Comp-27	110.334	20		-	-	5	-	5	-	5	-	5
	Jeypore Comp-38	176.738	20		5	-	5	-	5	-	5	-	-
	Jeypore Comp-41	102.171	25	5	-	5	-	5	-	5	-	5	-
	Jeypore Comp-42	140.074	25		5	-	5	-	5	-	5	-	5
	Jeypore 1 st add	198.20	25	5	-	5	-	5	-	5	-	5	-
Jeypore 2 nd add	144.00	25		5	-	5	-	5	-	5	-	5	
PS Total			280	25	25	30	30	30	30	30	30	25	25
Division Total			325	30	30	35	35	35	35	35	35	25	30

5.7 Strategy: Non timber produces such as Cane, bamboo, jengu leaves, caupats, patidoi, seeds and flowers of different trees, barks, roots, tubers, leaves etc. which have commercial value will be encouraged in JFMC areas. Methodology of closure of an area for the collection or extraction of particular forest produce for a specified period (closed area); restricting or banning the collection or extraction of any forest produce for certain period or periods of a year (closed season); limits on quantities of any forest produce to ensure sustainable harvesting for the future (sustainable harvesting limits); sustainable harvesting/ collection practices etc. will be adopted. NTFPs shall be managed on JFMC areas, fringe forest areas, community forest areas.

5.8 Method of treatment: Collection of NTFPs including Cane, bamboo, jengu leaves, caupats, patidoi, seeds and flowers of different trees, barks, roots, tubers, leaves, Dhupa Seeds, Dalchini leaves, Soapnut, Shikakai, Punarpuli and Honey will be allowed to communities involved in JFMC with strict adherence of JFMC Rules and under supervision of Forest Officials. Harvesting must be sustainable. Regeneration of NTFPs will be done involving local communities.

5.8.1 NTFP collection by JFMCs: Wherever JFMCs are formed, the collection of NTFP has to be entrusted to JFMCs, so that there can be a stake for the local communities to take interest in their proper collection and protection. No agents, outsider will be allowed to collect NTFPs from the Division.

5.8.2 Method of sale: NTFPs collected from areas other than JFMC areas and surplus NTFPs beyond domestic use will be put to sale in public auction or through tender process. The quantities of NTFPs will be ascertained from past records and auction rates for each NTFP items were fixed on weight basis. The sale will be held in the Range Offices. The entire collection and disposal of NTFPs should be done by JFMCs assisted by the department. Revenue collected from these will be deposited to the JFMC account. Any dispute will be resolved by the Range Officer.

5.8.3 Status of NTFP species: No systematic study of NTFP studies has been conducted. The information regarding their distribution, regeneration and productivity is must before a suitable strategy is involved. During the current Working Plan data on these lines should be collected. Apart from the items tendered by the department, local people do collect NTFP items for food and medicinal purpose. Data on such collections is required to assess the sustainability of removal of those NTFP items.

5.9 Prescriptions: The following prescriptions are suggested for the Working Circle –

- a) In consultation with the forest officials, JFMCs are allowed to collect NTFP from the area under JFMCs without damaging any part of the tree or trunk.
- b) Collection of bark of any tree is strictly prohibited.
- c) Only flowers, leaves, fruit and nuts are permitted to collect.
- d) A list of endangered species has to be prepared by the department time to time and collection of NTFP from such trees has to be banned.
- e) While collecting NTFP some trees in the area may be identified and left as mother tree./ tree for seed resources.
- f) Only authorised member of the VFC with their Identity card are permitted to enter into the forest and collect the NTFP.
- g) JFMCs are permitted to collect the NTFP only through the members of the VFCs from the permitted micro plan areas.
- h) The collected NTFPs in the VFCs areas should be stored in a declared Godown properly after processing and disposed by tender-cum-auction sale in the presence of the forest officials.
- i) JFMCs are to raise NTFP and bamboo species in their land.

5.10 Management of bamboo: Bamboo extraction was never taken up in a regular way in this Division, as bamboo exists in pockets. However, as & when required bamboo was extracted to meet the domestic requirement of the people. This can be continued as extraction in such small patches in a scattered manner. If flowering of bamboo is reported harvesting of green bamboo is essential in the patches where it is available. Dead and dried bamboos are susceptible for fire hazards. Bamboo will be harvested from the JFMC area. The bamboo plantations inside the Reserved forest meant for enhancement

of wildlife habitats are not proposed for harvesting. The following cutting Rules are prescribed for proper management of bamboos.

- a) Cleaning and cutting of bamboos should start from uphill side and should progress downward.
- b) Cleaning and cutting of bamboos should be carried out at the same time and not be done separately.
- c) The cutting should commence from the middle of November and be continued till middle of April and Transportation of extracted bamboos should be completed before onset of monsoon to prevent damage to natural regeneration.
- d) All dead and decayed bamboos should be removed. Young and healthy culms are to be retained. This will help in getting good support to younger culms. The current year shoots, one year and two-year-old bamboos should not be cut.
- e) Bamboo clumps to be worked from the centre to outer periphery. If the clump is congested it should be opened from one side and worked in horse-shoe pattern.
- f) Each clump must be treated as a unit of working and the total number of bamboos to be cut should be such that a minimum of 12 culms are left in each clumps. If the number of culms in the clump is less than 12 it should not be taken up for extraction.
- g) Bamboo culms should be cut 6"-18" above the ground. The cut should be in slanting manner, just above the first node to prevent accumulation of rainy water in it.
- h) In case of sporadic flowering the flowered clumps should be cut first but it should be done only after shedding of seed from clumps.
- i) All the seeds should be allowed to fall, before taking up extraction of dead bamboos.
- j) Complete sweeping of forest floor should be avoided
- k) New vehicle paths should not be formed in the area to prevent damage to regeneration
- l) Extraction of clumps should be taken up from only one side, instead of working from all sides
- m) Extraction should be started after rainy season and be completed as early as possible
- n) Strict fire protection measures have to be taken up to prevent occurrences of accidental fires in the forest, casing any damage to dead bamboos and also to protect the young regeneration.
- o) Such areas should be kept completely closed from grazing till the clumps are completely established. Normally this period is 12-15 years.

5.10.1 Bamboo felling:The felling series is to be further divided into four annual cutting areas. The areas harvested in the first year will again be harvested in the fifth year. Similarly, the area harvested which will be harvested in the second year will again be harvested in the sixth year. Likewise, all the cutting area will be harvested. Each of the cutting areas will be divided into coupes. The coupes will be annual in operation. The areas where bamboo and other NTFPs grow in continuous stretch are considered for exploitation by the local people and the bamboo based industries.

5.10.2 Felling / cutting rules for bamboo

1. Harvesting should be as per the prescribed yield only.

2. All culms should be cut as low as possible but not above 30 cm from the ground level. The actual cut should be immediately above a node. This needs to be strictly enforced and regular inspections by officers should be carried out to ensure that this is done. If this is not enforced, the whole clumps will deteriorate in years to come.
3. Only mature culms will be removed. At least six mature culms should be retained in each clump in addition to all the one-year old culms.
4. For large-scale operation the felling should commence in the month of October and shall continue up-to the end of May every year.
5. The culms left out should be uniformly distributed as far as possible.
6. No cutting should be allowed from the periphery except for above 3 (three feet) wide passage for removal from inside the clump. A horse shoe pattern of cutting should be allowed.
7. All the dead bamboo should be cut and removed.
8. Any occurrence of flowering (gregarious) should be reported to the Principal Chief Conservator of Forests, Assam with a copy to Silviculturist, Assam Forest Division, Basistha. The flowered clumps should be extracted by clear felling depending on the extraction facilities and demand.

5.10.3 Method of regeneration of bamboo

Bamboo can be propagated both by conventional and non- conventional methods:

1) Conventional methods:

- i) Propagation through seeds
- ii) Propagation through rhizome / off- set planting.

2) Non- conventional methods:

- i) Propagation culm cutting.
- ii) Propagation through branch cutting.
- iii) Propagation through macro proliferation.
- vi) Propagation through layering and marcotting.
- v) Propagation through tissue culture.

Bamboo flowers in an interval of 10-120 years depending upon the species. Viability of seeds gradually decreased after one / two months, if it is not stored with proper aeration for seed respiration and protection from insect and rodents. Therefore, seeds should be sown as soon as possible after collection and processing. The collected seeds are to be cleaned properly, dried in the sun for 2-3 hours then stored in properly aerated gunny bags. Simultaneously, humidity and temperature should be controlled to 8-10% and 10° -14° C respectively. The seeds are soaked in clean water for 10-12 hours to break the dormancy and water is drained out properly 10-20 minutes before sowing. After treatment, the seeds may be sown in nursery bed, polythene bags or pots.

Prepare a raised nursery bed of 10 x 1.5 m. by deep digging or hoeing and fill it with a mixture of soil, sand and fully decomposed FYM in 2:1:1 ratio. The week before sowing, drench the nursery bed with

insecticide (Aldrin) and fungicide (Bavistin) to prevent termite and fungal attack for each bed use 40 litres 0.05% Aldrin prepared by adding 0.5 ml. of Aldrex 30 EC per liter of water and 30 liters of 0.05% (a.i) prepared by adding 1 gram of Bavistin 50 wp'per liter of water.

The sowing should be done in bed of overhead shade protected preferably by thatch or bamboo split. Sowing in furrow of 2cm depth is advisable covering with thin layer of top soil and watering lightly once in a day. Seeds start germination after 3-7 days in favorable climatic condition and continue up-to 15-25 days.

a) Propagation through rhizome / off- set planting: Rhizome or off - set planting is the most commonly practiced and age old traditional method in home grown bamboos; however, it has several limitations too. The 1-2 years old culms are selected for off-set / rhizome planting - cut the culm keeping 2-3 internodes (1-2 m) high from ground level with active bed and excavate along with portion of rhizome. The rhizome must be separated by cutting from neck carefully to avoid damage. This rhizome should be transferred to the planting site as early as possible to avoid mortality. The planting should be done in well advanced dug pits of size 45 cm x 45 cm x 45 cm for small sized bamboo and 60 cm x 60 cm x 60 cm for large sized bamboos. Prior to one month planting pits should be treated with insecticide and dried FYM or, any well decomposed manure.

b) Propagation through runner / cuttings: The runners of 1-2 years old having viable buds are selected and are excavated very carefully without injuring and disturbance. The selected runners are then cut with sharp secateurs / knife keeping 3-4 internodes are taken in prepared nursery bed of size, 10 m x 1.5 m. Before burying under the soil, rooting hormones are applied by dipping the base of cut end and buried into the nursery bed in a furrow depth of 2-3 cm and covered with top soil. Water the bed lightly daily till it is rooted. The propagules start sprouting and produce shoot after 1-2 months and rooting after 2-3 months. The well rooted plants are taken out from nursery bed and each node with sufficient rooted plants are separated and transplanted in the poly bags. The polybags are kept overhead protected bed and again watered regularly. After 4-6 months, seedlings are ready for planted in the field. The best time for this method is during dormant period in the month of January-February.

c) Propagation through culm cutting: Propagation by culm is a viable and alternative method and has several advantages over other methods. This method involves treatment of culm cutting with growth regulation for root induction. The method is applicable for most species of economically importance bamboos.

The 1-2 years old mother plants are selected and trimmed by keeping 10-15 cm. long lateral branches and made the culm cutting keeping 2-3 internodes. Bore / open a hole between chemical solution of IBA or NAA @ 200 ppm up-to the cavity level. Then wrap the hole with polythene bag or, cello tape tightly.

Prepare 2-3 noded cutting with sharp knife or, hacksaw leaving 5-7 cm on either side of the nodes.

The prepared culms are buried in a furrow at 4-5 cm. depth at a distance of 45-60 cm and covered with top soil in well prepared bed. Shooting takes place after 1-2 months and roots emergence take place 4-5 months. Frequent watering should be given till proper root development. Rooted culms are taken out after

flooding the field or during rainy days when bed is loosened. Best time for propagation of bamboo in this method is during rainy season, ie. March-May. Thick walled bamboo such as: *Bambusa bambos*, *Bambusa balcooa*, *Dendrocalamus asper*, *Bambusa vulgaris*, etc. can be propagated under this method.

d) Propagation through branch cutting: This method is mostly used in thick walled sympodial bamboos. The 1-2 years old branches with 3-4 internodes to be selected for planting materials. The propagation should be made during active growth stage. Cutting should be placed horizontally below 7-10 cm in sand bed or, mist chamber. Then well rooted plants are transferred to polybags and in green house or, overhead shaded bed, Bamboo species: *Bambusa vulgaris*, *Bambusa nutans*, *Dendrocalamus hamiltonii*, *Bambusa balcooa*, *Bambusa pallida* are recommended for propagation through branch cutting method.

e) Propagation through macro proliferation: The multiplication of bamboo seedling by rhizome separation leading to matter sized planting materials is known as macro-proliferation. This is generally practiced in small seedlings usually raised through seeds.

When the seedlings are of 5-6 months having more than 2 plants with prominent rhizome development it is separated and is repeated every year till it overgrows. The culm with piece of rhizome and roots are carefully separated with the help of sharp knife after washing or, shaking the attached soil. The separated seedlings are planted in the poly bag and stored under proper nursery conditions.

5.11 Subsidiary silvicultural operations: In order to encourage yield, subsidiary silvicultural operations such as cleaning, weeding, soil working should be carried out. The area may be fenced with locally available thorny material. If there are some small streams passing through the site, it is beneficial to construct check dams and vegetative gully checks for moisture conservation. Climbercutting, thinning etc, should be done at regular intervals to have better yield.

5.12 Cultivation of Agarwood (*Aquilaria agallocha*)

Agar oil and wood are highly sought after products around the world, and Agar trees can offer lucrative global trade options to locals in this Division. Agar (*Aquilaria agallocha*) could be the driver of an economic empowerment for the marginalised aboriginal, native, tribal and forest dwelling communities in this Division. Such rural communities may be guided for exploring the green economic opportunities by planting Agar trees. Such plantation drives will not only work to combat climate change and pollution but exploring livelihood opportunities naturally would alleviate poverty by empowering marginalised communities. Hundreds of hectares of forest land are lying barren without any production. These barren lands can be brought under cultivation of Agar trees.

Aquilaria malaccensis locally known as Xasi or Agar, acts as a world class perfumery fixative and is highly sought after and priced by European perfumers for making their best grade scents. It acts as a stimulant, cardiogenic, carminative, aphrodisiac, alternative anodyne, anti diarrheal, anti asthmatic, astringent, laxative stomachic and tonic.

A cost and benefit analysis done by Kumar Deepak, an environmentalist working with the United Nations Development Programme (UNDP) reveals that around 3,000 *Aquilaria agallocha* trees in two hectares of farmland over a 20 year time period adds up to a total expenditure of about Rs 7.5 lakh. Anticipated yield and income generally comprise two phases. As an interim yield, 40% of the selected Agar plants were harvested in the first phase in thinning operation. The yield of distillable wood (Low quality Dum/Boya) from 10 years old tree (about 20 kg per tree) sells at about Rs 10 per kg. And the Dum quality wood from a 20 year old tree (about 50 Kg per tree) sells at Rs. 50 per kg. Batli Mal/kalagachi of a 20 year old tree (about 0.5 Kg per tree) sells at Rs. 2,000 per Kg. So the gross return from a two hectare field over two decades was Rs. 65 lakh.

Forest land being fertile and natural abode of Sashi (*Aquilaria agallocha*), introduction of cultivating the species by JFMCs will be promoted. This will definitely boost livelihood opportunities of local communities.

5.12.1 Regeneration of Agarwood (*Aquilaria agallocha*)

Distribution: North-Eastern States of India namely Assam, Meghalaya, Manipur, Mizoram, Arunachal Pradesh and Nagaland.

Climate and Soil: This is a tropical tree which grows over high rainfall tract throughout humid regions. The region experience low temperature variations between 20°C to 28°C and relative humidity around 80%. It grows over sandy loam and slightly acidic soils.

Propagation Material: Seeds.

Nursery Technique:

Raising Propagules: Seeds mature during July-August. It loses viability soon. Thus seeds are sown within a week of collection. Raising seedlings in poly-bag is preferred. Seed germination is more than 80%.

Propagule Rate and Pretreatment: 4500 plants/ha are required.

Planting in the Field:

Land Preparation and Fertilizer Application: Before transplanting of seedlings, land should be thoroughly ploughed and harrowed to bring it up-to a good tilt. FYM @ 20 t/ha may be applied at the time of land preparation supplemented with NPK @ 60:60:40 may be applied in split doses. The fertilizer level is increased with age from 3rd year onwards.

Transplanting and Optimum Spacing: Seedlings when attain a height of 30-40 cm should be transplanted in the field during rainy season (April-June) at optimum spacing of 3X 3 meter.

Intercropping System: Annual or biennial medicinal herbs viz. *Andrographis paniculata* (Kalmegh), *Withania somnifera* (Ashwagandh), *Rauwolfia serpentina* (Sarpagandha), *Bacopa monnieri* (Bhrami), *Piper longum* (Pippali) etc. may be cultivated as catch crops till the trees attain growth.

Inter-culture and Maintenance Practices: Spading and simultaneous weeding at 90 days after transplanting is required.

Irrigation Practices: Rainfed plantation.

Weed Control: Hand weeding is done after 90 days of transplanting, thereafter Gramoxone @ 0.5 kg/ha may be applied when necessary. Glycel @ 1.5 kg/ha may be applied to eradicate weeds.

Disease and Pest Control: Attack of *Heortia vitessoides* is observed during May-August. This causes defoliation of whole tree. Application of Thiodan @ 2 ml/lit at 15 days interval during infestation is found to control the pests effectively.

5.12.2 Harvest Management

Agar-wood develops a peculiar, persisting strong odour because of infestation by a fungal identified as *Zeuzera conferta*, it penetrates the hard wood, through wounds, injury or borers. All attempts to induce artificial infestation have failed; it is a natural phenomenon. It develops black patches and stores resinous oil which is separated through distillation of the woody chips. This oil has high value in medicine and perfumery industry.

