THE WORKING PLAN
FOR
KAMRUP EAST FOREST DIVISION

VOLUME- I
For the period of
2023-2024 to 2032-2033

Written by
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&
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Assam Forest Department
Government of Assam

भारत सरकार / GOVERNMENT OF INDIA
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सत्यमेव जयते

No. 12-6-10/91/2013/RONE/KAMRUP/WP/Assam/ 43-44

April 10, 2023

To

The Principal Chief Conservator of Forests & HoFF
Department of Environment & Forest
Govt. of Assam
Dispur

Sub: Approval of Draft Working Plan of Kamrup East Forest Division- reg.

Ref: (i) State Govt.'s letter No. FG.62/REWP/WP/Final Approval dated 22.03.2023.
(ii) Ministry's order No. 9-7/2012-ROHQ dt. 23.02.2018.

Sir,

With reference to the subject and State Govt.'s letter cited above, I am directed to inform that the matter has been examined and discussed in the Regional Empowered Committee (REC) meeting held on 28th March, 2023 in pursuant of Ministry's order as cited under reference no. (ii).

In this regard, I am directed to convey that on the basis of the recommendation of the REC, the Central Govt. hereby conveys the approval under Section 2 of the Forest(Conservation) Act, 1980 the approved Working Plan of Kamrup East Forest Division subject to the following conditions:-

A. General 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. 2023-24 to 2032-33.
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 all 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 05/12/2005 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 check 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 30^0 (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, 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 sps. 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 2027-2028 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.

B. Specific conditions:-

1. The Working Plan should have special provision for conservation of elephant corridors, water conservation, conservation of wetlands and archaeological sites.
2. The Working Plan should have provision for skill development for extraction, development and proper marketing of NTFPs, Bamboo including effort on composting through JFMCs. The Division may prescribe for the collaboration with RFRI, Jorhat for the same.
3. The Working Plan should prescribe for creation of preservation plots of important and threatened species and seek to involve school, college and other like organization in biodiversity conservation.
4. The Working Plan should prescribe for exploration of funds for JFMCs from other sources like MNREGA, CSR etc. The agency providing fund for the implementation of Working Plan to be specified.
5. Special attention to be given to climate change and development of climate-resilient models for plantation and conservation.
6. Provisions to be made for strengthening the protection mechanism and provision of wireless set, GPS sets, drone facility etc.
7. Working Plan should have prescription for proper demarcation of the forest area and if there is any encroachment, timely and decisive action to be taken.
8. The Working Plan may also calculate the indirect benefits derived from the forest as part of the budget projection.
9. All Appendices as mentioned in para 97 & 98 of the National Working Plan Code, 2014 should be provided in the Plan.

Yours faithfully,

10/4/23

(W.I. Yatboh)
Dy. Inspector General of Forests (C)

Copy to:-

1. The Additional Chief Secretary (Environment & Forests), Govt. of Assam, Dispur.

Dy. Inspector General of Forests (C)

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PREFACE

Forests being major natural resources that support sustenance of the human population, play the most important role in the environment and maintaining ecological balance that need to be conserved. Various anthropogenic pressures including industrialization and urbanization are causing depletion of forest cover. Conservation and management of forests has become one of the top priorities globally. Conservation and management practices of forests should focus on the sustained yield and maintaining the flow of ecosystem services. For achieving the sustained yield and improved ecosystem services, there is a need to formulate effective planning. Forests are under the influence of climate change and human-induced pressures affecting sustainability. This has called attention of planners to formulate strategies to achieve the "Sustainability," defined as "the maintenance of natural capital". There is an urgent need to harmonize balance between production from forests and ecological goals through planning processes performed at the national, regional, and local levels.

The significance of forest protection supporting sustainability is well witnessed in the Constitution of India. The Constitution of India under the constitution (42ndamendment) Act, 1976, added article 48A which reads as "Protection and improvement of environment and safeguarding of forests and wild life – "The State shall endeavour to protect and improve the environment and to safeguard the forests and wild life of the country". Similarly, fundamental duties for every citizen were added during 42nd amendment Act, 1976, as Article 51A (51A Fundamental Duties) which says "It shall be the duty of every citizen of India – (g) To protect and improve the natural environment including forests, lakes, rivers and wild life, and to have compassion for living creatures" (National Forest Commission, 2006). The efforts for a structured and scientific forestry planning in India were initiated long ago, beginning with the appointment of Dr. Dietrich Brandis as the first Inspector General of forest in 1894, and the formulation of the first National Forest Policy in 1894. Since then, attempts have been made to evolve more reasonable basis of forest planning and management. This primarily involved the integration of scientific basis for the conservation of natural resources to meet emerging needs of the country and the society.

Forests being a renewable resource can be sustained in eternity with well-planned management interventions. The need for management and planning of forests evolves over time with population driven demands. Forest planning is often subjective and unique to situations and problems being addressed. This may also vary according to the forest tract dealt with respect to its characteristics and composition, risks involved, long-term vision, and the requirements visualized at local or national level. Historically, in India, management of forests to retain a sustainable yield, working plan (also called as forest working plan or forest management plan) has been the main instrument in practice for almost 150 years. Although, the initial focus of these plans was primarily to fetch sustained yield of timber which has gradually shifted to the wider concerns of sustainable management of forests, and also the concerns of the forest fringe communities and overall forest-dependent life support system varying from local level to the national scale.

This Working Plan deals to address the concerns of ecosystem services, environmental stability, biodiversity conservation, climate change, carbon sequestration, soil moisture

retention, water yield, minor forest produce in the form of important non timber forest products, pharmaceutical and other industrial requirements, rights of the forest dweller communities. In recent years after the enactment of reducing emissions from deforestation and forest degradation (REDD +) initiative, the requirement of a working plan would shift to fulfill the need to give quantitative evidence about the forest resources to fetch payment benefits. This demands information related to biodiversity conservation, carbon sequestration, and enhancement of rural livelihoods which could fit in the working plans.
There has been a paradigm shift in the preparation of working plans in India. Post-Independence era (i.e. after 1947), forestry witnessed a shift in the priority of forest management from production to conservation forestry, particularly after the enactment of Forest Conservation Act in 1980.

Working plan for the Kamrup East Forest Division, Assam for the period 2021-2022 to 2031-2032has been prepared as per the National Working Plan Code, 2014 (NWPC, 2014 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. It is attempted to integrate information related to Criteria and Indicators (C&I) for sustainable forest management (SFM), carbon sequestration and mitigation, climate change, biodiversity monitoring and conservation, forest certification, enumeration and management of non-timber forest products (NTFPs), preparation of micro-plans for joint forest management (JFM), fringe forest management, water resource management, soil and water conservation, forest health and diseases, forest fires and protection.