Crop Maturity and Harvesting: Time of harvesting depends on disease infestation in hard wood. Agar is regarded as a pathological product formed as result of infection. Black patches in the bark indicate occurrence of infection and can be used for harvesting hard wood to commercial use.

Post-harvest Management: Wood chips or chips powdered mechanically without generating heat are soaked in water for 2-3 days and transferred to stainless steel vessel which is part of a distillation unit. The distillation is done for 30-36 hours. Oil and water is collected in a separator and stored. The oil and water ratio in the condenser is kept low on account of the high boiling point. Oil is stored in closed container preferable in Aluminum bottles.

Chemical Constituents: The woody chips have an essential oil commonly known as Agar oil from 0.8% to 2.2% in fungal infested wood of 8-50 years old plant. The wood contains hexadecanoic acid (25.0%), pentadecanoic acid (6.7%) and oleic acid (4.9%); other constituents range from 0.1 to 2.1%.

Yield and Cost of Cultivation (Hectare): This oil is exceptionally costly.

5.12.3 Treatment prescribed: Areas allotted under JFMC Working Circle and NTFP Working Circle will be selected for Agarwood cultivation. 30 % of such area shall be brought under Agarwood cultivation under JFMC agenda. Regeneration expenditures, as in other JFMC plantation, shall be borne by Forest Department. Protection of the Crop shall be done by the JFMCs. Sharing of harvested crop shall be as per norms of the JFM.

CHAPTER 6

Soil and Water Conservation (Overlapping) Working Circle

6.1 Name of the Working Circle: Soil and Water Conservation (overlapping) Working Circle. The detail map of this working circle as per the existing compartments is shown in Figure 6.1 and the recasted map as per the micro watershed RF wise is shown in Fig 6.1a to 6.1e .

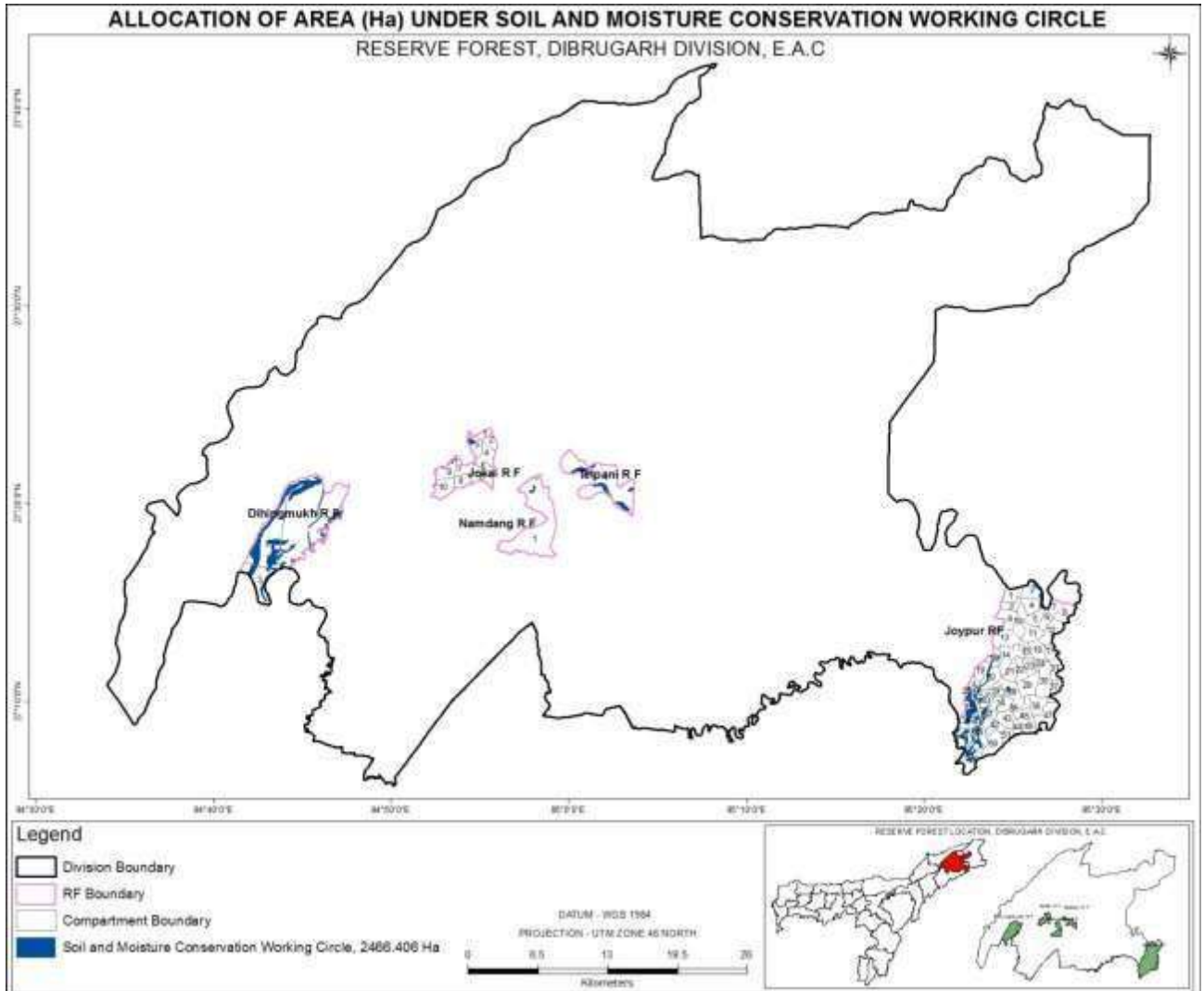


Fig 6.1a: Map of Soil and water conservation (Overlapping) working circle



Fig 6.1b: Map of Soil and water conservation (Overlapping) working circle of Dihingmukh RF.

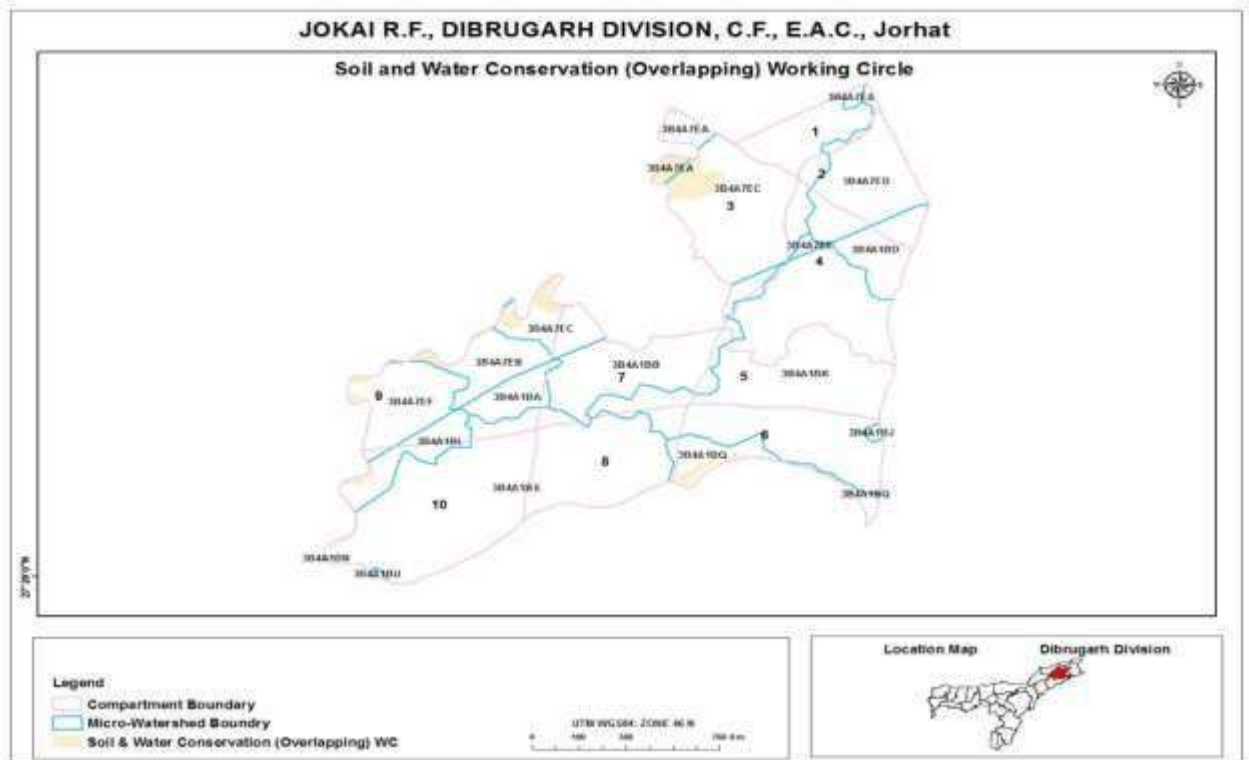


Fig 6.1c: Map of Soil and water conservation (Overlapping) working circle of Jokai RF.

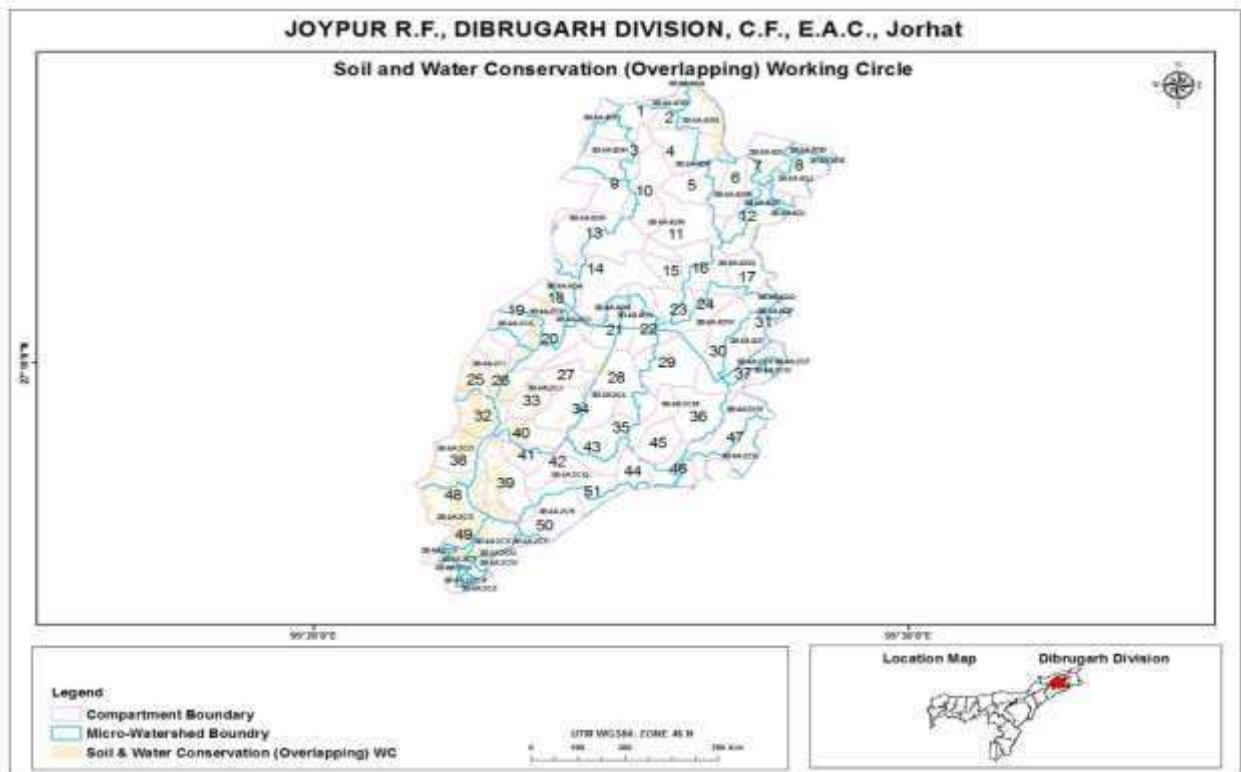


Fig 6.1d: Map of Soil and water conservation (Overlapping) working circle of Joypur RF.

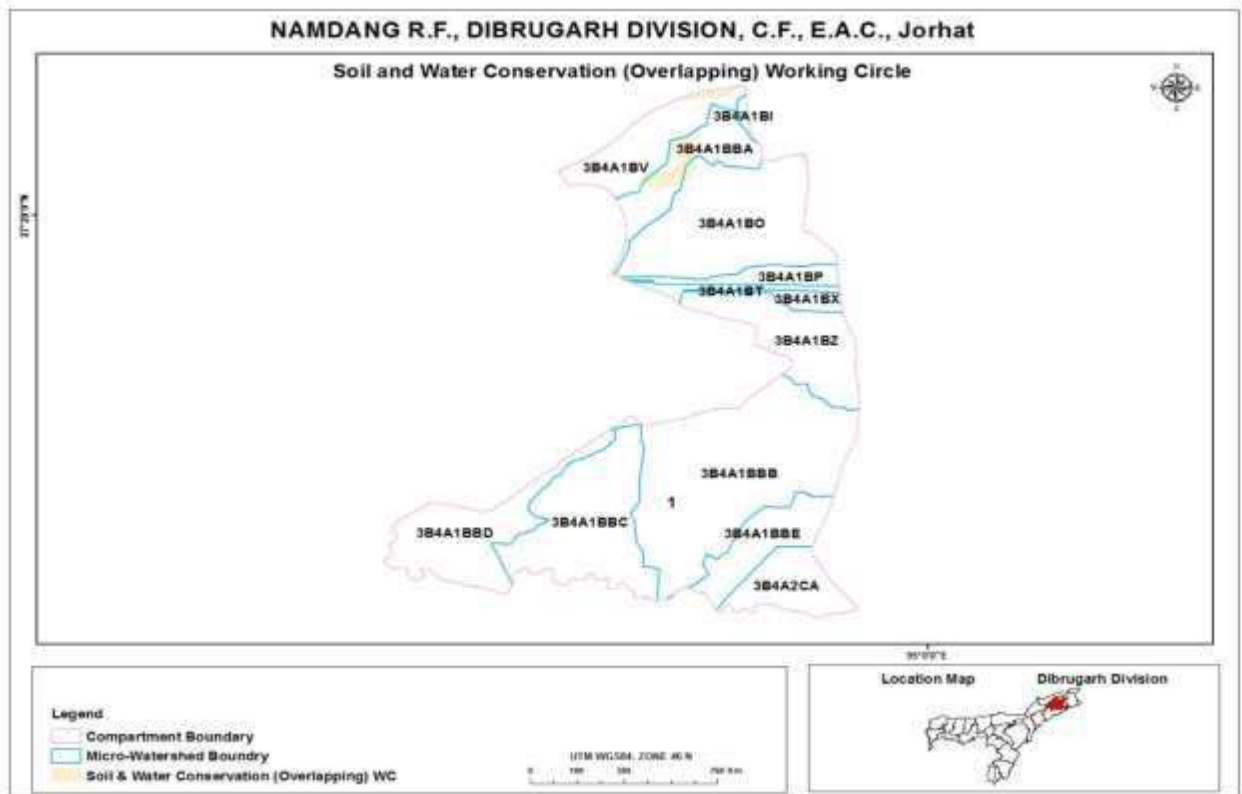


Fig 6.1e: Map of Soil and water conservation (Overlapping) working circle of Namdang RF.

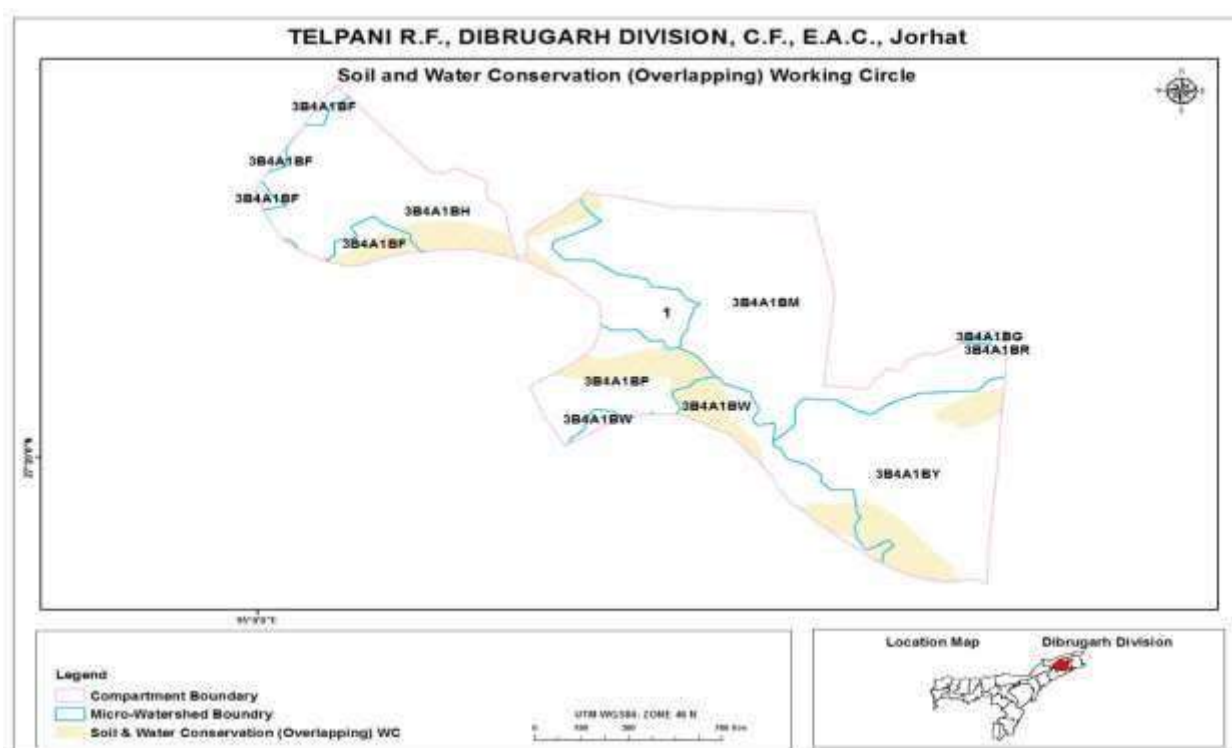


Fig 6.1f: Map of Soil and water conservation (Overlapping) working circle of Telpani RF.

6.2 General constituents of the working circle: All the areas of forest which are prone to soil erosion would be part of this Working Circle. The main emphasis is to reduce top soil erosion and minimize soil loss during floods. The effective soil conservation measures along with the catchment and watershed management are the pre conditions for a sustainable forest management. The forests are also sources of water (surface, sub-surface and ground water). Over exploitation of the ground water resources results in a decline in ground water levels; there is an urgent need to augment the ground water resources through suitable management interventions. It is desirable to have forest management practices with the principles of watershed based development approach especially in the source areas of water. Such areas should have restrictions on tree felling but there should be operations to improve the water regimes and natural regeneration. Many water streams originate from the RFs of the Division and many streams and rivers originated from other states pass through the RFs of this Division. Special provisions shall be made in the working plan to sustain water resources and to address the livelihood issues of the people living in and around the natural inland water sources. Further, areas susceptible to soil erosion such as steep slopes and areas in the vicinity of perennial streams shall be focused for soil and water conservation using mechanical or vegetative control measures.

6.3 General condition of flora and fauna: The forest in this Division is rich in biodiversity. The forest type of the overlapping working circle as per the classification made by Champion and Seth in their survey of forest types of India – Type IB/C1 Assam Valley Wet Evergreen Forest (*Depterocarpus*) or more commonly known as Upper Assam *Depterocarpus – Mesua* formation. It forms a part of the world heritage of tropical/subtropical wet evergreen forests, multi storied in structure and rich in biodiversity; more

popularly known as Rain Forests. The predominant species namely *Dipterocarpus retusus* reaches a height of 50 metres and above and girth up to seven metres. *Shorea assamica* is also visible in the top canopy along with *Dipterocarpus retusus* over a limited locality especially in slightly higher elevation with good drainage. Other species which are found covering the place in the top canopy are *Michelia champaca*, *Mesua ferrea*, *Magnolia* spp., *Canarium* spp., etc. The middle storey is dominated by *Messua ferrea*. Other species found in this canopy are *Terminalia chebula*, *Syzigium cuminii*, *Sapium baccatum*, *Dysoxylum binectariferum*, etc. In some areas, there occurs a third storey occupied by *Dendrocalamus hamiltonii*, *Livingstonia jenkinsonii*, etc. The undergrowth comprises of woody shrubs like *Myrsine capitellata*, *Osbeckia* spp. *Laportea crenulata*, Shrubs like *Phrynium placentarim*, *Alpinia allughas* etc. Climbers are numerous and found growing profusely, common among them are *Thumbergia grandiflora*, *Bauhinia vahlii*, etc. wherever there is an opening *Michenia scandens* – an exotic, invades the forests, suppressing all shrubs and advance growths of trees and intercepting free falling seeds from reaching the ground.

The areas are of very rich biodiversity having 60 mammal species, 270 plus bird species, 47 snake species, 25 amphibian species, 71 fish species, 300 plus butterfly species. The wild animals noticed in the tracts of the proposed area of the overlapping working circle include The Asian elephant, Tiger, The clouded leopard, Field mouse, Fruit bat, Wood rat, The jungle cat, The Rhesus monkey, Pangolin, Sloth bear, Indian civet, Sambar, Bamboo rat, Mole, Tree shrew, Himalayan Black Bear, Small civet, The leopard, The common langur, Giant squirrel, Hare, The slow loris, The Assamese macaque, The fishing cat, Muntjac, Hog deer, The mongoose, The Goral, Porcupine, The jackal, Wild boar, Common Otter. Different species of birds namely Drongos, pheasants, Jacanas, Orioles, Eagles, Hornbills, Owl, Minivets are found in the waterholes, water bodies located inside the Division.

6.4 Blocks, compartments allocated: Blocks, compartment and the area to be covered in this Working Circle is provided in Table 6.6.

Table 6.6: Area details under the soil and water conservation working circle of Dibrugarh Division, Assam

Sl. No.	Reserved forest	Compt No.	Compartment Area (Ha)	Area of the Overlapping WC	Area identified for Soil and Water Conservation intervention (Ha)		
					Area	Geo Co-ordinates	
1.	Dihingmukh R F	1	3301.22	3301.22	591	27.307758	94.745898
		2	1315.42	1315.42	576	27.307713	94.738956
		3	549.34	549.34	127	27.307804	94.752843
2.	Jokai R F	3	211.54	211.54	31	27.357325	94.905602
		6	181.15	181.15	7	27.357362	94.912544
		9	254.95	254.95	25	27.358416	94.905567
		10	295.70	295.70	6	27.357925	94.912897
3	Joypur RF	1	205.29	205.29	3	27.192529	95.439994
		2	267.47	267.47	61	27.199484	95.446942
		4	143.24	143.24	19	27.199451	95.426116
		5	217.35	217.35	7	27.248085	95.440044
		6	187.85	187.85	3	27.241141	95.440038

		8	142.20	142.20	6	27.206359	95.405297
		9	164.97	164.97	1	27.206395	95.426122
		12	284.83	284.83	16	27.206383	95.419181
		13	365.03	365.03	2	27.234162	95.419206
		17	284.83	284.83	8	27.234149	95.412264
		18	365.03	365.03	18	27.241094	95.412227
		19	400.01	400.01	17	27.227303	95.474734
		20	268.83	268.83	30	27.220348	95.467786
		25	108.90	108.90	44	27.171727	95.460801
		26	183.18	183.18	44	27.185616	95.460813
		27	110.33	110.33	6	27.150776	95.391366
		28	363.13	363.13	17	27.164638	95.377494
		31	188.49	188.49	8	27.150893	95.460783
		32	198.20	198.20	118	27.178629	95.43304
		33	114.68	114.68	10	27.178606	95.419157
		34	265.28	265.28	8	27.171673	95.426092
		37	158.82	158.82	7	27.185499	95.391395
		38	176.74	176.74	62	27.178555	95.391389
		39	226.50	226.50	48	27.171623	95.398325
		40	128.03	128.03	29	27.213394	95.460838
		41	102.17	102.17	15	27.192529	95.439994
		47	335.70	335.70	10	27.199484	95.446942
		48	301.13	301.13	129	27.199451	95.426116
		49	431.20	431.20	128	27.248085	95.440044
4.	Namdang R F	1	1840.32	1840.32	32	27.30206	94.961096
5.	Telpani R F	1	1600.94	1600.94	197	27.337175	95.044429
		Total	16240.00	16240.00	2466		

Area of the Soil and Water Conservation overlapping W.C is 16240.00 hect. Area identified for Soil and Water Conservation intervention is 2466.00 hectare.

6.5 Objectives of the working circle:The broad objective of this working circle is to conserve soil and water in the Division. The main objectives of this working circle shall be –

- a) To assess soil erosion vulnerability of various areas and to suggest control measures shown on a map.
- b) To propose several water harvesting structures and show them on map.
- c) To periodically monitor the river flow pattern with reference to annual rainfall/duration to show the status of improvement due to various control measures proposed.
- d) To map the wetlands in the forest area and to ensure that the water levels in these wetlands does not fall.
- e) To monitor the level of ground water in various wells, located within the vicinity of the RFs, with respect to the annual rainfall.

Activities proposed to be undertaken are-

1. Soil and water conservation works Proposed treatment area = 2466.00hect.

6.6 Associated Guidelines: Common Watershed Guidelines and any other guidelines related to conservation of soil and water shall be followed.

6.7 Strategy: Watershed approach to protect soil and water would be undertaken in the Division. The river sand will be protected as it acts as cushion for the meandering waterways. Catchment area treatment will be carried out based on the need to protect the fertile soil of the forest. The concept of springshed sanctuaries will be promoted. Hydrological regime will be maintained and flow of environmental goods and services is to be ensured by maintaining the runoff. The regenerative capacity of the endemic species will be enhanced by maintaining the optimum soil moisture. Activities would be undertaken with involvement of fringe village population. A total ecosystem conservation concept will be adopted for conservation of the wildlife habitat and conservation of biodiversity in these forests. An effective naturalization plan needs to be devised based on principles for maintaining natural diversity. To enrich the low diversity areas, efforts should be made to restore native (indigenous) complementing natural species. Monocrop should be avoided. Natural regeneration should be encouraged and wherever necessary, aided natural regeneration should be taken up. Introduction of exotic species in the area will be restricted and plantation of both, slow and fast growing native species of herbs, shrubs, and trees shall be promoted.

Involvement of local communities especially youths, women from the forest and fringe villages will be sensitized in forest and wildlife protection. Identification of issues relating to protection of forest and wildlife and taking appropriate measures, participatory planning and sharing of responsibility and benefits needs etc. will be taught to the communities. Involvement of local population can ensure control of illegal activities which can cause further degradation of the flora and fauna. For this purpose capacity building programs may be taken up. Application of spatial tools for regular monitoring and updation of any measures shall be taken.

6.8 Measures for its protection: Treatments to be done using the ridge to valley concept. Atleast 60 percent on the ridge should be covered with trees. Preference of vegetative measures over engineering measures is always an ethics of foresters. Emphasis will be laid not to disturb the hydrological regime and not to destroy the habitat of the native and endemic species. Realteration of any perennial spring water sources inside the Reserved forest is strictly be avoided.

6.9 Method of treatment: Prescription for soil and water conservation (SWC) –

- a) Identification of SWC related issues during microplanning.
- b) Technical and social feasibility of soil and water conservation works.
- c) Development of detailed project report.
- d) Gully plugging works to check further extension of the gullies.
- e) Minor engineering works in eroded areas and in slips prone areas to check the soil erosion and reduce runoff.

- f) Create works on the sides of diversion drains to checking further cutting of the drains/channels.
- g) Planting of cuttings of soil binding species in vegetative spurs but avoid exotic species.
- h) Gabion structures mainly retention walls, diversion drains if required after technical feasibility would be proposed.
- i) Proper anchorage of the gabion structures need to be ensured.
- j) Creation of continuous trenches across the slope and planting of soil binding species in the pit. The dug out soil will be placed towards the flow of water to check the soil erosion and reduce run-off.
- k) Riparian species and other less transpiring, water conserving species should be planted on the riparian areas and near water bodies.

CHAPTER 7

Wildlife Management and Biodiversity Conservation (Overlapping) Working Circle

7.1 Name of the working circle: Wildlife Management and Biodiversity conservation (overlapping) working circle. It covers the 21794.648 hectare of entire forest area of the Division. The detail map of this working circle is shown in Plate 7.1.

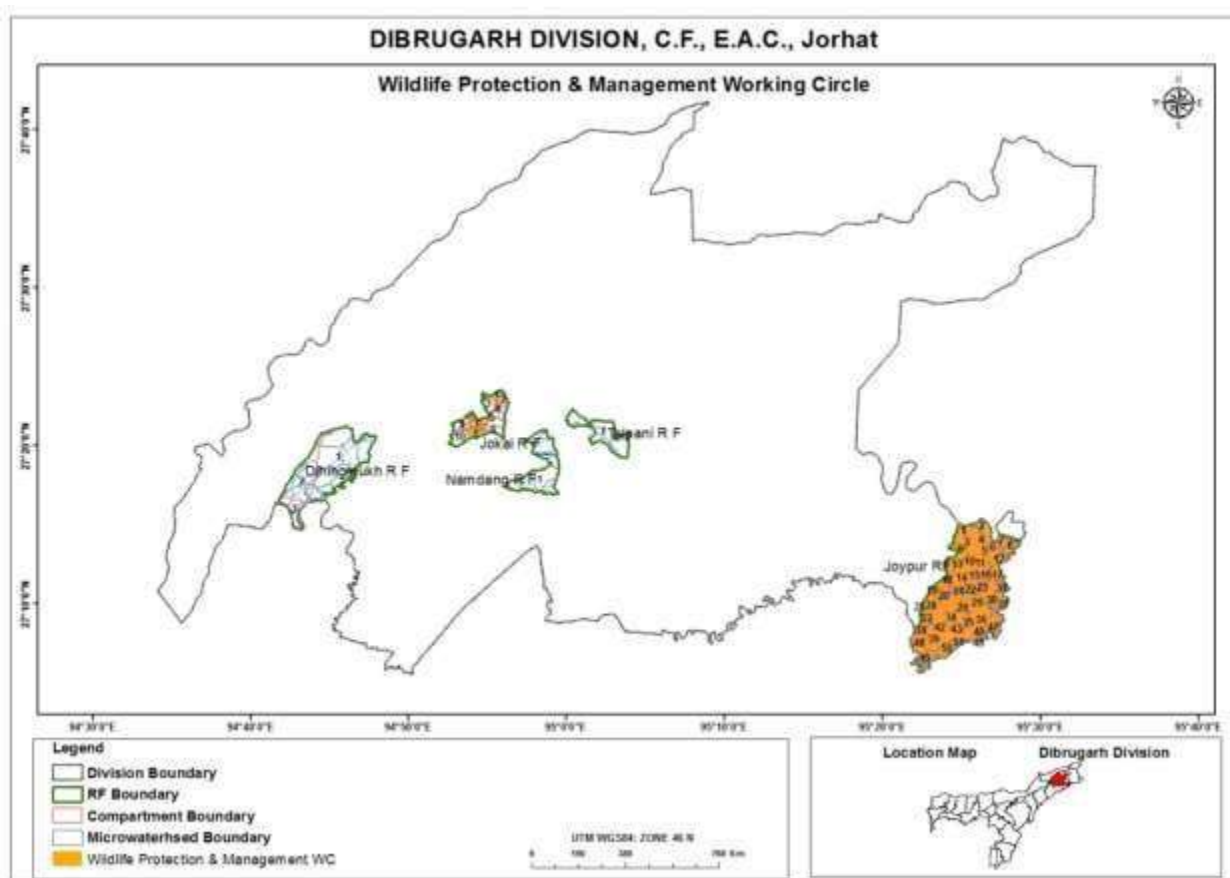


Figure 7.1: Map showing Wildlife Management and Biodiversity Conservation (Overlapping) Working Circle

7.2 General constituents of the working circle: The National Forest Policy'1988 aims at conserving the natural heritage of the country preserving the remaining natural capital with the vast variety of flora and fauna, which represent the remarkable biological diversity and genetic resources of the country. Forest management should take special care of the needs of wildlife conservation and forest management plans should include prescriptions for this purpose. It is especially essential to provide for `corridor` linking of the protected area in order to maintain genetic continuity between artificially separated sub sections of migrant wildlife. For better management of wildlife and to preserve the bio-diversity,

creation of protected areas (PAs) and their specific management practices are in force approximately 4% of the forest area of the country.

This will be on overlapping circle to cover all the areas of the Division. The plan should prescribe measures for wildlife habitat conservation and identification of corridors for movement of elephants and their protection and management for reducing man-animal conflict. Further this Division comprises a part of Dehing Patkai Wildlife Sanctuary (now National Park w.e.f. 9th June 2021) and also a part of Elephant reserve - Dehing Patkai Elephant reserve. A sizeable population of Asiatic elephants exists in the said elephant reserve. Ever increasing man-elephant conflict is a serious issue for the planners. There is a strong need of developing wild elephant habitat in all the RFs and civil areas of the Division to reduce man-elephant conflict. Rising population and shrinking habitat has led to increase in man - animal conflict and also resulted in maximum depredation to paddy and other agriculture crops raised by the people living near the forests. There is also necessity to bring some areas with water bodies and peripheral land mass into some special management under wet land conservation for proper management under this circle.

Biodiversity represents diversity of life forms. It includes diversity within species, among species of an ecosystem and among ecosystems. The contribution of individual species to the overall diversity within a community or ecosystem varies to a great extent. The coexistence of organisms that differ widely from each other contributes more to overall diversity than the co-existence of very similar species. Functional diversity is considered to be one of the main factors determining the long-term stability of an ecosystem and its ability to recover from major disturbances. Assessment of status of plant and faunal species and their periodic monitoring can be helpful in formulating strategies for conservation, maintenance and enhancement of overall biodiversity through sustainable management and use practices. Assessment of biodiversity especially the lower forms of life (algae, fungi, lichens, epiphytes, parasites, etc.) of a forest Division must be made an on-going program with the support from State Biodiversity Board as it may be difficult for the working plan officer (WPO) to do it within the time allotted for writing the plan.

Biodiversity is the totality of genes, species and ecosystem in a region. Richness of biodiversity of a region or country shows its richness of biological heritage, high conservation values and the richness of its population's socio-economic culture, as the biodiversity directly or indirectly affects the living standards of the human populations, health conditions and overall prosperity. In a bio-diversity rich country, there are multiple food choices, multiple choice of medicinal plants and multiple economic avenues. While biodiversity provides the people with a host of organic products, it is the people's duty to conserve the biodiversity which is the product of hundreds of millions of years of evolutionary history. In the recent past, biodiversity as a subject was not given the due importance. It is only after the Earth Summit held in 1992 at Rio de Janeiro, where on "Convention on Biological Diversity" (CBD) was adopted. The CBD having near universal membership has set out commitments for maintaining the biological resources underlining three main goals: (1) conservation of biological diversity, (2) the sustainable use of its components, (3) and the fair and equitable sharing of the benefits from the use of genetic resources. India is a party to the CBD and committed to conserve the natural heritage. The State of Assam has prepared the strategy and

Action Plan for Conservation of Biodiversity for the State in 2010 by constituting Assam State Biodiversity Board and also framing Assam Biodiversity Rules, 2010. Later with prime goal of preservation of the rich Biodiversity of the State, The Assam Project on Forest and Biodiversity Conservation Society (APFBC Society) was launched by the Govt. of Assam in collaboration AFD French Government on 28th June 2012.