The GPS coordinaties for the sample plots were 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 Forests, Assam. NESAC also supported the division by mapping the Forest Types, Canopy Density, Slope, Aspect and Landuses. The thematic maps were further validated on the ground with support from IORA Ecological Solutions Pvt Ltd (IORA). Other relevant surveys, including Plantations, Socio-Economic Survey (*forest and fringe villages*) were conducted in line with NWPC, 2014. Mapping of Trees Outside the Forest, Forest Carbon Stocks, Compartment Wise Growing Stocks, Waterbodies in the Division, Delineation of Microwatersheds, Estimation of USF, LULCF, Mapping of Working Circles were also carried out under the guidance of Additional PCCF(RE&WP), supported by consultants from IORA. Findings of the survey were duly discussed with the relevant stakeholders and then finalized.

The Kamrup East Forest Division lies entirely within the revenue district of Kamrup (Metro) and Kamrup. It is located within the geographical limits of 91°30′27″E to 91°10′42″E and latitude 25°54′15″N to 26°6′45″N. The division covers an area of 1,254 sq. km. The total area covered under this working plan is 469.26 sq. km. of which sixteen Reserve Forests cover 353.29 sq. km. and the rest of 115.96 sq. km. is covered under PRFs. The forests of this Division fall under three main forest types viz, Eastern Hill Sal Forests - Khasi Hills Sal Type 3C/C I a, Plain Sal Forests - Kamrup Sal - type 3C/C 2d (II), Moist Mixed Deciduous Forests

- type 3C/c3 (b) and types 3C/c3 (2 Sl). (as per Champion V. Seths classification of forest types).

With a view to achieving the goal, following six Working Circles are constituted-

(a) Sal Regeneration Working Circle
(b) Plantation Working Circle
(c) Joint Forest Management Working Circle
(d) Wildlife Management and Biodiversity Conservation (Overlapping) Working Circle
(e) Forest Produce [a) NTFP, b) Bamboo (Overlapping)] Working Circle.
(f) Forest Protection Working Circle.

Sal Regeneration Working Circle: This Working Circle has been constituted to cover all the areas having pure Sal in the crests, ridges and spurs of the hills as well as in a very limited area of the plains. This Working Circle also includes some of those areas where Sal is found in considerable numbers mixed with other species. As the outcome of the past systems of management is very discouraging, the pace of regeneration of Sal is to be accelerated within a reasonable period. The broad objective of this working circle is to improve the Sal stocks of the forest of this division by plantation, regeneration and gap filling. It is proposed that the identified Sal regeneration areas should be taken up for high density, Artificial Regeneration (AR) and Aided Natural Regeneration (ANR) work during the plan period.

Plantation Working Circle:Identified areas covered by moist mixed deciduous forests and Sal have been brought under this Working Circle to rehabilitate and restock the depleted forest of poor value by raising plantations of ecologically more valuable species to meet the demand of fuel-wood, timber and as a pool for carbon sequestration. The appropriate silvicultural operations may be allowed to improve the health of growing stock. Plantation working circle to cover existing plantations done by the department, blanks and under stocked areas not suitable for ANR (Assisted Natural Regeneration), 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. Apart from above, all encroached areas of different RFs of the division have been kept in this Working Circle.

Joint Forest Management Working Circle:This working circle has been constituted keeping in view the present requirement of the local people for planning and implementation of the various forestry activities. The past experience has taught a lesson that unless and until the people residing near the forests are taken into confidence and their regular requirements are met up, there is very less possibility of achieving the desired results of bringing up the forest cover. The management of forests will be as per micro-plan prepared by the community through Participatory Rural Appraisal (PRA), with the technical help of the officials of the Forest department.

Wildlife Management and Biodiversity Conservation (overlapping) Working Circle:

Kamrup East Division lies, Bio-Geographically under traditional zone between Indian Sub Region and Indo-Chinese sub-region of the oriental region. Therefore, the overall species diversity are on the higher side in the Reserve Forest areas. So far 30 species of mammals, 212 species of birds,29 species of reptiles,9 species of amphibians, and 383 species of plant were check-listed. The diversity of the area represents the genetic diversity, species diversity

and eco-system diversity and the values of biological resources have been recognized in most human disciplines for religion to science. The biological resources of the forest areas of Kamrup East Division are beyond qualification because they provide the biotic raw materials for every type of economic endeavour. But encroachments, illegal fellings, unscientific illegal collection of fuel-wood and fodder, jhum cultivation, conversion of forest land for agricultural purposes and development works etc. caused habitat degradation. Special emphasis will be given for restoration of habitat and biodiversity conservation.

Forest Produce Working Circle: a) NTFP and b) Bamboo (overlapping) Working Circle:The NTFP working circle, an overlapping working circle shall comprise largely of fringe forest areas or such other areas, which are fit for extraction of a particular NTFP (bamboo, Canes, Rattans etc.) without declining of the biological diversity. Closure of an area for the collection or extraction of particular forest produce for a specified period restricting or banning the collection or extraction of any forest produce for certain period, fixing limitation on quantities of any forest produce ensuring sustainable harvesting etc. will be prescribed. 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. 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. Apart from NTFPs, minor minerals are also collected under provisions of the Assam Minor Mineral Concession Rules, 2013 from Minor Mineral Units.

Forest Protection Working Circle: The main objective of this working circle is to provide protection to the forests and to facilitate them to restock by natural process and to provide rest to the forests, which had been under extensive biotic pressure. This working circle shall include complete whole forest area of the division. Such areas shall not be worked for timber or other NTFPs but 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 fringe forest areas/JFMC areas as well as 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.

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 Kamrup East Division. It is our belief that this working plan will help achieveing the stated objectives in a systematic manner and lead to sustainable management of forests in Kamrup East Forest Division.

Amal Chandra Sarmah, IFS
Yunush Salim, AFS

Acknowledgement

The success of any project depends largely on the encouragement, guidance and support of many other people. Apart from the efforts of my self, number of senior officials, colleagues, staffs contributed in preparation of this Working Plan. I have taken efforts in this project. However, it would not have been possible without the kind support and help ofmany individuals and organizations. I take privilege to express my gratitude to the people who have been instrumental in the successful completion of this Forest Management Plan.

I take privilege to offer my deepest gratitude and greatest appreciation to Ms. ImtianlaAo, DDGF and Sri W.I. Yatbon, IFS Dy.Inspector General of Forests (C), MoEFCC, Regional Office (NEZ), Shillong for their continuous guidance and support. Without their encouragement and guidance this project would not have been materialized.

I am highly indebted to Sri. M K Yadava, IFS, PCCF &HoFF, Assam for his guidance and continuous support and encouragement. I offer my sincere gratitude to the APCCFs and SPCCF namely Dr. Alaka Bhargava, IFS, Sri. MK Yadava, IFS, Sri T V Reddy, IFS, Sri N Anand, IFS and 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 Shri R.N. Boro, IFS, DCF (Retd), Sri Samir Sukla Baidya, DCF, Sri J.N. Bhagawati, D.C.F. (Retd), Sri Naba Kumar Malakar, DCF (Retd), Smt. HimamoniHandique, Research Officer, SmtPreeti Buraghain, DCF, Smt. Kasturi Goswami, RFO, MunmiGogoi, RFO and Sri Lakheswar Das RFO for their assiatance and co-operation in various stages. I am grateful to Shri Rajib Baruah, AFS, the then DFO and Shri Mrigen Baruah, AFS, ACF for their cooperations in providing division specific biodiversity and other field data. Shri Hem Bhattacharya, Surveyor (Rtd.) deserves mention for pain stakingly collecting field data.

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 theo/o. Addl. PCCF (RE&WP), Assam. I offer my sincere acknowledgement to NESAC and staffs of GIS Cell of o/o CCF (RE&WP), Assam for their valuable contributions.

Finally, I express my deep sense of gratitude to Sri Yunush Salim, DCF, they key contributor, whose and sincere work and continuous endeavour has given final shape of this Working Plan.

Amal Chandra Sarmah, IFS

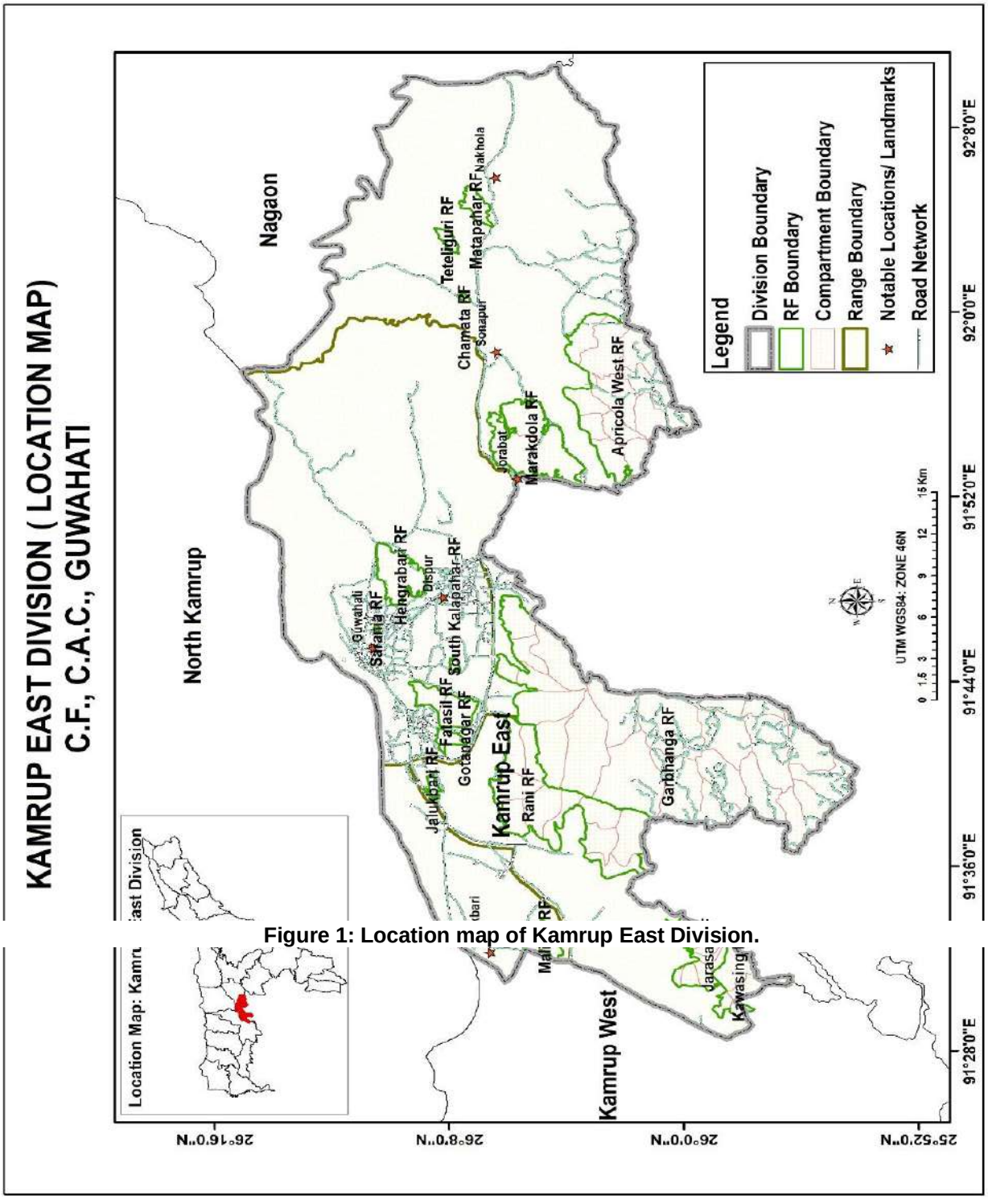


Figure 1: Location map of Kamrup East Division.

EXECUTIVE SUMMARY

1. Introduction:

The Kamrup East Forest division lies entirely within the revenue district of Kamrup (Metro) and Kamrup. It is located within the geographical limits of 91°30′27″E to 91°10′42″E and latitude 25°54′15″N to 26°6′45″N. The division covers an area of 1,254 sq. km. The total area covered under this working plan is 469.26 sq. km. of which Sixteen Reserve Forests cover 353.29 sq. km. and the rest of 115.96sq. km. is covered under PRFs.

The total stock of RFs and the PRFs spread across the division covers:-

(a) Eastern Hill Sal Forests - Khasi Hills Sal Type 3C/C I a,
(b) Plain Sal Forests - Kamrup Sal - type 3C/C 2d (II),
(c) Moist Mixed Deciduous Forests - type 3C/c3 (b) and types 3C/c3 (2 Sl).

The RFs and PRFs of the division are mainly in the spurs of the foot hills of Khasi Hill Ranges protruding out into the northern plains. Kawasing and Jarasal RFs, situated in western end of the division have forests in the plains and are located on the alluvial terraces, gradual cutting and levelling of mild spurs of the foothills. These alluvial plains forests are cut off by the narrow low lying winding tracts, above the nearby streams or river beds suitable for wet cultivation of rice. The geological formations of the Kamrup East Division, except the recent soil and alluvium, belong to the Archean Gneissic complex. The oldest formation is composed of gneissic and schist, which are extensively intruded by granites. The main block of forests of this division within this area is situated on outlying portion of the Shillong plateau. The principal rocks of this outlying portion are acidic and basic gneisses, which have been metamorphosed by intruding igneous rocks.