This overlapping working circle will include wildlife management and biodiversity conservation. All the RFs under this Division are covered by Dibru - Patkai Elephant Reserve. A part of Upper Dehing RF (East block) and Dirok RF has been covered under Dehing-Patkai Wildlife Sanctuary. The RFs under this Division is brought under Wildlife management overlapping working circle. Under this overlapping working circle activities proposed should include habitat improvement, management for elephant corridor improvement and protection measures. Special emphasis shall be given for creation of plantation of fodder species and digging of water holes so that the animals get sufficient food and water within its habitat. Measures should also be suggested for combating man-elephant conflicts.

7.3 General Condition of Flora and Fauna:

7.3.1 Flora: The forest type of the overlapping working circle as per the classification made by Champion and Seth in their survey of forest types of India - Type IB/C1 Assam Valley Wet Evergreen Forest (Dipterocarpus) or more commonly known as Upper Assam Dipterocarpus - *Mesua* formation. It forms a part of the world heritage of tropical/subtropical wet evergreen forests, multi storied in structure and rich in biodiversity; more popularly known as Rain Forests. The forests adjacent to Dehing - Patkai Wildlife Sanctuary is characterized by multistoried layer of canopy; the predominant species like *Dipterocarpus retusus* reaches a height of 50 metres and above and girth up to seven metres. *Shorea assamica* is also visible in the top canopy along with *Dipterocarpus retusus* over a limited locality especially in slightly higher elevation with good drainage. Other species which are found covering the place in the top canopy are *Michelia champaca*, *Mesua ferrea*, *Magnolia spp.*, *Canarium bangalensis*, *Artocarpus chaplasi*, *Altingia excelsa*, *Ailanthus grandis*, etc.

The middle storey is dominated by *Messua ferrea* and *Vatica lanceaefolia*. Other species found in this canopy are *Terminalia chebula*, *Syzigium cuminii*, *Sapium baccatum*, *Dysoxylum binectariferum*, *Terminalia belerica*, etc. In some areas, there occurs a third storey occupied by *Dendrocalamus hamiltonii*, *Bamboosapallida*, *Livingstonia jenkinsonii*, etc.

The undergrowth comprises of woody shrubs like *Myrsine capitellata*, *Osbeckia spp.*, *Laportea crenulata*, Shrubs like *Phrynium placentarim*, *Alpinia allughas* etc. Climbers are numerous and found growing profusely, common among them are *Thunbergia grandiflora*, *Bauhinia vahilii*, etc. wherever there is an opening *Michenia scandens* - an exotic, invades the forests, suppressing all shrubs and advance growths of trees and intercepting free falling seeds from reaching the ground.

7.3.2 Fauna: The wild animals noticed in the tracts of the proposed area of the overlapping working circle include The Asian elephant, Hoolock gibbon, Tiger, The clouded leopard, Field mouse, Fruit bat,

Wood rat, The jungle cat, The Rhesus monkey, Pangolin, Sloth bear, Indian civet, Sambar, Bamboo rat, Pipstrelle, Mole, Tree shrew, Himalayan Black Bear, Small civet, The leopard, The common langur, Giant squirrel, Hare, The slow loris, The Assamese macaque, The fishing cat, Muntjac, Hog deer, The mongoose, The Goral, Porcupine, The jackal, Wild boar, Common Otter.

Various aves namely residents, local migratory, migratory noticed within the area of the overlapping working circle include Baya, Copper smith, Rain quail, Crested Tree swift, House swift, Hawk Crested Honey Buzzard, Blue throated barbet, Large Racket tailed drongo, Indian Eagle owl, Red jungle fowl, Brain fever bird, All but buls, Brahminy duck, Spoonbill, House sparrow, Small skylark, Pariah kite, Jungle crow, White breasted water hen, Great pied hornbill, Magpie Robin, Spotted dove, Spotted owlet, Bank myna, Spot billed pelican, Green pigeon, Black headed oriole, Adjutant stork, Blossom headed parakeet, Brown Fish owl, Black winged stilt, Pheasant tailed jacana, Blue rock pigeon, Water cock, Bronze winged jacana, Red rumped swallow, Maroon backed imperial pigeon, Grey headed myna, Crow pheasant, Rufous wood pecker, Grey hornbill, White wagtail, Geese, Koel, Barn owl, Chestnut bitten, Red turtle dove, Indian lorikeet, Pintail, Palla's fishing eagle, Osprey, Common king fisher, Fire breasted flower pecker, Whit necked stork, Hoopoe, White backed Munia, Spotted Munia, Hill myna, Nakta duck, Fairy blue bird, Blue jay/ Indian Roller, Little Cormorant, Darter, Wire tailed swallow, Mallard, House crow, Black drongo, Little green bee-eater, Yellow backed sun bird, Painted snipe, Bar headed goose, Indian night jar, Scarlet minivet, King vulture, Gold fronted leaf bird, Ring dove/ collared dove, Pied king fisher, Open bill stork, Crested serpent eagle, All babblers, Yellow eyed babbler, Redvented bulbul, Paradise fly catcher, Common vulture, Common myna, Shama, Brahminy kite, Shikra, Emerald Dove, Teal, Harridan, Palm swift, Black partridge, Treepie, Large parakeet, Lapwing, Tailor bird, White winged woodduck.

Wild animals have occupied a place in the local folklore. Local people respected and protected wildlife however due to modernization, growing needs and changing in the mindset of the people, there were changes impacting killing of wildlife for fun or pleasure or other greed needs.

7.4 Objectives of the working circle: The aim under this proposed overlapping working circle is to ensure wildlife habitat conservation, identification of corridors for movement of elephants and their protection, management options for reducing man-animal conflict, and conservation and preservation of biodiversity. Further the specific objectives of this working circle is divided into two sub-heads, one focusing wildlife management and the other focusing biodiversity conservation in the areas.

7.4.1 Wildlife management: It is necessary to take up protection and conservation measures throughout forests in the interest of wildlife protection and management, keeping this aspect in view the specific objectives of management are as follows.

- (1) To protect and conserve wildlife and ensure viable population of wildlife.
- (2) To increase the population of wildlife by providing proper habitat management including shelter, water, food etc. and to develop infrastructure facilities for the betterment of wildlife.
- (3) To preserve area of biological importance as natural heritage for the benefit of education, research and enjoyment of the people.

- (4) To improve and restore the demographic indicator of growth relating to population of all endangered, endemic, rare species of animals and plants.
- (5) To involve local people in wildlife conservation and educate and motivate local people for protection and conservation of wild animals there by providing an environment of security to wild animals.
- (5) To enhance the scope of employment potential and additional income generation by promoting ecotourism. To identify and promote ecotourism in wetlands namely, Merbeel and the other at Namphake Village in the periphery of Joypur RF.
- (6) Formulating strategies for reduction of man animal conflict.
- (7) To control illegal trade and poaching in wildlife and their products.
- (8) To reduce biotic interference affecting the growth of wildlife and regulate cattle grazing.
- (9) Rescue and rehabilitation of wild animal
- (10) Ensuring that development of roads, railways in these areas does not create habitat fragmentation.

7.4.2 Biodiversity conservation: The specific objectives towards biodiversity conservation within the Working Circle are-

- a) To ascertain the present status of various flora and fauna, especially the lower life forms, algae, fungi etc. and the IUCN Red Data book species, if any, and to monitor their status periodically. Various biodiversity parameters such as dominance, diversity, frequency, basal area, importance vegetation index etc. shall be calculated for each compartment.
- b) To map herbs, shrubs and climbers, and to make inventories of various NTFPs and Medicinal Aromatic Plants.
- c) To prepare and update people's biodiversity registers with the help of Biodiversity Monitoring Committees formed. The support of universities as well as interested NGOs shall also be taken for this.
- d) To carry out various studies related to biomass productivity, regeneration potential, NTFP productivity, carbon sequestration, effects of climate change on species range shifts, species growth rates and biodiversity, etc. by establishing permanent sample plots, preservation plots, regeneration plots and NTFP plots at various representative locations within the forest. State government is expected to provide support to the Division in form of instruments and subject matter experts.
- e) To initiate non-polluting, non-degrading ecotourism activity in the areas which are representatives of unique ecosystems, such activities will provide livelihood support to locals and shall be largely aimed at awareness generation among tourists and locals.
- f) To take up collaborative projects with local and international Educational Institutes, Academic bodies, Research and other Organizations, agencies.

7.5 Activities proposed to be undertaken are: Activities proposed to be undertaken are-

1. Enrichment plantations = 50 hectares.
2. Establishment of 1 anti-wildlife depredation unit.

3. Elephant proof trenching of earthwork = 3,75,000 m³.
4. Safe elephant corridors 4 nos.(Continuous for 10 years)
5. 160 nos. wildlife awareness camps.

7.6 Monitoring of Wild animals: Presence of wild animals in the Division should be observed by the following methods–

- a) **Sighting:** Near water holes, salt licks, grazing sites, near the roads, actual sightings of wild animals and their photography.
- b) **Infrared photography:** Installation of photographic units on probable areas to get picture of the wild animal.
- c) **Pug marks:** By keen observation of these pug/h hoof marks we can identify the category of wild animals, their sex and age. This gives an indication, however for authentication of wildlife, evidence based photographic method should be applied.
- d) **Grazing marks:** Identification of the category of herbivore by analyzing the nature of grazing and browsing, since all herbivores have different grazing.
- e) **Feces:** Collection and examination of animal feces for knowing the wildlife and getting idea on their population, food, etc.
- f) **Antlers marks:** Before falling of antlers e.g. spotted deers and Sambars rub their antler on some stem.
- g) **By salt licks:** In forest some soil contains more percentage of salt and minerals and wild animals lick such salt bearing soil to get the required amount of salt. Sights of such indicates presence of wildlife.
- h) **By sound:** Hearing sounds of wild animals a fair understanding of the wildlife presence, location can be ascertained.
- i) **By wallowing sights:** Sambar, Wild Boars etc. like mud and they wallow in mud. By this they clean their skin and protect it from insects. Such signs indicate presence of wildlife
- j) **Nail Marks:** Tiger and Bear with the help clear, sharpens their claws/nails by scratching the bark of some trees. Such signs indicate presence of wildlife.
- k) **And all other direct and indirect evidences.**

The Government of Assam and the Assam Forest Department, have come forward with laudable decision to take initiative for protection of wildlife and plant biodiversity in the Division. **The Dehing - Patkai** Wildlife Sanctuary is one of the prime habitats of innumerable flora and fauna and many of them are critically endangered. The flagship species of the Dehing-Patkai Wildlife Sanctuary is the highly endangered White Winged Wood Duck (*Cairina scutulata*) and the Hoolock gibbon (*Binopithecus hoolock hoolock*), the only Western Ape found in India. Both are Schedule - I species of the Indian Wild Life (Protection) Act 1972 and also listed in the Appendix-1 of Endangered Species under Convention of International Trade on Endangered Species (CITES), 1973.

This is also the prime habitat of Asiatic Elephant and part of **Dehing-Patkai Elephant Reserve** covering 340 square kilometers. There is regular movement of elephants in between Assam and Arunachal Pradesh and mostly through Dehing-Patkai National Park. This is considered to be one of the vital corridors of Asian elephant in the region which has established link with Myanmar.

The endangered birds are the long-billed vulture (Critically endangered), White Winged Wood Duck and Greater Adjutant Stork. The Globally critically endangered tree *Vatica lanceaefolia* (Morhal) is among the plants of conservation importance. Some of the common birds found in the forests are the Great White Billed Heron, Lesser Adjutant Stork, Slender Billed Vulture, White Cheeked Hill Partridge etc. The primate census carried out during 2009 recorded 2359 nos. of primate. This includes 256 nos. of Hoolock gibbon under the Dibrugarh Division. Moreover, it is a breeding ground of different species of reptiles and invertebrates. The Forests of Dehing-Patkai National Park is classified as Assam Valley Tropical Wet Evergreen Forests. The evergreen forest cover has provided the safe and secured home to all living forms. The P.A. is significant for five tier tree canopy. The top canopy is formed by *Dipterocarpus retusus* and *Shorea assamica* forests.

Primates: The distribution of the primates within the Sanctuary depends on the time of flowering and fruiting of the plants in different locations. The different canopy layers of the forest provide adequate food and shelter to the primates. There is no significant natural enemy of the primates within the Sanctuary except Leopard and Python.

Tigers and leopard: Tiger and leopard are found in the forests.

Elephants: The method adopted for estimating the elephant population is total count followed by 15% sample check.

There are 204 elephants as per the estimation done in February 2011 in Dibrugarh Forest Division and out of that 60 elephants were found in Dehing Patkai National Park. The number fluctuates as the corridor is contiguous with the forests of Arunachal Pradesh. This Sanctuary is an ideal habitat for elephants with abundant fodder, water and cover, natural saltlicks and undisturbed terrain. There are two well-known corridors for movement of the elephants viz. Bogapani and Golai notified by Govt. of India.

The wildlife, which used to flourish in the forests of the Division, is threatened due to various anthropogenic factors. Broadly due to increase in demand for wildlife products all over the world, poaching problems have increased over the years in the region and specifically for the Dibrugarh Division. Hence, special efforts are required to be made by the Division to protect the wildlife in the Division. Migratory birds visiting the area mostly during winter also face threat from poachers and fishermen. There are many endangered insects and plants included in the schedule of Wildlife Protection Act 1972 in this Division. The insects are threatened from the insecticides and pesticides that's gets leached into the Division from

the surrounding tea estates. These insects play a very important role in pollination of floral species and overall ecology of the Division.

7.7 Strategy: For wildlife management the key focus is to ensure maintenance of wildlife preferring habitats in the Division. This is to be ensured through spatial mapping of such areas and assisting regeneration of suitable species in those areas. For biodiversity conservation, natural regeneration or assisted natural regeneration shall be promoted. The regenerative capacity of the endemic species, elephant liking species shall be enhanced. A total ecosystem conservation concept will be adopted for conservation of the wildlife habitat and conservation of biodiversity in these forests. An effective naturalization plan needs to be devised based on principles for maintaining natural diversity. To enrich the low diversity areas, efforts should be made to restore native complementing natural species rather than planting as many different kinds of trees as possible without looking into the natural regeneration and the needs of the natural fauna of the site. Further, introduction of exotic species in the area will be restricted and plantation of both, slow and fast growing native species of herbs, shrubs, and trees shall be promoted.

Since the composition under the forest type found in Dibrugarh has signature species namely Hollong, Mekai, Nakar, it is essential to protect and maintain the habitat. It is necessary to prescribe plantation of these signature species to maintain the composition of the forest type in Joypur Reserved forest. High rainfall experienced in this Division which facilitates dense undergrowth is another important factor that needs to be maintained.

- a) Involvement of local communities especially youths, women from the forest and fringe villages will be sensitized in forest and wildlife protection issues identification and appropriate measures, participatory planning and sharing of responsibility and benefits needs to be promoted. Excluding local population can often lead to illegal activities which can cause further degradation of the flora and fauna. The efforts therefore be to impose restrictions on local populations through participation in purview of legal and allow traditional practices to continue to ensure their long-term success. Capacity building programmes would be taken up at intervals.
- b) Further efforts should be made to preserve as many patches of natural communities as possible. This will help to sustain regional diversity. Wherever possible, fragmentation of large patches of natural vegetation be avoided. Even a narrow access road through a forest can act as a barrier to movement of small organisms and effect their habitats.
- c) Ecotones between natural communities support a variety of species from both communities. Hence, these should be allowed to develop naturally between adjacent communities.
- d) Regular monitoring and updation of species data through research and development activities needs to be taken up taking the present data as the base. Ethno biological information also needs to be generated for the species recorded in the Division.

7.8 Measures for its protection: Measures for protection in this working circle is elaborated below under proposed wildlife management prescriptions, and proposed biodiversity conservation measures.

7.8.1 Proposed wildlife management prescriptions: The main issues are hunting, poaching, illegal felling, illegal removal of NTFP, encroachment, grazing, man-animal conflict, livestock disease.

7.8.1.1 Hunting: It has been observed that in the past there were occasional attempts by miscreants to capture wild elephants. There were some cases of hunting of male wild elephants in the past. At present no such incident has taken place.

However, forest staffs in the Division should keep vigil on any such activities. The forest staff shall develop an intelligence system with the help of local people to gather information about any activities related to hunting and take appropriate steps accordingly for its prevention. Five watch towers proposed under antidepredation unit which may be utilized for vigilance against hunters. Killing of stray out Leopard and other animals by agitated crowd has found common everywhere. Stringent legal measures need to be taken to apprehend the culprits besides initiation of legal procedure for exemplary punishment is a must. Offenders may be arrested on the basis of video footage and intelligence feedback.

7.8.1.2 Poaching: The forest staff shall develop an intelligence system with the help of local people to gather information about any activities related to poachers and traders of wild life and take appropriate steps accordingly to prevent any poaching in the Division. The Division should take steps to facilitate the process to make suitable amendments in existing forest laws and laws pertaining to wild animals for imposing exemplary punishment including life imprisonment for poachers.

7.8.1.3 Illegal felling: Illegal felling is a challenging problem in the division. The forest staff shall keep vigil through patrolling, information gathering through network develop with the help of local people. Illegal felling to be stopped and illegal doers involved shall be arrested as per the rules and provisions of AFR1891(Amendment) Act1995. Equipments including vehicle, boat etc. used for committing forest offences are to be seized and confiscated.

7.8.1.4 Removal of NTFP: No NTFP which are consumed by wild animals shall be removed from the Working Circle area except that which are cultivated in JFMC areas for domestic consumption of the communities.

7.8.1.5 Encroachment and Other Illegal Activities: A few boundary pillars have been constructed in the protected area proper demarcation during the last management plan period. Encroachment identified and the standard procedure eviction of any such encroachment is to be done at priority. No new villages or new dwellers should be permitted to come out in future in close proximity of the wildlife habitats.

7.8.1.6 Grazing: The grazing is negligible in the Division. However, domestic cattle sometimes stray to the forests of the Division. Stray cattle are to be driven away and local people to be made aware on the effect of livestock grazing inside the Division. All domestic cattle need to be immunized from time to time. Initiation in this regard should be taken by facilitating vaccination camps for cattle of the fringe villagers.