The working plan has been prepared for a period of ten years from 2021-2022 to 2030-2031. It replaces the previously approved working plan prepared by Sh.P.C. Das 2001-2002.
This working plan has been prepared as per the guidelines of the Govt. of India contained in the National Working Plan Code-2014. Remote Sensing/Geographic Information Systems (RS/GIS) tools have been used to develop all the thematic maps. Compartment-wise growing stock of timber has been assessed based on the standardized technique of forest resource survey assessment by laying out quadrats of 0.1 ha based on systematic grid based sampling. Biomass of the growing stock has been assessed and the carbon sequestration value of the entire forest has been evaluated based on Forest Survey of India's allometric equations, to serve as a baseline for future planning. Dependency of the people on forest was assessed through socio-economic survey. Species Importance Value Index (SIVI) was calculated, ToF mapped, continuous sizeable forest patches of greater than 10 ha USF are estimated and microwatersheds delineated for effective management of forests in this division.

Encroachment is a major threat to the forests of this division. Total areas of 2479.66 ha in different R.Fs have been encroached. The Government of Assam is committed not only to conserve its forests and protect them from future encroachments, but also to clear existing encroachments. In view of this, comprehensive forest and boundary surveys are being carried out and the encroachers will be evicted in due course of time. The RFs and PRFs of the division are surrounded by numerous villages. Pockets of habitations exist in most of the RFs.

Anthropogenic pressure, deforestation, forest degradation and shrinking of wildlife habitats have resulted in an increase in incidences of man-elephant conflicts in the division. The anthropogenic pressure together with other biotic interference in the forests has caused habitat loss of the valuable fauna which thrived in the division earlier. Wild dog species reported earlier in the division, is not seen anymore. There is considerable decrease in the population of wild elephants and wild boars in these forests. Demarcation of the boundaries of RFs and their maintenance is often not very effective. In most places boundary pillars could not be traced out. Hence the boundary demarcation of all the forests (both RFs and PRFs) should be made and monitored periodically. It is proposed that the frequency of patrolling be intensified.

a) Vision Statement: To bring all degraded forest areas under dense tree cover with biodiversity restoration, making a pool for carbon sequestration and thereby contributing towards retardation of climate change; and provide ecosystem services for sustainable development.

b) Goals and objectives of management:

Goals:

i. Protect the existing forests in the division from degradation and encroachment.
ii. Bring all open areas under dense tree cover.
iii. Improve the quality of the forests from open, medium dense to very dense forest.
iv. Improve the biodiversity in forests from ecological security and economic security.
v. Improve the habitat of wildlife and protect the wildlife.
vi. Involve people in protection of forests and provide livelihood support to people dependent on forests.
vii. Reduce pressure on forests for livelihood needs of the people by providing alternatives for livelihood.

Objectives:

i. Manage the forests for ecosystem services and sustainable development,
ii. Improve the quality of growing stock in the forests in terms of density, regeneration and biodiversity,
iii. Increase carbon sequestration and contribute positively toardsreductionin carbon emission and climate change, and
iv. Generate revenue from NTFP and provide livelihood to people from NTFP collection.
v. Promote watershed protection and management to sustain increasing requirement of water in the fringe villages & Guwahati city.

c) SWOT Analysis: The division has diversified forest; for instance, in the Southern and Western regions Sal forest is abundant, whereas Garbhanga RF, towards Southwest, is dominated with Bamboo Brakes. River Brahmaputra is the perennial source of water here, while many small tributaries ensure continuous source of water in the division.

NTFPs like GondhKachu, *Andrographis* spp., *Rauvolfia Serpentine*, etc. are commonly found in the moist areas. JFMCs in the division are functioning satisfactorily and act as a social fence, providing information on any illegal activities. There is ample scope for promotion of Ecotourism; especially in the *DeeporBeel* area. Forest fragmentation and lack of active working plans, as of now, is the major concern of the division. Whereas forest fire and jhum

(*shifting cultivation*) is a worrying situation in Garbhanga RF. Illegal felling of trees, mostly on the Meghalaya border and encroachments are some major threats in the divison. The detailed SWOT analysis carried out for prescribing appropriate measures for achieving the goals and objectives of the working plan is presented in the box 1.

SWOT AnalysisofKamrupEastDivision,Assam.

STRENGTHS	**WEAKNESS**
➢ Availability of adequate species of flora. ➢ Fertile Soil. ➢ Existence of perennial waterbodies. ➢ Natural Salplantation. ➢ Presence of trainedand experienced staffs.	➢ Inadequate number ofstaffs and deficiency of new blood in department. ➢ Underground ethnicproblems. ➢ Lack ofinfrastructure. ➢ Poor fund flow. ➢ Large degradedarea. ➢ Disputed inter-State boundary.
OPPORTUNITIS	**THREATS**
➢ Co-operation from sociallocal organization/JFMC. ➢ Ecotourism potential. ➢ Presence of adequate minorminerals. ➢ Forest dependant community transformable to opportunity. ➢ Potential to become enhanced carbon sink	➢ Illegal felling ➢ Encroachment ➢ Jhumcultivation. ➢ Uncontrolled collection of firewood. ➢ Poor condition of adjoining village people of the RFareas.

d) Expected Outcome: Being close to Guwahati city, the division acts as the main forest area for the urban areas.

i. Forest development activities will not only result in increasing green cover to enhance oxygen level but also restore the biodiversity in the forests of this division. Besides, it will create a pool for carbon sequestration and thereby contribute towards retardation of climate change.
ii. The water holding capacity of the soil will rise and the water tables will be enriched.
iii. Need-based plantation will be carried out for meeting the demand of people living in the fringe areas of the forest.
iv. Ecotourism prospects especially along the adjacent areas of *DeeporBeel* area will fetch good livelihood opportunity to the community people.
v. Effective awareness campaigns, to be organized time to time, will lead to significant reductions in man-animal conflicts in the division.

e) Abstract of Plan Prescriptions: The abstract of plan prescriptions through different working circles showing the expected physical targets of Kamrup East Forest Division for the plan period is shown in table (e).

Table (e): Abstract of plan prescription expected targets for KamrupEastDivision.

Chapter	**Name of the**	**Prescribed activity**	**Physical target over a**

No.	W.C.		period of ten years
Part 2 Chapter 2 Para 2.6.7	Sal Regeneration Working Circle	Regeneration (Natural) ANR supported by artificial regeneration Total activity area consolidating all compartments = 7468.00hect.	Area earmarked for Sal regeneration = 2947.00 hect
		1st weeding = May/June 2nd weeding = July/August 3rs weeding = September Pressing and Control burning = Late October to early November	2947.00 hect
		Raising of Sal polypot seedling for vacancy filling 10,00,000	Polypot seedling 10,00,000
Part 2 Chapter 3	Plantation Working Circle Working Circle	Sylvicultural operation Cleaning and Thinning in Periodic Block I,II, and III	15210.804 hect.
		Creation of Nursery for 13431 hect plantation during the Working Plan period.No of Nursery = 5, one each in every Range for 10 years	No. of nursery beds 40000 No of Nursery = 5, one each in every Range for 10 years
		Weeding: 3 rain weedings in 1st& 2nd year 2 weedings in 3rd& 4th year year It should be ensured that the plantations are established at the end of 5th year.	Area to be covered =3800 hect.
Part 2 Chapter 4 Para-4.7.1, 4.7.5	Joint Forest Management (Overlapping) Working Circle	Nursery and Plantation and entry point activity: Plantation = 2926 hect Maintenance 2926 hect x 5years	Plantation = 2926 hect Maintenance 2926 hect x 5 yrs
		JFMC training and awareness programmes for the period of 2019-2020 to 2028-2029. (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 Chandubi, Kulsi, Ukium, Jongakhuli, gamarimura (Jeep safari, Boat riding, Ethnicuising,night halt at cottages etc.	5 units.
Part 2 Chapter 5 Para- 5.6,	Wildlife Management W.C	Habitat enrichment: a) Regeneration of various fruit, fodder species b) Maintenance of Plantation	1218 hect. 10 nos

5.7		c) Maintenance of Water hole	
		a) Formation of Anti depredation Squad and equip with logistics b) Purchase of vehicle c) Engagement of Kunki Elephant d) Construction of watch towers e) Digging of Elephant proof trenches f) Erection of elephant (battery/solar) fence g) Awareness campaign	a) As shown in detailed estimate. b) Total 10 Bolero SUV and 5 Mini trucks c) 2 Kunki Elephants during elephant depredation season. d) 10 Watch towers e) Total 50 kms f) 50 km g) 80 programmes
Part 2 Chapter 6 Para-6.6.2, 6.6.6	Non timber forest produce (overlapping) working circle	a) NTFP Plantation = 756 hectares b) NTFP Maintenance = 1812 hect. c) Bamboo Plantation = 714 hectares d) Bamboo Maintenance = 1722 hect	a) 756 hectares b) Maintenance = 1812 hect c) 714 hectares d) Maintenance = 1722 hect
Part 2 Chapter 7	Forest Protection WC	Ejection plan: areas under encroachment shall be covered under ejection plan 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.	20734.977 hect. Area is under encroachment. Out of which some areas are allotted under Forest Right Act. After final allotementnet net area under encroachment shall be worked out and eviction plan will be implemented.
		Boundary pillars (Main pillars 1 every 1 klilometer and sub pillars 3 every 1 km). Creation of barriers including rajor-wire permanent fencing etc. to check biotic interference wherever necessary. Main Pillars = 679 Sub Pillar = 1569	a) Main boundary pillars=679 b) Sub pillars 504 = 1569 c) Creation of barriers including rajor-wire permanent fencing etc. to check biotic interference

f) Abstract of Works Prescribed During the Plan Period Along with Annual Target: The abstract of works prescribed in the working plan of Kamrup EastForest Division, Assam, for the plan period showing its year wise target is summarized below in table (f).

Table (f): Abstract of annual targets for Kamrup East Division.

Chapter No.	W. C.	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 2.6.7	Sal Regeneration Working Circle	Sylvicultural operation Cleaning and Thinning	721	716	716	711	709	718	721	696	696	697
		Regeneration (Natural) ANR supported by artificial regeneration **2947**hect area shall be covered up for ANR work during the plan period.	320	316	315	324	305	299	282	266	260	260
Part 2 Chapt- 3 Para 3.6.7	Plantation Working Circle	Creation of Nursery for 13431 hect plantation during the Working Plan period. No of Nursery = 5, one each in every Range for 10 years 3.00 lakh seedling to be raised/nursery/year	5 no.	5 no	5 no	5 no	5 no	5 no	5 no	5no	5 no	5no
		Regeneration plantation during the Working Plan period. Area earmarked for Teak regeneration = 13431 hect.	1361	1363	1359	1377	1390	1338	1324	1324	1307	1288
		Weeding: 3 rain weedings in 1st& 2nd year 2 weedingss in 3rd& 4th year year. It should be ensured that the plantations are established at the end of 5th year.	1361	2724	4083	5460	6850	8188	8151	8112	8060	7971
Part- 2 Chapt- 4 Para- 4.7.1, 4.7.5	Joint Forest Management Working Circle	Nursery and Plantation and entry point activity: Plantation = 2926 hect	307	301	307	305	292	292	290	280	279	273
		Maintenance 2926 hect x 3 years	-	608	915	1220	1512	1804	1787	1766	1738	1706
		JFMC training and awareness programmes for the period of 2019-2020 to 2028-2029. (4 programs twice a year for ten years, each programme 30 persons). a) 40 training.	4	4	4	4	4	4	4	4	4	4
		b) 40 awareness programme.	4	4	4	4	4	4	4	4	4	4
		Ecotourism development in	5	5	5	5	5	5	5	5	5	5

		Chandubi, Kulsi, Ukium, Jongakhuli, gamarimura (*Jeep safari, Boat riding, Ethnicuising,night halt at cottages etc.*										
Part 2 Chapt-5 Para-5.6, 5.7	Wildlife Management and Biodiversity Conservation (overlapping) Working Circle	Habitat enrichment: a) Regeneration of various fruit, fodder species = 1218 hect.	125	125	125	125	125	125	125	125	118	100
		b) Maintenance of Water hole= 10 nos	10	10	10	10	10	10	10	10	10	10
		a) Formation of Anti depredation Squad and equip with logistics	5	5	5	5	5	5	5	5	5	5
		b) Purchase of vehicle	-	5	5	5	-	-	-	-	-	-
		c) Engagement of Kunki Elephant	2	2	2	2	2	2	2	2	2	2
		d) Construction of watch tower	-	2	3	5	-	-	-	-	-	-
		e) Digging of Elephant proof trenches (KM)	-	10	10	10	10	10	-	-	-	-
		f) Erection of elephant (battery/solar) fence (KM)	-	10	10	10	10	10	-	-	-	-
		g) Awareness campaign	8	8	8	8	8	8	8	8	8	8
Part 2 Chapt- 6 Para-6.6.2, 6.6.6	NTFP & Bamboo WC	NTFP Plantation = 756 hectares	75	75	75	75	76	76	76	76	76	76
		NTFP Maintenance = 1812 hect. (756 hect x 3 years)	-	75	150	225	225	226	227	228	228	228
		Bamboo Plantation = 714 hectares	73	73	73	73	72	70	70	70	70	70
		Bamboo Maintenance = 1722hect (714 hectares x 3 years)	-	73	146	219	219	218	215	212	210	210
Part 2 Chapt- 7 Para-	Forest Protection	a) Intensive protection measures will be taken for protection Strengthening the forest protection squads/ personnel	5	5	5	5	5	5	5	5	5	5