7.8.1.7 Degradation of Wildlife Habitat: Due to anthropogenic pressure, the wild life habitat has

deteriorated. Water, food, safe resting places for wildlife, breeding areas, and nesting areas is to be

ensured in the Division. Wallows and salt licks are other factors. For this the following activities are proposed –

Creation of water holes: Water availability, or the scarcity of it, is one of the major factors that decide the Health of wildlife and its habitat. During water scares seasons, probability of wildlife increases near water holes or near villages and thereby increases their susceptibility to poaching. So it is proposed to create water holes, density shall be commensurate with the density of wild animals found in the area.

Fruit and fodder plantations: Plantation of fruit plants like *Dilena* spp., *Syzygium* spp., *Psidium* spp., *Artocarpus* spp., *Mangifera* spp., *Tamarindus* spp., *Phyllanthus* spp. *Eugenia* spp., etc. in wildlife area; plantation of fodder species like *Musa* spp. *Bambusa* spp. *Bauhinia* spp., *Andropogon* spp., *Buchanania* spp., *Cassia* spp., *Dioscorea* spp., *Ficus* spp., *Lagerstroemia* spp., *Saccharum* spp. etc. shall be taken up. To improve the prey base, care of herbivores should be taken by improving the assured fodder availability in the forest. The open areas in wildlife rich zones should be developed with suitable fruit and fodder species as mentioned above.

Development of Nesting Sites: Especial emphasis should be given to improve and maintain the characteristic water bodies suitable for white winged wood duck. Water bodies, small and large should be developed and maintained for migratory birds and other bird species. To provide suitable nesting places to birds, seed sowing of *Ficus* spp. and its planting should be done near water-bodies and in the riparian areas. No new villages or new dwellers should be permitted to come out in future in close proximity of such important wildlife habitats.

7.8.1.8 Man Elephant and Wild Animal Conflict: Delinking of corridors, obstructions in movements of wild Asiatic elephant and other wildlife, habitats reduction, expansion of small tea gardens in the fringe areas, reduction of elephant preferable species are some of the key reasons leading to man elephant conflict in the forest areas of this Division. Forest Department should notify corridors for elephants. Railways and Assam State Transport Corporation, Private bus owners & drivers, Road Carriages associations/owners/drivers are to be made aware of elephant corridors and wildlife corridors. Speed of trains should not be more than 30 kmph while passing through these corridors. The drivers of the train should be made aware. There should be coordination between forest department and railways. The treatment methods proposed for reducing man elephant conflict are elaborated below –

Improvement of elephant corridor: The rapid development across the Dibrugarh Division of Dehing Patkai Elephant Reserve has resulted in the decline of forest cover and as a result the frequency of crop depredation by wild elephant has increased considerably. The Division witnessed >400 crop raid during last five years (2008-2012) (Department record, Dibrugarh FD). This is supplemented with property damage and human killed by elephants. While in retaliation seven elephants had succumbed to death during this period. This forest of this reserve is connected to that of Myanmar and is an important landscape for a long ranging species like elephant. There has been no study on the population of Asian elephants in the region. Treatment proposed for maintaining the elephant corridors include removal of any

anthropogenic constructions that are obstructing movement of elephants in the corridor areas to be cleared. A 300 m width to be maintained for each of such corridors.

Establishment of anti depredation unit (ADU): A committee will be constituted with the ADS members and local veterinary officer, prominent villagers from JFMC who have knowledge on wildlife. Discussions should be conducted to jointly find solutions for man animal conflict issues. The ADS should be equipped with wireless sets, high beam torch light, tranquilizers, tranquilizing guns, GPS. Tranquilizers to be carefully used as per the Assam forest department standards incase of only straying small animals like cats, etc. For tranquilization the local veterinarian officer would be consulted. Five watch towers will be constructed. It is proposed that under the anti depredation unit kumkies (trained elephants) should be kept at the Division at all times to chase away makhana and other straying elephants, wild elephant herds from areas outside wildlife areas especially from human habitations/settlements/agricultural fields/towns etc. It is proposed to keep four (2) kumkies during planting in the Division as anti depredation measure.

Trenching: Straying of elephant and other wildlife from the Division is to be minimized. Areas often used by makhana and other stray animals are to be obstructed by means of trenching. A total of 1 km length of fragmented trenches is proposed in identified patches.

Removal of electric fencing to reduce elephant deaths: Any electric fencing on tea estate surrounding the Dibrugarh forest Division should be removed respecting the Notification issued on 11th November 2009 (see box) by The Inspector General of Forests and Director (Project Elephant). Forest department staff should ensure that any such electric fencings that might cause electrocution to wildlife including elephants should be immediately removed.

The Inspector-General of Forests and Director (Project Elephant) has issued a notification on 11.11.2009 regarding the death of elephants by electrocution which reads as under :-

"The Ministry is receiving reports of deaths in tea/coffee estates especially in Assam and Karnataka due to unregulated voltage in the solar power fencing erected by them. This is a serious issue and in fact such an Act tantamounts to wilful hunting as per section 16(b) and thus is in violation of section 9 of the Wildlife (Protection) Act, 1972.

2. You are, therefore, requested to make it known to all the tea gardens, coffee estates and other located in the elephants areas to ensure that no such fencings are erected in future. Wherever death of elephants due to electrocution in such places have taken places, the management needs to be prosecuted for hunting and such fencing needs to be removed at once."

Wildlife first aid kit: Wild animals get wounds, injured by accidents or by disease. These wounds and injuries are so small that there is no need to get them to Veterinary doctor. Therefore, training of the forest staff on such injuries and first aid is to be organized so that they know about such wound, injuries, disease. Wildlife first aid kits should be kept in the Range Offices and be made available to any subordinate officer as and when required.

Awareness: Awareness campaign should be conducted to sensitize the people from not creating chaotic situation when wildlife stray into habitations, agricultural fields etc. Local people should be sensitized that

creating such a situation makes wildlife management difficult and the wildlife creates much havoc due to the confusions created. During chasing they should not wound any wildlife and straying wildlife should not be killed by any local people.

7.8.2 Proposed Biodiversity Conservation Prescriptions: Guidelines proposed on treatment prescriptions for preservation and conservation of biodiversity in Dibrugarh Division is as follows –

- a) **Important Value Index (IVI):** Tree species whose IVI is less than 5.00 will be promoted by planting and preservation.
- b) **Fruit trees:** Fruit trees such as Outenga, Mango, Amla, Bel, Jamun, Arjuna, Bahera, Bot, Aahat, Bamboo, etc. will not be felled during any operation. Regeneration of such fruit trees shall be encouraged.
- c) **Promoting endemism:** Areas infested with dense *Mikania micrantha*, *Lantana* spp., *Parthenium* spp. (found on the areas nearby the villages) be replaced by useful economical species. Compartments or parts of compartments which have population of fruit trees, or trees of lesser known species shall be preserved against any exploitation activity.
- d) **Banning application of inorganic pesticides:** Application of pesticides/ insecticides around a 5 km periphery of the forest in this Division shall be completely banned. The forest houses diverse insects, birds and application of insecticides/pesticides by the surrounding tea estates affects the insect population of the forest. It hampers pollination of important tree species and indirectly affects the birds and fish population.
- e) **Fire protection measures:** Though there is no report of fires incidences, yet, Fire protection measures, shall done as a precautionary measure to protect the endemic biodiversity.
- f) **Disturbances:** During plantation or departmental removal for any wind fallen trees care should be taken not to sacrifice the rarely found species or their regeneration.
- g) **Natural regeneration:** Natural regeneration or aided natural regeneration shall be promoted. The regenerative capacity of the endemic species, elephant liking species shall be enhanced. A total ecosystem conservation concept will be adopted for conservation of the wildlife habitat and conservation of biodiversity in these forests. An effective naturalization plan needs to be devised based on principles for maintaining natural diversity. To enrich the low diversity areas, efforts should be made to restore native complementing natural species rather than planting as many different kinds of trees as possible without looking into the natural regeneration and the needs of the natural fauna of the site. Further, introduction of exotic species in the area will be restricted and plantation of both, slow and fast growing native species of herbs, shrubs, and trees shall be promoted.
- h) **Involvement of local communities:** Involvement of local communities especially women in forest and wildlife protection through awareness, participatory planning and equitable sharing of responsibility and benefits shall be promoted. Capacity building programmes needs to be taken up.
- i) **Preservation of good patches:** Efforts shall be made to preserve as many patches of natural communities as possible. This will help to sustain regional diversity. In no case fragmentation of large patches of natural vegetation shall be allowed. Even a narrow access road through a forest can act

as a barrier to movement of small organisms and affect their habitats. Ecotones between natural communities support a variety of species from both communities. Hence, these should be allowed to develop naturally between adjacent communities.

- j) **Biodiversity monitoring:** Regular monitoring and updation of species data through R&D activities needs to be taken up taking the present data as the base. Ethno biological information also needs to be generated.
- k) **Permanent Preservation Plots:** Due to increasing biotic pressure and imminent climatic change, the natural regeneration of most of the tree species has not been taking place. To preserve the natural floristics of the forest, it is proposed to establish permanent preservation plots of Hollong, Nahar and Mekai in the selected compartments. Natural regeneration will be studied, areas will be identified and preservation plots for the above mentioned tree species will be initiated. Mother trees will be identified, marked and used as seed sources for artificial regeneration. The area preserved will be demarcated on the ground with instructions to avoid any disturbances. The various coordinates of longitude, latitude, altitude will be recorded and a map prepared. Preservation plots shall not be less than 3 ha area and will be studied for ecological succession and biodiversity of the area. No grazing shall be allowed in this area nor shall any type of cultural operation be done. Biannual studies on composition and structure of the forest will be done. In case of trees, girth at breast height shall be recorded. The biodiversity will be recorded periodically as per NWPC, 2014 code. The Conservator of Research and Education Circle shall inspect the area annually along with the Divisional Forest Officer of Dibrugarh Division to record their findings. A copy of the findings should be sent to the Additional Principal Chief Conservator of Forests (RE&WP) for further investigations.
- l) **Ecotourism:** The forest type is tropical wet evergreen forest of Holong-Mekai and Nahor, and is the last surviving patch of this type of forest in the country. There are some huge trees with natural cane and bamboo brakes that attract many tourists. The area is famous for sighting two flagship species white winged wood duck and hollock gibbon. The land is also famous for elephant, 8 species of cats, slow loris, binturong, malayan sun bear, crab eating mongoose, five species of hornbills, different species of snakes including king cobra, krait, 350 species of birds, butterflies and moths and varieties of orchids, climbers, lianas, etc. To maintain biodiversity, an ecotourism activity is proposed. Ecotourism committee will be registered by the CF. The natural attributes viz. landscape, waterscape, and wildlife will be enlisted and explained for effective ecotourism management. Namphake EDC and Namchang EDC need to be constituted under the CF to manage the ecotourism activities in the periphery at DehingPatkai Sanctuary. Boating is feasible in Buridihing River, it will be one ecotourism activity. For effective building of capacity of the people bird sighting is proposed. Establishment of an ethnic weaving centre at Namphake village is proposed. Development of the orchid center at Kothalguri and establishment of a new orchid center at Sukanjuri is proposed. Capacity of the local guides from the EDCs will be developed to cater visiting tourists' need of boat ride, birds watching, wildlife trail, camping and visits to ethnic village for ethnic dance, folksongs, ethnicscene, handicrafts, and visit to tea garden. Establishment of ethnic weaving centres at Namphake, Namchang, Abhoipur, Kocharipathar, villages are proposed. Development of

orchid center at Kothalguri and establishment of a new orchid center at Sukanjuri. Road development from Namchang to Joypur, 8 km in length with pavers blocks is proposed to benefit the local marginalized communities for movement of tourists for the purpose of ecotourism. A school bus is proposed for the benefit of the students of the Namchang village. Piggery and other activities are proposed as approved in the microplans in Panisukia FV, Abhoipur, Kocharipathar, Tantipothar, Nahorjan, and Labangkhula. Maintenance of the natural salt lake at Soraipung and construction of hide for elephant watching is proposed.

7.8.3 Management of Tree Outside Forests (TOF):

Trees outside the forest (TOF) comprise a heterogeneous and locally very different natural resource, also referred to as tree resource outside the forest (TROF). In India, TOF is defined as all those trees, which have attained 10cm or more dbh and are available on lands not notified as 'forests' or 'other wooded land'. Trees outside Forests include trees on agricultural lands, in urban and settlement areas, along roads, in home gardens, in hedge rows, scattered in the landscape and on pasture and rangelands. The tree resource outside the forest (TROF) is a highly diverse and locally different natural renewable resource. Trees outside forests occur in natural and in cultivated landscapes and serve then a number of ecological, and economic functions. They play a prominent role in securing rural livelihoods like provision of timber, firewood, fodder, fruits, shadow for cattle besides serving important ecological functions, particularly for the conservation of biodiversity, offering shelter and food, and nesting sites for wild animals and other ecological functions like erosion control, water protection and carbon sequestration.

In many regions, the decreasing forest cover, the increasing forest fragmentation, the presence of trees in agroforestry systems and the increasing urbanization with the need for green corridors make the relative importance of TOF grow. The significance of tree resources outside the forest has been emphasized in several contexts and before the year 2000 mainly on a local basis (e.g. Guevara *et al.* 1998, Harvey and Haber 1999). Small forest patches and trees that do not fall under the current forest definition play an increasingly important role, particularly in tropical landscapes, and should be incorporated in regional forestry and natural resource development programs.

Trees outside the forest were addressed as an important resource in the global forest assessments of FAO for the first time in FRA 2000 (Forest Resources Assessment Programme). However, it had not been included in the general data collection part but as one of a series of special studies (FAO FRA 2001a). FAO dedicated a volume of its forestry journal *Unasylva* to trees outside the forests (*Unasylva* 200) where there is also a paper addressing issues of large area assessments (Kleinn 2000).

In November 2001, FAO convened an Expert Consultation on TOF (Sadio, *et al.* 2002), titled "Enhancing the contribution of trees outside forests to sustainable livelihoods", where a number of key observations and recommendations were made. An overall observation was that the information base being insufficient and scarce in most regions and that, particularly with respect to management options there are still open questions, geographically differing in character but many of them practically everywhere.

Suggestions:

- Prior to year 2000 TOF were not assessed in the global forest resource assessment (FAO 2000) and the interaction between these categories need to be further investigated. People's participation is a key factor in the sustainable management of TOF. Group consensus should be encouraged in decision, making and also to avoid possible conflicts.
- Research should be undertaken to identify such production systems for TOF that are efficient, ecologically sustainable and financially viable. This includes the development of planning tools, including decision support systems that assist producers to cope with climate variability. With a proper management of inputs, the productivity of the lands involving trees outside forests can be increased many fold.
- Agro-forestry should be looked upon as a means for improving the socio-economic conditions of the rural poor and should be the main plan of integrated rural development programme. In order to increase fuel, timber, and forage production agro-forestry programmes should be adopted on a large scale, this would include rural woodlots for the rural areas. Such programmes should be time-bound and target-oriented. People participation is a critical factor of success of such programmes.

7.9 Dehing-Patkai National Park and Elephant Reserve:

A part (24.7 sq.km.) of Dehing-Patkai WL sanctuary(now National Park) is managed by Dibrugarh Division. There is no separate management Plant for the P.A. Till the emergence of a management Plan for the NP, following measures may be prescribed-

7.9.1 To conserve the habitat for long term sustenance of bio-diversity of the forest

This objective deals with the conservation of various habitats for sustenance of biodiversity of Dihing-Patkai sanctuary which include suggestions for improving the habitat for maintenance of biodiversity, mitigation of threats and maintain a condition ideal for long term sustenance of biodiversity. Identification and protection of important habitat of threatened and endangered species is prerequisite for proper management of any protected area. Thus, it is also essential to identify the key habitats for endangered and critical species like elephants, Tiger, Leopard, western hoolock gibbon, other primates, the critically endangered White-winged duck (*Asarcornis scutulata*), hornbills etc. After identification of key habitats, protection and management of habitats can be initiated.

Degraded forests need plantation of indigenous tree species. One of the most successful method of habitat restoration is Assisted natural regeneration (ANR), i.e. after the proposed degraded area is identified habitat restoration could be initiated based on assisted natural regeneration and plantation for gap filling. Assisted natural regeneration involve collection of seedlings, saplings of the indigenous tree species from the surrounding forests, and after a middle phase of growth in nursery, these samplings are planted in the degraded habitat. More detail can be found in the Rainforest regeneration manual of Nature

Conservation Foundation (Mudappa et al 2010). A massive afforestation/restoration drive is proposed to be undertaken during the next five years. About 50 hectare area in Dehing-Patkai sanctuary requires restoration, and these identified areas are proposed to be regenerated by planting saplings of fruit bearing indigenous and wild species through the assisted natural regeneration.

7.9.2 Protection – To maintain the biological and physical integrity of the area it is essential to protect the area and ensure that no human interference takes place in the area. Patrolling is one of the most effective ways of protection, in this regard in Dehing Patkai sanctuary there is lack of patrolling paths. In addition to the patrolling path, there is lack of sufficient protection camps. So, along with the patrolling path there is urgent need to create permanent protection camps. Gradual increase of illegal extraction would cause habitat destruction. The only way to protect against such illegal extraction is to have beat offices or protection camp along the major illegal harvest areas. It is essential to create and maintain approx. 50 km of footpath all along the sanctuary for patrolling. An earlier peripheral path around the sanctuary existed earlier has been lost due to inadequate maintenance. Thus a number of patrolling foot paths covering the length and breadth of the sanctuary, protection camps and watch tower are proposed.

7.9.3 Management of Buffer areas – Buffer areas of the sanctuary refer to community areas and forest area in zone of influence of the P.A. For maintaining and protection of the community forest areas it is essential to involve villagers in protection of the community forest. It is advisable to form village forest protection committees with support of forest department in each village, where these committees can employ village forest guards on temporary basis for protection of the village forest. The strategy being that if on temporary basis most of the villagers get employment from the department over the years they would be more willing to contribute for protection of the forest and also work at discouraging hunting and logging.

Another way to reduce the pressure of firewood collection is to provide alternate source of cooking to them in form of LPG connection, Pressure Cooker, solar cooker etc. to the families in the fringe villages. Another renewable option which could be explored is biogas, as the villagers already have cattle, biogas can work to reduce their dependency on firewood. Other alternate sources of income for the fringe villagers should be also initiated by forest department and poultry, piggery and other developmental activities has been proposed to build confidence with these organizations and to reduce their pressure on the Dehing Patkai resources.

There is negligible hunting and poaching pressure on Dehing-Patkai at present. But over the years this may increase and may be alarming at a point of time. It is to ensure the survival and persistence of endangered flora and fauna of the sanctuary. The objective aims at protection of species against hunting and poaching, maintenance of habitat for survival and persistence of species, and makes suggestions to improve, maintain and mitigate the anticipated threats, and to maintain a condition that is best suited for the animals. For protection of species critical areas and habitat should be identified which need regular patrolling. This involve either direct onsite protection by patrolling, protection camps or Beat offices or this can also be achieved by creation of a network of intelligence gatherers who can provide information on

possible poaching and pre-emptive strike against the poachers. For controlling this anticipated hunting and poaching it is required that a group of villagers be trained in assisting the foresters in protection of the P.A.

7.9.4 Wildlife trade control – No recorded information is available about wildlife trade in the division. Yet, care should be taken to thwart all such probable attempts. There is every possibility of hunting for bush meat and traditional medicines. Protection and regular patrolling will help to stop poaching. Trade can be abated only by intelligence gathering and Village Forest Protection Committee and village forest protection guards can be a useful resource for intelligence gathering, and control of wildlife trade. For protecting critical areas close to villages Village Forest Protection Committee would be very useful.

7.9.5 Wireless stations – There is absence of any means of communication inside the Sanctuary, there is no access of Mobile phones also with lack of telephone Towers. Thus for effective management and protection of the sanctuary it is essential to establish fast and effective communication. Wireless stations are an important means of effective communication in remote areas. A main wireless station is needed in the main camp or Division office with substation each in areas. These stations would also be effective in patrolling and information sharing in case of any disturbance. All beat offices thus should have wireless device. All the patrolling groups must carry at least one wireless device.

7.9.6 Staff motivation and training - Special rewards need to be proposed for the encouragement of those among the field staff, who show some commendable performance while on duty. This shall include activities like detection of poaching incidents and nabbing of culprits and such other activities. All arrangements need to be done for training and capacity development of field staffs.

7.9.7 Awareness Campaign: To ensure the participation of local communities in the conservation planning of the Dehing-Patkai landscape, awareness generation among them is a pre-requisite. Awareness activities can involve wildlife awareness and environmental awareness through medium of picture, videos and talks by resource persons. It is essential to make the community aware of the importance of protecting forest, wildlife and wildlife related laws, rules and regulation. Similar awareness activities can be carried out in a small scale approach involving the school children from the surrounding villages. In addition, to promote all these activities, preparation and installation of signage and hoardings at strategic places should be carried out. These signages in local languages can educate people on restrictions on hunting, logging and firewood collection, and punishments; information on mitigation of wildlife conflict; on the importance of forest and wildlife. Awareness in the public administration level can also be achieved by conducting meetings with the district administration to make them aware about the initiatives. Along with the conservation initiatives taken for the Dehing-Patkai sanctuary, parallel awareness generation programmes describing the mitigation measures of human-animal conflict in the region can also be taken up by the department. As villagers are unaware of compensation procedure, awareness about how to report crop depredation or injury and casualty is also essential.

7.9.8 Eco-tourism- Eco-tourism is another option which reduces peoples dependencies by providing jobs and it also sensitizes the visitors. In Dehing-Patkai infrastructure for tourism is very limited. There is no rest houses etc. where tourist could stay, neither capable guides are available. There is a need to develop amenities for the tourists in the sanctuary. Traditional houses consisting of 10 huts can be constructed for lodging of the tourist. Additionally a rest house can also be constructed.

7.9.9 To reduce human-wildlife conflict in Dehing-Patkai sanctuary:

Human wildlife interaction of any kind that results in negative impact on people or their resources or on wild animals and their survival is referred to as human-wildlife conflict. It has emerged as an important issue in conservation of wildlife as such conflict can lead to widespread antipathy toward wild animals. Generating awareness amongst the masses and involving community in management of conflict can address the issue of negativity about wildlife amongst general public. Awareness programmes also include awareness about wildlife conflict and possible management. Such initiatives are necessary for engaging the community in issues of wildlife management. Crop damage by the wild animals is a major issue in wildlife-human conflict and results in negative attitude of the communities towards wildlife and it may provoke some extent of retaliatory killing or fatal injuries to the wild animals. These can be averted if the department ensures proper training of the local villagers on how to prevent crop damage by wild animals and also follows an effective system of providing incentives to the individuals who efficiently prevent the crop damage by wild animals by implementing the strategies as mentioned by the department or as trained by the experts. An insurance scheme covering the loss of livestock and crop due to wild animal attacks and raids may help to reduce man-animal conflict.

7.9.10 To initiate scientific studies on endangered and threatened flora, fauna and habitat

Research is an important aspect in management of any protected area; a protected area cannot be managed without information on the various species of the area, their ecology, habitat and relevant issues in management. Thus research should be given due importance and there should be incentive and promotion of research at a protected area. A good manager can utilize the information given by researchers and can take a judicious decision on implementing recommendations for conservation of wildlife.

Proposed activities

- a) Habitat improvement including plantation of fodder, fruit and other indigenous species.
- b) Creation and maintenance of patrolling paths 50 km.
- c) Construction of at least 2 protection camps and 1 watch tower spread across the sanctuary, more so toward the boundary with fringe villages
- d) Creation of Village Forest Protection Committee/Eco Development Committee in fringe villages
- e) Protection of buffer area village forests through Village Forest Protection Committee
- f) Training of staff, including exposure visits within and outside the state
- g) Procurement anti-poaching kits/equipment and other logistics.
- h) Procurement of Vehicle and Wireless sets.
- i) Creation of need based Adhoc protection squad comprising villagers

- j) To improve communication facilities within PA for better coordination and management.

Table: 7.10: Yearwise activities to be done

Activities	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31
a) Enrichment plantations = 50 hectares.	10	5	5	5	5	5	5	5	5	-
b) Establishment of 1 anti-wildlife depredation unit.	1	1	1	1	1	1	1	1	1	1
a) Elephant proof trenching of earthwork = 3,75,000 m ³ . (unit x1000 m ³)	75	75	75	75	75	-	-	-	-	-
d) Safe elephant corridors 4 nos. (Continuous for 10 years)	4	4	4	4	4	4	4	4	4	2
e) 160 nos. wildlife awareness camps.	16	16	16	16	16	16	16	16	16	16
f) Construction of Camps, Watch Tower	4	2	2	2	2	-	-	-	-	-
g) Construction & maintenance of Road 100 km	50	20	10	10	10	-	-	-	-	-
h) Scientific Studies, Monitoring	√	√	√	√	√	√	√	√	√	√
i) Eco-tourism	5	5	5	5	5	5	5	5	5	5
j) Training of staff including exposure visit	20	20	20	20	20	20	20	20	20	20

CHAPTER 8

Miscellaneous Regulations

8.1 Deviations: Any large and unusual operation, variation from yield and target for plantation/regeneration and other activities provided in control forms of the working plan constitutes a deviation. Deviation beyond 25 percent of target is considered to constitute a major deviation. All deviations, which permanently alter the basis of management laid down in a working plan, will require prior sanction of the PCCF. All deviations, which do not permanently alter the basis of management and with the necessity of which he agrees, may be approved and sanctioned by the Working Plan Conservator on behalf of the PCCF. Where there is difference of opinion between the Working Plan Conservator and the territorial Conservator of Forests, the former will refer them to the PCCF for instructions. The PCCF/CFWP, as the case may be, will counter sign the deviation statement. Minor deviations can be sanctioned at the level of the CF Working Plan or the PCCF as the case may be, but the PCCF before sanctioning the major deviations of following nature, will necessarily take prior approval of the Regional CCF/APCCF of the Ministry of Environment and Forests:

- (i) Change in Silvicultural system
- (ii) Clear felling of natural forest
- (iii) Formation of new felling series; and
- (iv) Large scale felling due to natural calamities.

For all major deviations with respect to prescriptions where sanction of the MoEF is mandatory, an explanatory note along with the request for regularization has to be sent by PCCF (HoFF) to RAPCCF (MoEF). In case, where there is difference of opinion between the PCCF (MoFF) and RAPCCF (MoEF), the former will refer the matter to DG F&SS (MoEF), whose decision shall be final. The PCCF (HOFF) will countersign the deviation statement for reporting to the MoEF (para 132 of National Working Plan Code-2014). The following format for deviation statement should be used:

Year..... Division.....

Sl. No. of Deviation	Control book, name, form,	Reference to Working Plan		Nature of deviation requiring sanction
		Paragraph	Nature of Prescription	

The DFO territorial will forward through the Head, territorial circle, typed copies of this form in triplicate yearly with his copy of control forms. No explanatory remarks are required on this form but these should be given in the forwarding letter. The Head, Working Plan Organisation, as per situation given above, after sanction, will return one copy of the statement to the DFO territorial through the Head, territorial circle, and the other copy will be sent to the WPO for record. All major deviations without altering the basis of

management, the prior sanction of the PCCF (HoFF) should have been obtained in advance, the sanction number and date should be quoted in the last column.

8.2 Construction of Roads/Link roads:As envisaged in Sec-2 of Forest (Conservation) Act, 1980, no construction of roads/link roads passing through the forests except those which are required for forestry activity including patrolling path etc. shall be allowed without prior approval of MoEF&CC, Government of India.

8.3 Buildings:The old buildings requiring repair needs to be approved by the PCCF. Those building that are not put to use needs to be used.

8.4 Maintenance of boundaries and Pillars:This has been dealt with in the Protection Working Circle. To avoid legal disputes in the future, maintenance or boundary pillars is necessary especially the state boundaries. Inspection path of 3 m wide all along the boundary should be prepared for inspection and protection. The boundary pillars must be numbered and written. The distantly located pillars may be connected to one another by digging lines, which should be regularly cleared. Boundary registers should be maintained. The records are to be prepared in triplicate and kept in Range, Division and Circle Offices. The Range Officer should check the boundaries once a year and record a certificate to that effect on the Boundary Register. The Block Officer should check the entire boundaries of the forest under his charge and send the necessary report to the Forest Range Officer. The Beat Guards should keep the records of boundaries of their beats in the Beat Book. The programme repair of Boundary Pillars should be followed as given in the Protection Working Circle.

8.5 Fire Protection:There are as such no significant damages from fires, however the following miscellaneous regulations are necessary to ward of forest fires:

- i) Annual maintenance of fire lines to be done in the month of January through vegetation clearing from fire lines.
- ii) Fire risks should be notified by the DFO to the staff for necessary preventive measures.
- iii) Entry of people inside the forests for extraction of MFP should be regulated.

The territorial staff should maintain cordial relations with the local people to garner their support in case of fires and other eventualities. The Divisional Forest Officer should visit the fire-affected areas immediately after it comes to his knowledge and should submit a report to the Conservator of Forests giving all the detail of occurrence of fire, causes of fire and damage occurred to the crop with remedial measures for the future.

8.6 Control of Grazing:The prescriptions on control of grazing made in the various working circles should be strictly observed. In this regard, strict enforcement of the penal provision of the Indian Forest Act, 1927 and the Cattle Trespass Act, 1871 should be ensured.

8.7 Preservation Plot:It is proposed to preserve 3.00 ha area of endemic species Hollong - Mekai - Naharas the permanent preservation plot to study the increment of these species in the area and its

further prospects. Artificial protection measures around this forest patch shall be taken. The boundary geo-coordinates should be recorded. Periodical measurement should be taken and recorded. Account of any silvicultural operation, maintenance measures and natural disasters should also be recorded. Existing preservation plots is any will be maintained.

8.8 Nurseries:To meet the needs of plantation in the area, new nursery for raising tree species, medicinal plants, fruit species shall be created. To raise good quality seedlings, the following steps should be taken up in the nurseries:

- i) Seed from identified Plus Trees should be used. In case of other species seed from reliable seed orchards should be used.
- ii) Production through vegetative means like root, stem, shoot cuttings, tissue culture, tree improvement techniques, cloning, rhizomes to raise the planting stock.
- iii) For bamboos, cuttings, rhizome multiplication method should be used to raise qualitative seedlings.

To minimize the cost of transportation of seedlings to the field in the difficult terrain situations, seedlings should be raised in the root-trainers which give sturdy seedlings with high root-shoot ratio.

8.9 Seasoning and Treatment of Timber:Increasing longevity of wood/timber helps in Carbon sequestration. As a measure for Carbon sequestration,all wind fallen harvested trees, and seized timbers shall be sent to Govt. Timber Treatment and Seasoning Plant, Makum for the purpose of treatment, seasoning and conversion. Treated sawn timber will be sold by DFO. Govt. TT&S Plant Division, Makum and royalty realized will be deposited to State exchequer.

8.10 Stone Mahals:All stone mahals should be geotagged.Mining operation shall be done under strict supervision of forest officer following all rules and regulations stipulated in Assam Minor Mineral Consession Rules. It should be ensured that no environmental and ecosystem degradation takes place.

8.11 Sand Mahals:All sand mahals should be geotagged. Mining operation shall be done under strict supervision of forest officer following all rules and regulations stipulated in Assam Minor Mineral Consession Rules. It should be ensured that no environmental and ecosystem degradation takes place.

8.12 Fishery Mahals:All fishery mahals should be geotagged, inspection carried out and fishing adhering all the formalities / norms may be in operation in the fishery mahals. It should be ensured that in no way there are any fish biodiversity losses and introduction of exotics fishes and any environmental and ecosystem and its services degradation / deterioration through fishery mahal activities.

8.13 Celebration of Forest related festivals:Awareness campaign to educate and sensitize people with the objective to protect forest and biodiversity including flora and fauna is to be undertaken. Celebration of some specific days/festivals together with communities especially students are suggested.

Van Mahotsava is an annual pan-Indian tree planting festival, occupying a week in the month of July. During this event millions of trees are planted. It was initiated in 1950 by K. M. Munshi, the then Union

Minister for Agriculture and Food to create an enthusiasm in the mind of the populace for the conservation of forests and planting of trees. By encouraging Indians to support tree planting and tending, festival organizers hope to create more forest in the country. It would provide alternative fuels, increasing production of food resources, creating shelter-belts around fields to increase productivity, provide food for cattle, offer shade and decorative landscapes, reducing drought and helping to prevent soil erosion.

Wildlife Week is celebrated all over the country in the month of October from 2nd to 8th October every year with the view to preserve the fauna means the animal life of the India. Wild Life Week celebration was planned to arouse the general awakening of the normal people in the country towards the protection of wildlife. It was first started in the year 1952 with the great vision of saving the life of the Indian animals by taking some critical steps. It involves the planning to save animal extinction of any species of the India. The Indian Government has established an Indian Board of Wild Life which works to improve the awareness as well as the consciousness of the Indian people towards the wildlife preservation.

World Environment Day (WED) is celebrated on 5 June every year, and is the United Nations' principal vehicle for encouraging awareness and action for the protection of our environment. First held in 1974, it has been a flagship campaign for raising awareness on emerging from environmental issues to marine pollution, human overpopulation, and global warming, to sustainable consumption and wildlife crime. World Environment Day has grown to become a global platform for public outreach, with participation from over 143 countries annually. Each year, WED has a new theme that major corporations, NGOs, communities, governments and all celebrities worldwide adopt to advocate environmental causes.

World Wildlife Day: On 20 December 2013, at its 68th session, the United Nations General Assembly (UNGA), in its resolution UN 68/205, decided to proclaim 3 March, the international day of the adoption of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) on the planet raise awareness and benefits fauna and flora in 1973, as **World Wildlife Day**, which was proposed by Thailand, to celebrate and raise awareness of the world's wild fauna and flora.

World Earth Day is an annual event celebrated around the world on April 22 to demonstrate support for environmental protection. First celebrated in 1970, it now includes events coordinated globally by the Earth Day Network in more than 193 countries.

International day for the preservation of the ozone layer: September 16 was designated by the United Nations General Assembly as the International Day for the Preservation of the Ozone Layer. This designation had been made on December 19, 2000, in commemoration of the date, in 1987, on which nations signed the Montreal Protocol on Substances that Deplete the Ozone Layer. In 1994, the UN General Assembly proclaimed 16 September the International Day for the Preservation of the Ozone Layer, commemorating the date of the signing, in 1987, of the Montreal Protocol on Substances that Deplete the Ozone Layer.

8.14 Training of Staffs:

The ongoing developments in the forestry sector at policy, administrative and implementation level together with paradigm shift towards sustainable forest management, participatory forestry, biodiversity conservation, forests for climate change mitigation and adaptation through the mechanism of REDD +(Reducing Emissions through Deforestation and Forest Degradation) , focus on forest based livelihoods and forests for water and increasing role of technology and social media in forestry and sustainable development etc. have necessitated fundamental re-orientation and attitudinal changes of forestry personnel. These challenges coupled with conflict resolution issues faced in protection, management and conservation of the forest resources require appropriate capacity building of frontline forestry personnel by providing them the state of art information, knowledge and skills. Staffs and officers of the division shall be deputed to various forestry training Institutes including SFTIs of the State for imparting training.

8.15 Achieving SDG:

Sustainable Development Goals

The world economies have unified in their efforts to achieve the goals of sustainable development. This is in sheer contrast to the earlier approaches where governments pursued goals for the growth and development of their respective economies. The struggle for growth and excellence has created imbalance in the economic development among countries, depleted some of the natural resources and has thus altered the ecological balance. The impact of this is being experienced in the form of global warming and climate change. Since this threatens the very existence of human life on earth, a course of action that would ensure a safe environment for future generations has become the need of the hour. Sustainable development is a term coined to ensure that development takes place in such a way that natural resources are sustained and passed on to the future generations unimpaired.