		with modern equipments, logistics, vehicle and manpower.										
		Ejection plan: areas under encroachment shall be covered under ejection plan 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.	-	250	250	250	-	-	-	-	-	-
		Boundary pillars (Main pillars 1 every 1 klilometer and sub pillars 3 every 1 km). Creation of barriers including rajor-wire permanent fencing etc. to check biotic interference wherever necessary. Main Pillars = 679	100	100	100	100	100	100	79	-	-	-
		Sub Pillars = 1569	225	225	225	225	225	225	219	-	-	-

ii. 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.

Sl.No.	Term	Definition
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 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 Budget	Comparative evaluation of the amount of carbon stored in natural forests (sinks) and the amount emitted by them (sources), which is undertaken to determine whether the forests are sequestering more carbon than they are emitting to the atmosphere. Carbon budgets can be drawn up on various scales, including global.
19.	Carbon Sequestration	The uptake and storage of carbon. Trees and plants, for example, absorb carbon dioxide, release the oxygen and store

Sl.No.	Term	Definition
		the carbon. Fossil fuels were at one time biomass and continue to store the carbon until burned.
20.	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.
21.	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
22.	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.
23.	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.
24.	Contour Map	A topographic map that portrays relief by means of lines that connect points of equal elevation.
25.	Crown	The live branches and foliage of a tree.
26.	Crown Density	The amount and compactness of foliage of a tree crown.
27.	Diameter at Breast Height (DBH)	The stem diameter of a tree measured at breast height, 1.3 m above the ground.
28.	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.
29.	Deforestation	The long-term removal of trees from a forested site to permit other site uses.
30.	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.
31.	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.
32.	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,

Sl.No.	Term	Definition
		generation and renewal of soil and soil fertility
33.	Endemic Species	A species that is indigenous to a particular area; not introduced and often with a limited geographical range.
34.	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.
35.	Evergreen	Never entirely without green foliage, leaves persisting until a new set has appeared.
36.	Forage	Grasses, herbs, and small shrubs that can be used as feed for livestock or wildlife.
37.	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.
38.	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.
39.	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.
40.	Forest Encroachment	The intrusion or establishment of a significant number of trees on grassland(s).
41.	Forest Fire	Any wildfire or prescribed fire that is burning in forest, grass, alpine, or tundra vegetation types
42.	Forest Floor	"Layers of fresh leaf and needle litter, moderately decomposed organic matter, and humus or well-decomposed organic residue.
43.	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.
44.	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

Sl.No.	Term	Definition
		protected areas and reserves. Should be performed at regional, subregional, landscape, and watershed scales.
45.	Genetic Diversity	Variation among and within species that is attributable to differences in hereditary material.
46.	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.
47.	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.
48.	Greenbelt	A strip of undisturbed soil and vegetation left along waterways or access routes to minimize the environmental impact from development.
49.	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.
50.	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 longwave radiation. Their action is similar to that of glass in a greenhouse.
51.	Ground Truthing	The use of a ground survey to confirm the findings of an aerial survey or to calibrate quantitative aerial observations.
52.	Groundwater	Water below the level of the water table in the ground; water occupying the subsurface saturated zone.
53.	Growing Stock	The volume estimate for all standing timber at a particular time.
54.	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.
55.	Harvest	To fell or remove timber, other than under a silviculture treatment.
56.	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.
57.	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.
58.	Institutional	"The laws, regulations, policies, social norms, and

Sl.No.	Term	Definition
	Arrangements	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.
59.	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.
60.	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.
61.	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.
62.	Livestock	Farm animals regarded as an asset.
63.	Lopping	Chopping branches, tops, and small trees after felling into lengths such that the resultant slash will lie close to the ground.
64.	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.
65.	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.
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.

Sl.No.	Term	Definition
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.

iii. List of flora in Kamrup East Division:

The Kamrup East forest division is a habitat of diverse flora. The detail list of different flora is given in table 3.

Table 3: List of diverse flora found in Kamrup East Division, Assam.

Trees

Sl. No.	Vernacular Name	Botanical Name	Status
1	Ahoi	*Vitex peduncularis*	Common
2	Ahot	*Ficus religiosa*	Common
3	Ajar	*Lagerstroemia speciosa (syn I llosioginao)*	Common
4	Am	*Mangifera indica*	Common
5	Amari, Lali	*Amoorawallichii*	Common
6	Amlokhi	*Emblica Officinalis (syn. Phyllanthusemblica)*	Common
7	Amra, Amara	*Spondias pinnata (syn. S. magifera)*	Common
8	Atha-bor	*Ficus elastica*	Common
9	Autha-dimaru	*Ficuusroxburghii*	Common
10	Bagari	*Zizyphusmauritiana (syn. Z. jajuba)*	Common
11	Baghnala, Haaluka	*Litseaglutinosa (syn. L. Sebifera)*	Scanty
12	Bajranali	*Fagarabudrunga (syn. Zanthoxylum budrunga)*	Scanty
13	Banbagari	*Zizyphusrugosus*	Common
14	Bandardima	*Dysoxylumbinectariferum&Chisochetonpaniculatus*	Common
15	Bat	*Ficus bengalensis*	Common
16	Barthekera	*Garcinia pedunculata*	Few
17	Barun	*Createevanurvala*	Few
18	Bel	*Aegle marmelos*	Few
19	Belphoi, Sakho	*Castonopsispurpurella (syn. C. hystrix)*	Common
20	Bhadia	*Vitex pinnata (syn. V. pubescens& glabrata)*	Common
21	Bhakul-potol, Phulkata	*Styrax serrulatum*	Common
22	Bharatmuni, Bhoira, Rotha	*Symplocoslaurina (syn. S. spicate)*	Common
23	Bhatghilla	*Oroxylum indicum*	Common
24	Bhos	*Salix tolrasporma*	Few
25	Bhodoll	*Sapromatomatum*	Common
26	Bhela	*Semicarpuis anacardium*	Few
27	Bhelkor	*Trewianudiflora (syn. T. polycarpa)*	Common
28	Bhelu, Bolom	*Teramelesnudiflora*	Common
29	Bhomra, Bahera	*Terminalia belerica*	Common
30	Bhomrati	*Symplocosoxyphylla*	Few
31	Bhotola	*Trevesiapalmata*	Few
32	Bijol-gach	*Grewia elastica*	Common
33	Beal, Gadarhuta	*Cordia dichotoma*	Common
34	Boga-ameri	*Aphanamaxispolystachy (syn.Amoorarohituka)*	Few
35	Boga-kalti, Bhela	*Canthiumglbrum*	Few
36	Boga-Kotra, Kurol	*Bauhinia variegata*	Common