India has, over the past years, directed its development pathway to meet its priorities of employment, economic growth, food, water and energy security, disaster resilience and poverty alleviation. India has also aimed to restore its natural capital and adopt transparent and robust governance along democratic lines. However, emerging challenges of climate change impacts, increasing inequities, and lagging human development indices are well recognised by both the citizens as well as the government. The SDGs will be more ambitious than the MDGs, covering a broad range of interconnected issues, from economic growth to social issues to global public goods. To realise this vision, a just-as-ambitious plan for financing and implementation is needed. The magnitude of the SDG financing challenge far exceeds the capacity of any one organisation and demands a strong partnership among governments, the private sector, and development organisations.

Sustainable Development Goals:

Goal 1 End poverty in all its forms everywhere

Goal 2 End hunger, achieve food security and improved nutrition and promote sustainable agriculture

Goal 3 Ensure healthy lives and promote well-being for all at all ages

Goal 4 Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

Goal 5 Achieve gender equality and empower all women and girls

Goal 6 Ensure availability and sustainable management of water and sanitation for all

Goal 7 Ensure access to affordable, reliable, sustainable and modern energy for all

Goal 8 Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

Goal 9 Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

Goal 10 Reduce inequality within and among countries

Goal 11 Make cities and human settlements inclusive, safe, resilient and sustainable

Goal 12 Ensure sustainable consumption and production patterns

Goal 13 Take urgent action to combat climate change and its impacts*

Goal 14 Conserve and sustainably use the oceans, seas and marine resources for sustainable development

Goal 15 Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

Goal 16 Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

Goal 17 Strengthen the means of implementation and revitalize the global partnership for sustainable development

Dibrugarh Forest Division shall contribute for achieving Sustainable Development Goals.

8.16 Forest Certification:

Forest certification, a mechanism based on third-party auditing of compliance with established standards, was quickly accepted as a means to promote sustainable forest management and directly influenced forest management practices. Through certification as a soft policy instrument, it is possible to provide credible assurance to customers about the effective compliance of forest management with sound social, environmental, and economic principles. However, as sustainable development is a continuous process and its concept is further adjusted according to new knowledge, sustainability indicators are continuously improved in order to achieve credibility and legitimacy within society through a wider form of participation involving citizens or their representatives.

The key financial benefit of forest certification is market access. In summary, the benefits of forest certification were grouped into conventional economic, social, and environmental components of sustainable development. In addition to those perceived benefits associated with forest certification, there are also direct and indirect expenses related to certification adoption. Forest certification was developed in

the early 1990s to curtail tropical deforestation through verified use of sustainable forest management

Certification systems generally are market-based, non-regulatory, and focused on forests, operations and products, and associated businesses and communities. Certified raw material is accounted for or tracked using chain-of-custody and certified products typically are labelled.

In the global quest for ways to protect the world's forests and to slow down, if not reverse, the pace of deforestation, much faith has been reposed in what is known as Forest Certification (FC) and the Criteria and Indicators (C&I) of Sustainable Forest Management (SFM). The C&I are supposed to give an objective measure of how close the forest management is to a sustainable regime. The FC framework is supposed to provide an impartial process for inspecting each forest management unit (FMU) to assess its performance periodically and bestow an internationally recognized certificate of good practices. By extension, the FC framework also provides for certifying and labeling the products that come out of such units. In principle, consumers can encourage the manufacturers to use more and more of these certified raw materials. By actively rejecting or shunning material coming out of unsustainable logging or poaching, consumers could theoretically put pressure on the primary producers themselves to clean up their act and adopt sustainable ('green') practices. Thus the undesirable practices that are resulting in deforestation the world over will be eliminated.

Measures for Forest Certification shall be taken in next Working Plan.

8.17 Convergence with other Departments:

With a view to achieving the goal of the Working Plan, socio-economic condition of communities residing around the forest need to be uplifted. It is important that the various development projects reach communities. Forest department may play the pivotal role to take the communities accessed to various departments so that they can avail such Government schemes/projects. Work in Convergence with other departments like Panchayat & Rural Development, Agriculture department, Animal Husbandry & Veterinary department, Fishery department etc. can facilitate the communities to avail following schemes/projects to bring about overall improvement in the quality of life of the people in forest fringe areas.

Panchayat & Rural Development:

1. Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS),
2. Deendayal Antyodaya Yojana – National Rural Livelihoods Mission (DAY-NRLM),
3. DeenDayal Upadhyay – GraminKaushalya Yojana (DDU-GKY),
4. Pradhan Mantri Awaas Yojana – Gramin (PMAY-G),
5. Pradhan Mantri Gram Sadak Yojana (PMGSY),
6. Shyama Prasad Mukherjee National RuRBAN Mission
7. National Social Assistance Programme (NSAP)

Agriculture department:

1. National Mission for Sustainable Agriculture (NMSA)
2. Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)
3. The Paramparagat Krishi Vikas Yojana (PKVY)
4. Pradhan Mantri Fasal Bima Yojana (PMFBY)

5. Livestock insurance Scheme
6. Micro Irrigation Fund (MIF)
7. Assam Farmers' Credit Subsidy Scheme (AFCSS),
8. Assam Farmers' Interest Relief Scheme (AFIRS)
9. Assam Farmers' Incentive Scheme (AFIS).

Animal Husbandry & Veterinary department:

1. Chief Minister Samagra Gramya Unnayan Yojana' also referred as Assam Milk, Meat & Egg Mission society (AMMEMS-CMSGUY).
2. Livestock, health & Disease Control Programme

Fishery department:

1. Development of Inland Fisheries and Aquaculture

8.18 Duties and responsibilities of officers and staffs: Duties and responsibilities of officers and staffs are mentioned in The Assam Forest Manual, Vol-II. All officers and staffs must adhere to the Manual and shall be be dutiful to protect and develop the forests.

CHAPTER 9

Monitoring, Assessment and Reporting

9.1 Control and Records:The control forms required for control of deviation from prescriptions for JFMC operation, plantation and regeneration, forest protection, soil and moisture conservation, FRA operations, Wildlife Management and Biodiversity Conservation is provided in this chapter. The control forms shall be prepared and submitted annually to the Conservator of Forests with a copy to the Working Plan on the 1st of January for scrutiny and for getting sanctions for deviations, if any.

The following control forms will be used for monitoring all the important operations prescribed and suggested in this working plan:

9.1.1. Bamboo Harvesting Control Form:For cutting bamboo identified for felling and bamboo left out, the Control Form 1 shall be used.

9.1.2 Silvicultural Control Form:For control of all silvicultural operations such as subsidiary cultural operations, cleanings, burnings etc., Form No. 2 shall be used.

9.1.3 NTFP Control Form:For controlling and maintaining a record of all NTFPs harvested so as to make the removal/harvesting of NTFP sustainable, Form No. 3 shall be used.

9.1.4 Wildlife Management and Biodiversity Conservation Control Form:For improvement of wildlife habitat and conservation and preservation of biodiversity, Form No. 4a, 4b & 4c shall be used.

9.1.5 Plantation Control Form:For any plantation block, gap, regeneration natural and assisted Form No. Pa, 4a, 4b & 4c shall be used.

The DFO territorial will annually make entries in his copy of the control forms and send them, together with the deviation statement in triplicate to the Head, territorial circle. After the entries have been checked and approved, the Head, territorial circle will first get his copies completed and then send it in two copies to the concerned WPO. The latter will then complete his copy and finally return the DFO's set for deposit in the latter's office till next year. The WPO will send the deviation statement with appropriate justification in four copies to the CCF/APCCF (RE&WP) for recommendation to PCCF (HoFF) for sanction. After the sanction, one copy each will be sent to the WPO, Head, territorial circle and the DFO territorial for their record and the CCF/APCCF (WP) as the case may be, will retain the fourth copy for his set of control forms. The control forms should be submitted by the DFO territorial to the Head, territorial circle by October and the latter should send them to the WPO concerned by December each year (para 129 of the National Working Plan Code-2014).

9.2 Compartment history: Compartment history will be furnished and any deviation for aligning compartments for the current context of sustainable management of forests adhering to watershed

approach will be recorded. The DFO will direct the marking Officer to write the compartment description and maintain in the registrar. The compartment history along with a thematic map will include the operations, silvicultural operations, and any other operations in the compartment as prescribed in the working circles.

9.3 Maintenance of Records: A detailed record of each forestry activity shall be maintained in order to have a solid database for scientific monitoring, evaluation and future planning. In order to avoid any complicity at any level, the controlling officers should inspect the following documents during inspection and enter signed observations.

- i. Annual Plan of Operations (APO)
- ii. Plantations Journals
- iii. Nursery Registers
- iv. Measurement Books
- v. Divisional Note Book
- vi. Fire Control Forms
- vii. Beat Book

9.3.1 Annual Plan of Operations: An annual plan of operations should be prepared by the Divisional Forest Officer based on the prescriptions and operations to be carried out as per the provisions of the Working Plan. It should be approved by the Conservator of Forests.

9.3.2 Plantation forms and journals: For each plantation, a separate journal shall be maintained in the prescribed form wherein a complete record of plantation viz. year and month of plantation, area planted, Number of plants planted, species, All activities such as advance work, plantation, regeneration, maintenances, felling and enumeration, maintenance cost, weed cutting, constructing of fire-lines etc. should be recorded for a year. For each year, there will be one entry that should be signed by the Forest Range Officer. The inspection notes by the officers should be recorded in the journals. The Divisional Forest Officer should inspect the entries at the time of annual office inspection.

Details of expenditure incurred month-wise, compartmentwise and operationwise including maintenance cost for subsequent three years. At the end of each year observation regarding success of plantation, survival percentage and the reports on monitoring and evaluation should be given. Specific instructions given during the inspection by senior forest officers is to be recorded. Instructions of the PCCF/APCCF on checking of plantations issued from time to time should also be followed.

9.3.3 Nursery register: For each nursery, separate registers need to be maintained. It shall have monthly detail of operations and expenditure incurred, seedling raised, species etc. shall also be recorded in the register. A copy of the nursery statement showing details of species wise nursery stock should be sent to the Divisional office monthly.

9.3.4 Divisional Note-Book: The Divisional Forest Officer should maintain a note-book in which the following information shall be recorded.

- a) Flowering of important tree species.
- b) Seeding of important tree species including geocoordinates of mother trees
- b) Gregarious flowering of bamboos.
- c) Climate-rainfall and temperature experienced during this year and its effect of the forest crop.
- d) Pests and diseases noticed in the crop, treatment and result thereof.
- e) Growth date of trees collected during the year.
- f) Labour related problems faced during the year.
- g) Market trend of forest produce.
- h) Working of JFM committees.
- i) Any other major important issue from the forest management point of view.

9.3.5 Fire Control Form: The record of forest fires should be maintained without any bias. The details of area burnt with sketch, cause of fire, date of fire, time of fire, date and time of control, damage and financial loss will be recorded. The copy of the fire report should be sent to the Conservator of Forests.

9.3.6 Deviation statement: To exercise control over progress of various operations at the end of each financial year, the prescriptions of the working plan will be compared with the actual operation done in the field on felling, silvicultural operations and miscellaneous works and any excess or short fall shall be recorded giving reasons for deviation and sanction of the competent authority shall be obtained as per the details given in the Miscellaneous Regulations.

9.3.7 Beat Books: Each beat Officer will maintain a Beat-Book to be prepared and issued by the Divisional Office. The Beat-Book shall contain the following information:

- a) Beat map
- b) Detail of forests in the beat
- c) Copy of boundary register of forests
- d) Duties of Forest Guard
- e) Legal status of the forest area with notifications
- f) Abstract copy of the relevant sections of the Indian Forest Act, 1927; Wildlife (Protection) Act, 1972; Forest (Conservation) Act, 1980 and vernacular translation thereof.
- g) List of buildings, roads, paths, fire-lines in the beat
- h) List of plantations raised during the past 10 years
- i) Record of water table at various places in the area

9.3.8 Registers and Records: The following updated (till previous financial year) register and records will be maintained by the Division:

- i) Compartment histories
- ii) Fire records and registers
- iii) Register of Boundary Pillars
- iv) Register of Rights and Concessions
- v) Record of forest produce harvested
- vi) Free grants
- vii) Register of land transferred to other departments under FC Act.
- viii) Register of soil and water conservation works
- ix) Register of rotational grazing
- x) Register of invasive species e.g. Lantana eradication
- xi) Register of wildlife management may include detailed record of human wildlife conflicts that includes data on human casualties and injuries, loss of domestic animals and crop damage and compensation paid etc.
- xii) Register of Government buildings that includes log of the repairs and addition (if any) undertaken in the building.
- xiii) Register of registered saw-mills in the Division.

9.3.9 Annual Inspection: Annual inspection of DFO territorial office by CF/CCF and Range office by DFO territorial is mandatory within three months of completion of financial year to have checks on annual statements in control forms and deviation statements and maintenance of registers and records.

CHAPTER 10

Summary of the Prescriptions

The brief summary of prescription against each Working Circle are narrated in table 10.

Table 10: Summary of prescriptions for each working circle.

Chapter No.	Name of the Working Circle	Prescribed activity	Physical target over a period of ten years/ Remarks
Part 2 Chapter 2	Joint Forest Management Working Circle	Preparation of microplans aligned with the working plan and objectives of the JFMC working circle.	Stakeholders engagement in achieving the objectives of JFMC working circle.
		Practice sustainably harvesting of NTFPs	Sustainable NTFP harvesting.
		JFMC participation for anti encroachment	Ensure enhancement of forest cover through community participation.
		Promotion of near to nature agriculture	Maintenance of ecology of the area
		Performance based incentive system	Ensure maximum plantation survival.
		Promotion of ecotourism at Jokai RF and Namdang RF	Improvement of livelihoods of local population.
		Development of nursery under Joint Forest Management Working Circle for the period of 2022-2023 to 2031-2032.	a) Establishment of 5 community forest nurseries. b) 1,00,000 seedlings in each nursery.
		Plantation under joint forest management working circle for the period of 2022-2023 to 2031-2032	2100 hectares as production forest. Maintenance= 2100hect.for 5 years
		JFMC training and awareness programmes for the period of 2022-2023 to 2031-2032. (4 programs twice a year for ten years, each programme 30 persons).	a) 40 training. b) 40 awareness programme. c) 2400 beneficiaries target.
Part 2 Chapter 3	Plantation and Regeneration Working Circle	Development of database of mother trees	Database and geo tagged location of good seed bearing trees.
		Ensuring availability of quality planting materials from natural stands	To ensure minimum seed losses and enhance maximum seed germination.
		Proposed works under Plantation and regeneration working circle in Dibrugarh Division for the period of 2022-2023 to 2031-2032	8450 hectares Maintenance 8450 hect for 5 years
Part 2 Chapter 4	Forest Protection Working Circle	i) Intensive protection measures will be taken for protection with greater emphasis to forest areas with canopy density over 60 percent, grassland of Jeypore Reserved forest. j) Ejection plan. k) Boundary pillars (Main pillars 1 every	a) Strengthening the forest protection squads/personnel with modern equipments, logistics, vehicle and manpower. b) Ejection plan 1440 hectares. c) Main boundary pillars 168 d) Sub pillars 504

		lilometer and sub pillars 3 every 1 km). l) Creation of barriers including rajor-wire permanent fencing etc. to check biotic interference wherever necessary.	e) Creation of barriers including rajor-wire permanent fencing etc. to check biotic interference
Part 2 Chapter 5	NTFP (overlapping) and Bamboo Working Circle	NTFP promotion, sustainable harvesting, database creation	Preservation of threatened NTFPs.
		Bamboo cutting regulations.	Ensure sustained yield of bamboo and maintenance of bamboo habitat for wildlife.
		NTFP plantation	395 hect
		Bamboo plantation	325 hect.
Part 2 Chapter 6	Soil and Water Conservation (overlapping) Working Circle	Micro planning for SMC works and adoption of best practices for SWC.	Ensure conservation of soil and water.
		a) Soil and water conservation intervention b) Proposed treatment area.	a) 2466 hectares.
Part 2 Chapter 7	Wildlife Management and Biodiversity Conservation (overlapping) Working Circle	g) Habitat improvement including plantation of fodder, fruit and other indigenous species. b) Creation and maintenance of patrolling paths 150 km c) Construction of at least 5 protection camps and 2 watch towers spread across the sanctuary. m) Creation of Village Forest Protection Committee/Eco Development Committee in fringe villages Protection of buffer area village forests through Village Forest Protection Committee. n) Training of staff, including exposure visits within and outside the state f) Procurement anti-poaching kits/equipment and other logistics. o) Procurement of Vehicle and Wireless sets.	a) Enrichment plantations 500 hectares. b) Patrolling paths 150 km c) 5 protection camps and 2 watch towers b) Establishment of 2 anti-wildlife depredation unit. c) Elephant proof trenching 3,75,000 m ³ . d) Safe elephant corridors 4 nos. e) 160 nos. wildlife awareness camps. f) Procurement anti-poaching kits/equipment and other logistics. g) Procurement of 2 SUV/MUV Vehicle and Wireless sets
		Develop network with local participation, awareness creation, anti depredation unit and promotion of ecotourism.	Ensure Wildlife Management and Biodiversity conservation.

CHAPTER 11

General Financial Forecast & Financial Plan of Operation

11.1 General:The costs and prices are influenced by market forces and depend on supply and demand. It further depends on the principles of management and pattern of exploitation adopted from time to time. Therefore, it is not possible to estimate with reasonable accuracy the expenditure and revenue during the period of this working plan. The estimates given below are based on the current prices of various items of forest produce and the cost involved in carrying out the prescriptions of the plan at current rates.

11.2 Past Revenue and Expenditure:The details of past revenue and expenditure have been given in the following table 11.2.

Table 11.2: Past revenue and expenditure ('000 lakhs) of Dibrugarh division

Year	Revenue (Rs .)	Expenditure (Rs .)	Surplus / Deficit(Rs .)
2008-2009	128.131	285.645	157.514
2009-2010	128.952	557479	428.527
2010-2011	93.36	251.797	158.436
2011-2012	92.488	213.295	120.806
2012-2013	71.862	70.52	(-) 1.342
2013-2014	68.919	104.678	35.758
2014-2015	96.913	292.591	195.678
2015-2016	37.394	206.701	169.307
2016-2017	27.471	397482	370.011
2017-2018	95.128	348.924	253.796
2018-2019	41.093	368.923	327.83

Revenue generation from minor minerals from 2009-10 to 2018-19

Year	Amount (in Rs.)	Year	Amount (in Rs.)
2009-10	5,34,21,073.00	2014-15	2,74,53,206.00
2010-11	2,32,68,233.00	2015-16	1,68,42,621.00
2011-12	1,92,70,447.00	2016-17	2,80,24,798.00
2012-13	54,22,036.00	2017-18	2,95,68,654.00
2013-14	78,56,670.00	2018-19	3,20,90,023.00

11.3 Future Revenue:

11.3.1 In this Working Plan there is no harvesting prescription. This is in view of necessity for restocking the already degraded forest. As such, no revenue is forecasted from harvesting of forest produce. However, the division will continue collecting revenue from mines and minerals.

11.3.2 Total Estimated Revenue: Average revenue collection during last ten years is Rs. 2,43,21,776.00 which may be considered as estimated revenue and assuming increase of 5% in one year the total estimated revenue in a year may be Rs.2,55,37,865.00.

11.4 Future Expenditure:

11.4.1 The expenditure includes all development works during the Working Plan period of 10 years. Average annual expenditure will be 10,51,62,745.00. The estimate is as per price index prevailed in current year. The estimated expenditure may increase subject to increase of price index and alteration/inclusion/modification of plan. Table 11.4.1 shows the estimated expenditure.

Table 11.4.1 shows the estimated expenditure

SL No.	Item	Qty	Rate (in Rs.)	Estimated expenditure (Rs.)
JFMC Working Circle				
	Creation of nursery	5	6,65,000/-	33,25,000.00
	Raising Plantation	140 hect.	52528/-	2,07,48,560.00
	Maintenance of plantation	1648 hect	18864/-	3,10,87,872.00
	JFMC Training	8 training x 10 yrs	2,50,000	2,00,00,000.00
	Promotion of ecotourism	2 x 10 years	10,00,000	1,00,00,000.00
Plantation and regeneration WC				
	Plantation and regeneration			6,83,19,525.00
	Maintenance of plantation			3,01,94,750.00
Forest Protection Working Circle				
	Cost for implementing the ejection plan			3,74,10,500.00
	Cost for creation Nursery and Plantation			21,92,41,120.00
	Roads and Bridges			49,50,000.00
	Wall/fencing in strategic places to check biotic interference			4,50,00,000.00
	Intensive protection measures including patrolling, staff mobilizing etc.			20,00,00,000.00
	Maintenance of Boundary Pillars	Main Pillars=168 Sub Pillar=504		76,93,650.00
NTPF & Bamboo WC				
	Bamboo Plantation	25 hect	57013/-	14,25,325.00
	Bamboo Plantation Maintenance	105 hect	4446/-	4,66,830.00
	Creation of NTFP Plantation	25 hecct	52528/-	13,13,200.00
	Maintenance of NTFP Plantation	105 hect	18864/-	19,80,720.00
Soil & Water Conservation WC				
	Creation of Plantation	500 hect	52528/-	2,62,64,000.00
	Engineering works for Soil conservation measures	-	-	5,00,00,000.00
Wildlife & Biodiversity Conservation WC				
	Enrichment plantations	50 hect.	52528/-	26,26,400.00
	Establishment of 1 anti-wildlife depredation unit			6,83,35,000.00
	Elephant proof trench	3,75,000 m ³	110/-	4,12,50,000.00
	Safe elephant corridors 4 nos.			90,00,000.00
	160 nos. wildlife awareness camps			4,32,00,000.00
	Construction of Camps, Watch Tower			2,40,00,000.00
	Construction & maintenance of Road			2,00,00,000.00
	Eco tourism activities			1,12,95,000.00

Scientific Studies, Monitoring			94,50,000.00
Patrolling, monitoring etc.	-	-	2,50,50,000.00
Training of staff including exposure visit			1,80,00,000.00
Total estimated expenditure = Rs.			105,16,27,452.00

11.6 Cost of the Preparation of the Working Plan: The actual expenditure incurred on the preparation of this Working Plan during 2013-2014 to 2018-2019 and expenditure likely to be incurred during 2019-2020 is given in table 11.6.

Table 11.6 Table showing the cost of preparation of the working plan

Details	Expenditure incurred during Financial year in Rs.			
	2013-2014 (Actual)	2018-2019 (Actual)	2019-2020 (Estimated)	Total
01. Pay	-	-	-	-
02. Labour	-	-	-	-
03. Dearness Allowances	-	-	-	-
04. Travelling allowance	-	-	-	-
05. T.T.A	-	-	-	-
06. Other allowance	-	-	-	-
08. Office Expenditure	-	-	-	-
11. Stationery & printing of forms.	-	-	-	-
12. Office furniture	-	-	-	-
13. Telephone	-	-	-	-
15. Vehicles maintenance and petrol	-	-	-	-
18. Publication	-	-	-	-
42. Other expenditure (Field data collection from sample points, plantation survey, boundary survey, socioeconomic survey, encroachment survey for the forest areas of 2000 ha and travel cost of forest staff)	771000	-	-	771000
47. Computer Maintenance		-	-	
Total	7,71,000	-	-	7,71,000

(Note: The working plan team has been assigned to revise & prepare the working plans of the Division. Hence, 60% of total expenditure can be considered as the expenditure for making this plan)

11.7 Cost of Enumeration: The details of cost of enumeration carried out under various working circle and Regeneration Survey are given in table 11.6.

11.8 Mandays to be generated during current plan period: As given in Para 11.5 the total estimated expenditure for 2018-2019 has been worked out as Rs.41.093 Crore. In forestry works the labour component is averaged as Nil of total expenditure. Therefore, taking current rate of Rs.250 for one manday as fixed by the state Government, the expected mandays employment to be generated during current plan period will be Approximately 45 lakhs.

11.9 Possible Funding Agencies: Normally the forestry activities are funded through various schemes under District, State & Central sector. In the state, the district & state sector schemes are totally

funded by State government. Presently 40 schemes are under operation. Assam being given special

status by the central government; the central sector schemes are funded on a 90%:10% basis. Eight such schemes are running in the state. The details are given in chapter V of Part I of the plan. Besides these schemes, funding can also be received from other sources. The following are the main agencies from where the funds may be obtained for implementation of prescriptions of this plan.

Table 11.9 Table showing the probable funding sources

S.N.	Funding Agency	Schemes involved	Nature of works
1.	Ministry of Forest & Environment, Government of India.	National Afforestation and Eco-Development Board (NAEB), Project Elephant, Project Tiger etc.	Ecological restoration, Wildlife & forest Protection.
2	Ministry of Agriculture, GOI	River Valley Project	Increase of Forest cover Through Afforestation.
3	Ministry of Rural Development, GOI	Integrated-Watershed Development, Industrial and Pulpwood Plantation	Integrated Forest Development.
4	District Rural Development Agency (DRDA)	National Rural Employment Guarantee Act (NREGA)	Community infrastructure & Forest resource development
5	Forest Development Corporation, Uttarakhand	Forestry developmental work	Buildings, Roads, Silvicultural operations, marking, etc.
6.	French Government	APFBC	Biodiversity Conservation,

11.10 Prioritization of works: All the works prescribed in this plan are important for effective forest management. Hence, funds should be made available to carry out all the prescriptions prescribed for the sustainable management of the forest. However, scarcity of financial allocation is often felt while working plan prescriptions are followed in the division. Therefore, priority of works has been fixed to guide DFO while preparing annual budget & sending his demand. It is also suggested that DFO should carry out top priority works with the available budget:

Table 11.10: Table showing the priority of work

Priority	Nature of works to be carried out
I	Forest Protection i.e. protection from forest fire, encroachment, illicit felling, poaching etc.
II	Joint Forest Management Activities
III	Plantation and regeneration
IV	Long distance Group patrolling & Monsoon patrolling.
V	Improvement of waterbodies
VI	Soil & Water Conservation works.
VII	Strengthening the knowledge of field staff by imparting training & exposure visits.
IX	Maintenance of buildings & other infrastructure (Nursery etc.) in the division.

CONTROL FORM NO. 1**BAMBOO HARVESTING**

Provision of working plan											
Year	Locality to be exploited				Results of operation					Comparison balance + No - No.	Remarks
	Forest	Compt.	Area (Ha)	No of culms to be removed	Year of working	Balance brought forward No of culms	Forest	Compt.	No. of culms felled		

CONTROL FORM NO. 2**SILVICULTURAL OPERATIONS**

Provision of Working Plan										
Year	Para of W.P.	Locality		Nature of Operation	Results of Operation			Cost Amount spent (Rs.)	Remarks	
		Forest	Comptt.		Year of operation	Locality of operation				Area (ha)
						Forest	Comptt.			

CONTROL FORM 3**NON TIMBER FOREST PRODUCE**

Year	Para of W.P.	Locality		Area (ha)	NTFP to be harvested	Results of Operation				Comparison		Remarks	
		Forest	Comptt.			Year of harvsting	Locality		Area (ha)	NTFP harvested	Excess (+)		Short (-)
							Forest	Comptt.					

CONTROL FORM NO 4a

WILDLIFE MANAGEMENT & BIODIVERSITY CONSERVATION

Ref: Area to be taken up for habitat improvement
Annually and improvement planting of fruit trees and fodder species

Control Year	Plantation centre	Prescribed		Marked		Remark
		RF &comptt.	Area	RF &comptt.	Area	

Total running excess/ deficit in area at the end of the year of commencement of the plan

..... (±) hectares.

CONTROL FORM NO. 4b

Wildlife Management & Biodiversity Conservation

Ref: Para Map of the area planted

Control year	RF &Comptt.	Plantation centre	Area of under planting	Blank area Planted
--------------	-------------	-------------------	------------------------	--------------------

Scale 1 : 16,000

N.B:

1. Map of the Compartment to be traced from stock map and the area over which under planting is done and other blank area where fresh plantation is created should be plotted in this centre form.
2. Area treated in past year under same prescription if falls in same comptt. should also be shown.
3. One form to be used annually for each compartment.

CONTROL FORM NO. 4c
Wildlife Management & Biodiversity Conservation

Ref: Para Weeding, maintenance, ANR to be continued in subsequent years till plantation is established.

Control year	RF &comptt. No.	Plantation centre	Year of creation	Area of plot	Item of Subsidiary operation			Remarks
					Prescribed	Executed	Month	

N.B : One form to be used for all plots (other than plot of year) in a Compartment each year.

CONTROL FORM NO. PI
PLANTATION AND REGENERATION RECORDS
PLANTATION FORM

General instruction One set forms to be maintained for each plantation centre and these should be loose bound between two hard-covers so that additional sheets can be added from time to time. Some of the forms relate to the whole centre and some for individual plots as detailed below:

Form no. P I a one form for the whole centre

Form No. P I bTo the scale map for whole centre. Individual plots need not be shown here.

Form No. P I C..... To the Scale map showing individual plots in the centre. Now plots to be added and plotted as soon as plantations are created. One form for whole centre.

Form No. P II aOne form for the whole centre.

Form no. P II b.....One form for the whole centre

Form no. P III aTo be maintained for each individual plot.

Form No. P III bTo be maintained for each individual plot.

Form No. P III CTo be maintained for each individual plot.

FORM NO. P I a

Name of plantation centre

Division.....

Reserve

Range

Block

Beat

Compartment No.

Situation

Aspect and slope

Soil

Brief description of

Forest type

Top Story

Mid Story

Under growth

Ground Cover

Sources of labour

Supply – Villages

Approximate number

Of daily labours

Available in different

Periods

General Remarks

FORM NO. P.I b

Name of plantation centre

Division.....

Reserve

Range

Block

Beat

Compartment No.

SITUATION MAP

Scale 1 : 16,000

N.B : The position of the centre should be shown in this map with reference to the nearest Beat office, Range Office, inspections Banglow. Location of roads, river, compartment / Block/ Reserve Boundaries should also be indicated in the Map.

FORM NO. P.I C

Name of plantation centre	Division.....
Reserve	Range
Block	Beat
Compartment No.	

PLANTATION CENTRE MAP

Scale 1 cm – 50 meters

N.B : The map will be shown the individual plots with plot No. and year of creation recorded on the body of each plot. Nearest Compartment boundaries are also to be shown in the map. Now creations are to be plotted and added each year.

FORM NO. P.II a

Name of plantation centre	Year in which plantation
Reserve	commenced in the centre
Block	Division.....
Compartment No.	Range
.....	
Beat	

AREA STATEMENT

Year of Creation	Plot No.	Area attempted in hectares	Species	Area failure/Successful			Remarks
				Year of assessment	Failure in ha.	Successful in ha.	
1	2	3	4	5	6	7	8

N.B :

1. In column 1 the calendar year in which planting / sowing etc. of a plot were done is to be filled in.
2. Column 1 to 4 should be filled in during the first year of a plantation plot. As soon as new plots are taken in hand in the centre. These columns should be filled in.
3. Column 5 to 7 are to be filled at the end of 5th year of each plot.
4. In remarks column reason for failure and sanction no. writing off failures should be entered.

FORM NO. P.II b

Name of plantation centre

Year in which plantation

Reserve

commenced in the centre

Block

Division.....

Compartment No.

Range

Beat

SUMMARY OF EXPENDITURE AND REVENUE

Year	Expenditure (₹) of the year from Commencement			Revenue (₹) of the year			Progressive total of revenue (₹)
	Creation	Upkeep	Total	Creation	Upkeep	Total	

N.B :

1. Col. 1 should preferably be the calendar year.
2. In Col. 2 cost of creation of the plot of that calendar year inclusive of seed cost nursery cost and first year's tending should be entered.
3. Col. 3 will show the cost of tending, thinning etc. of previous year's plots incurred during the particular calendar year of column 1 .
4. Col. 5, 6, 7 will reflect the progressive total of column 2,3,4 respectively from year to year.

FORM NO. P.III. a

Name of plantation centre Division.....
 Reserve Range.....
 Block Beat.....
 Compartment No. Year of creation.....
 Area (Hectares)
 Brief description of :
 Type of plantation
 Method of Formation
 Species
 Quantity of seeds / number of stumps
 Number of transplant used
 Spacing
 Category of labour
 Inter-culture of field crops (if any)
 Fencing

Financial year	Date of work	Brief summary of works	Extent of area covered by the item of work	Cost in ₹		Cost in terms of unit of daily labours ₹		Remarks
				Free labour converted to ₹.	Cash paid labour in terms of ₹	No. of free labours	No. of paid labours	
1	2	3	4	5	6	7	8	9

N.B :

1. This form is to be maintained plot by plot. Additional sheets to be added as soon as new area taken in hand.
2. All items of work including cost of seed collection, nurseries etc. for the particular plot should be entered in this form and hence entries are to start prior to the year of creation of the plot.
3. Form to be filled up immediately on completion of a particular item of works.

FORM NO. P.III. C

Plantation centre Plot No Year of Creation

ReserveBlock.....

Compartment No.Division

RangeBeat

PROGRESS OF HEIGHT AND DIAMETER / GIRTH GROWTH

Species	Age at which measurement recorded	Height (in meter)		Diameter/girth (in centimeters)		Remarks
		Maximum	Average	Maximum	Average	

N.B :

1. For the purpose of measurements old trees growing along the edges of the plot in the open. Measure a few groups of stems selected at random of property at fixed intervals along the rows of plots. The maximum would be the topmost dimension found during such measurements of groups and the average is to be worked out in the usual way.
2. From end of the 1st to 4th year of the plot only height measurement are to be recorded annually from the end of 5th year onwards record height / diameter of Girth measurements at periods intervals (say 5 years)
3. One form to be maintained for each plot, end to be opened as soon as plot is created.

FORM NO. P.III. C

Plantation centre Plot No. Year of Creation

ReserveBlock Compartment No.

DivisionRangeBeat of the plot Area (in ha.).....

Analysis of cost per hectare upto the end of 10th year

Sl. No.	Item of work	Total cost (₹) for the entire plot		Total Cost (₹)	Remarks
		Cost of materials (₹)	Total No. of daily labour		

1. Seed collection
2. Nurseries
3. Clearance of site
4. Burning
5. Staking / Lining
6. Hoeing / site preparation
7. Sowing/ Dibling/planting
8. Fencing
9. 1st year's fire –protection measure
10. Repeat item 9 and 10 for 2nd to 10 year add
Clearing in the 6th year and thinning in the appropriate year.

N.B :

1. One form to be maintained for each plot and posting carried out at the end of each financial year.
2. In remarks column enter quantity and type of materials used.

PLANTATION JOURNAL

General Instruction :

One bond Register with serially numbered pages to be maintained for each center. First page to provide an index showing plot No. year of creation and reference to page nos. in which the plot appears. A Map showing the location with GPS Co-ordinates in KML,GPX Format to be attached including Google Spread sheet and a Trace Map not in scale.

Entries to be effected for each plot in the form of abstract of information furnished in the plantation Forms.

Sufficient blank pages to be left out between two plots for the purpose of future entries.

Proforma could be as follows.

LEFT- HAND PAGE OF THE REGISTER

Name of plantation center Division Plot No.
ReserveRange Year of Creation
Block Beat..... Compartment No.
 Area (in Ha.)
 Species

Type of Plantation Method of Formation
 Quantity of seeds/number of Spacing
 Stumps or transplant used field –crops raised (if any)
 Fencing

Brief summary of work done	Month 7 year in which done	Cost.
1. Seed collection /Nurseries		₹
2. Cost of the creation of the Plot including first year's tending And fire-protection.....		₹
3. 2 nd year's tending and fire protection etc.		₹

(Removal due to disease/windfallen/decay (if any) to be entered in red ink and photographs to be attached)

RIGHT HAND PAGE OF THE REGISTER

Remarks by the Inspecting Officer.

Noting