Sl. No.	Vernacular Name	Botanical Name	Status
	(Kanchan)		
37	Bogipoma	*Chukrassiavelutina (syn. C. tabularis)*	Common
38	Bohot	*Artocarpus lakoocha*	Common
39	Bola	*Morus lavigata*	Few
40	Bonbholuka, Poreng	*Olea dioica*	Few
41	Bonhualu, Harupadrai	*Beilschiediabrandisii*	Common
42	Bonpasla, Memoi	*Meliosma pinnata*	Common
43	Buritokon	*Mallotusroxburghii*	Common
44	Chika maruli, Kondalkania	*Alangium chinensis (syn. A. begoniaefolium)*	Common
45	Choi-parali	*Oreocnido integrifolia*	Common
46	Dhuna	*Canarium bengalense*	Few
47	Dewa, Cham	*Arthocarpuschaplasha*	Common
48	Dhopabar	*Ficus mysorensis (syn. F. drupaces)*	Common
49	Dhopaparali	*Haplopheregmaadenophyllum*	Common
50	Dimaru	*Ficus hispida*	Common
51	Dol-poduli	*Glochidionvelutinum*	Common
52	Dudhi	*Wrightia tomentosa*	Common
53	Dudhkhuri	*Holarrhenaantidysenterica*	Common
54	Dukoha	*Dryptesassamica*	Common
55	Gaborhitha, Samsuku	*Pavetta indica*	Common
56	Gaborhitha, Gaborhura	*Micromeiumpubescens*	Common
57	Gadgubar	*Ficus latifolia*	Common
58	Gainali, Gunaru, Gonderi	*Premna latifolia*	Common
59	Gamari	*Gmelina arborea*	Common
60	Gaurikeuta	*Wendlandia tinctoria*	Few
61	Garobhala	*Myristica linifolia (syn. M. longifoila)*	Common
62	Garobhangra	*Symplocosferruginea (syn. S. javanica)*	Common
63	Garogine	*Aporosaroxburghii*	Few
64	Garokhuta	*Aporosaaurea*	Common
65	Garumara	*Crypteroniapaniculata*	Common
66	GodhajanJara	*Syzigiumcerasoideum (syn. Engeniaoperculata)*	Common
67	Gohora	*Premna bengalensis*	Common
68	Gonsoroi	*Cinnamomum glaucescens (syn. C. cordifolia)*	Common
69	Haldu, Taraksopa	*Adina cordifolia*	Common
70	Harumoin	*Randia fasciculata*	Common
71	Hatikerapa	*llexgodajam*	Common
72	Hatipoila	*Pterospermumacerifolium*	Common

Sl. No.	Vernacular Name	Botanical Name	Status
73	Heloch, Mikhantenga	*Antidesmaghesaembilla*	Common
74	Helok, Poreng	*Elaeocarpus robustus*	Common
75	Hewra	*Streblus asper*	Common
76	Hiharu	*Albizzia odoratissima*	Common
77	Hilikha	*Terminalia chebula (syn. t. citrina)*	Common
78	Hingori	*Castanopsis indica*	Common
79	Hoanlu, Muga	*Litseamonopetala (syn. L. polyantha)*	Scanty
80	Juglo	*Macaranga indica*	Common
81	Jam	*Syzygiumcumini (syn. Eugenia jumbolana)*	Common
82	Jarath, Rohini	*Mallotusphillipinensis*	Common
83	Jari	*Ficus benjamina*	Common
84	Jaribar	*Ficus gobbosa*	Common
85	Jari-udal	*Fermianacolorata (syn. Stercuilacolorata)*	Common
86	Jatipoma	*Toona ciliata (syn. Cedrela toona)*	Common
87	Jia, Jigra	*Lanneacoromandelica (syn. L. grandis)*	Common
88	Joba-hingori	*Sloaneaassamica (syn. Echinocarpusassamica)*	Few
89	Jodha, Lowa	*Engelhardtia spicata*	Few
90	Kadam	*Anthocephaluscadamba*	Common
91	Kanchan	*Bauhinia sp.*	Common
92	Kathalpatia, Amchoi	*Belischmiediaassamica*	Few
93	Kathal	*Artocarpus heterophyllus (syn. A. intogrifolia)*	Common
94	Kathia-Koroi, Datbijli	*Dorrisrobusta*	Common
95	Kaunla	*Machilusglobosa*	Common
96	Kau-thekera	*Garcinia cowa*	Common
97	Kendu	*Diospyros eregrina (syn. D. embryopteris, D. toposia and D. ianceaefolia)*	Common
98	Ketkora, Moin	*Vanguicra spinosa*	Few
99	KharipatiDimaru	*Ficus nervosa*	Common
100	Khokon	*Duabanga grandiflora (sy. D. sonneratioides)*	Common
101	Khukru, Garokhukru	*Tricalysiasingularis*	Common
102	Kolti, Kaliari	*Mitrephora tomentosa*	Common
103	Korha	*Sapiumeuginaefolium*	Common
104	Koroi	*Albizzia procera*	Common
105	Koronda, Keseru, Karangiya	*Hteropanax fragrans*	Few
106	Kotoki	*Llexsulcata*	Few
107	Kotra, Tengakoltra	*Bauhinia malabarica (syn. Piliostigmamalabarica)*	Common
108	Kotra	*Cordia grandis*	Common
109	Kuhir	*Bridelia retusa*	Common

Sl. No.	Vernacular Name	Botanical Name	Status
110	Kuji-thekera	*Gareiniakydia*	Common
111	Kum	*Careya arborea*	Common
112	Kurial	*Bauhinia purpurea*	Common
113	Kurila	*Brassiopsis speciosa (syn. glomerata)*	Common
114	Larubandha	*Mallotus albus*	Common
115	Leteku	*Caccaureaspaida*	Common
116	Lohajam	*Eugenia formosa*	Common
117	Mahudi	*Croton juliflora*	Common
118	Makri Sal	*Schimawallichii*	Common
119	Maksi	*Callicarpa arborea*	Common
120	Mani Sal	*Sapindusmukorosii*	Common
121	Manuk	*Ulmuslancifolia*	Common
122	Maskoita	*Callicarpa macrophylla*	Few
123	Mauhita, Hukotia	*Celtis tetranda*	Common
124	Mejankari	*Litsea chinensis*	Threatened
125	Miretenga, Neoli	*Protium serratum (syn. Bursera serrata)*	Common
126	Modar	*Erythirnavariegata (syn. E. indica)*	Common
127	Moin, Bihmoin	*Xeromphis spinosa (syn. Randiadumetorum)*	Common
128	Moj	*Albizzia lucida*	Common
129	Morolia	*Macaranga denticulata*	Common
130	Mota-ameri	*Turpiniapomifera*	Common
131	Naga-dalchini	*Cinnamomum obtusifolium*	Common
132	Nagini	*Elaeocarpus aristatus*	Common
133	Nahar	*Mesua ferrea*	Few
134	Odal	*Sterculia villosa*	Common
135	Okshl, Oxl	*Dilleniapentagyna*	Common
136	Owtenga	*Dillenia indica*	Common
137	Pajihuta	*Actinodaphnoobovata*	Common
138	Pakri-bor	*Ficus rumphii*	Common
139	Palas	*Butea monosperma (syn. B. frondocsa)*	Common
140	Panial	*Flacourtiacataphracta (syn. F. jangomas)*	Common
141	Panikadam, Bhurkhundi	*Hymenodictyonexcelsum*	Common
142	Pareng	*Linoceria macrophylla (syn. L. ramiflora)*	Common
143	Parali	*Sterospermumpersonatum (syn. S. chelonoides)*	Common
144	Pasatia	*Buddleia asiatica*	Common
145	Patkuhir, Markuhi	*Bridelia tomentosa (syn. Vitex negundo)*	Common
146	Petarichawa	*Actinodaphneaugustifolia*	Common
147	Phakdima, Sobiagaon	*Treaorientails (syn. T. cannabina & T. ambronensis)*	Common
148	Phoko, Dhapapatia	*Meliosmasimplicifolia*	Common
149	Phulgamari	*Endospemumchinense*	Common
150	Pichala	*Kydiacalysina*	Common

Sl. No.	Vernacular Name	Botanical Name	Status
151	Pisoli	*Grewamicrocos (syn. Microcospaniculata)*	Common
152	Raman-bih	*Aesculus panduana*	Common
153	Rangkoli	*Diospyros nigricans*	Common
154	Rudraksha	*Elaeocarpus genitrus*	Common
155	Rumu, Sutrong	*Lophopetalum fimbriatum*	Common
156	Sal	*Shorearobusta*	Common
157	Salkali, Kolonthi	*Diospyros variegata*	Common
158	Satiana	*Alstoniascholaris*	Common
159	Sau	*Albizzia cheinensis (syn. A. stipulata)*	Common
160	Segun	*Tectona grandis*	Common
161	Seleng	*Sapiumbaccatum*	Common
162	Sida	*Lagersthemia parviflora*	Common
163	Silubar	*Ficus retusa*	Common
164	Simalu	*Salmaliamalabarica (syn.Bombaxmalabricum, B.ceiba)*	Common
165	Sirish	*Albizzia lebbeck*	Common
166	Som	*Perseabombycina (syn. Machilusbombycina)*	Common
167	Sonaru	*Cassia fistula*	Common
168	Taruakadam	*Accaciafarensiana*	Common
169	Telbhurki	*Caesaria glomerata*	Common
170	Temi-sakho	*Lithocarpusspicatus (syn. Pasania spicata)*	Common
171	Tengabor	*Ficus infectoria (syn. F. lucescens)*	Common
172	Tepora	*Garcinia zanthochymus*	Few
173	Teta	*Vitex canescens*	Common
174	Tetuli	*Tamarindus indica*	Common
175	Tespat	*Cinnamomum tamala*	Common
176	Tezranga	*Myristica angustifolia*	Common
177	Thekera	*Garcinia pedunculata*	Common
178	Titasopa	*Talaumaphellocarpa (syn. Paramicheliabaillionii)*	Common
179	Uriam	*Bischofiajavanica*	Common

SHURBS, HERBS, ETC.

1	Abutenga, Nikhontenga	*Antidesmadiadrum*	Common
2	Agar	*Urena lobata*	Common
3	Akalbih	*Clerodendron indicum (syn. C. siphonanthu)*	Common
4	Akan	*Calotropis gigante& Calotropis acia*	Common
5	Anchukath, Asugach, Akalbin	*Morinda angustifolia*	Common
6	Arakchantita	*Rauvolfia serpentina*	Common
7	Athubhanga	*Leea sp.*	Common
8	Awuapat, Machpora	*Maesa indica*	Common

Sl. No.	Vernacular Name	Botanical Name	Status
9	Baghanchora, Tezmoi	*Zanthoxylum hamiltonium (syn. Z. nitidum)*	Common
10	Bahak	*Adhatodavasica*	Common
11	Bhang	*Cannabis sativa*	Common
12	Bhedelilata	*Hedyotis scandens*	Common
13	Bhekuri	*Solanum indicum*	Common
14	Bhit-tita	*Solanum torvum*	Common
15	Bringa, Bining-guli	*Rhamnus nepalensis*	Common
16	Bishalyakarani, Titabahak	*Justicia gendarussa*	Common
17	Bitmora, Dhubiokhala	*Gardenia campanulata*	Common
18	Biyonihaputa	*Desmodiumlabumifolium (syn. D. candatum)*	Common
19	Bogitora	*Alpinia allughas*	Common
20	Bonbabori	*Phyllanthus simplex*	Common
21	Bonjora	*Paramignyagriffithi (syn. P. scandans&Elaeganus latifolia)*	Common
22	Bonkapahi	*Abroamaugusta*	Common
23	Bontil	*Anisomeles ovata (syn. A. iindica)*	Common
24	Bontulasi	*Geniosporumstrobiliferum (syn. G. coloratum)*	Common
25	Boriala	*Sidacarpinfolia (syn. acuta & S. rhombifolia)*	Common
26	Bormanimuni	*Hdrocotyle asiatica (syn. Centellaasiatic)*	Common
27	Changal-ladi	*Glycosmis pentaphylla*	Common
28	Chaul-dhoa	*Ardisia sollanaces (syn. A. humilis)*	Common
29	Chirata	*Exacumteragonum*	Common
30	Daridiga, Bonmedelua	*Cassia tora*	Common
31	Dhopat-tita	*Celerodendronviscosum (syn. C. infortunatum)*	Common
32	Dighlati	*Litsaeasalicifolia*	Common
33	Doukhiguti	*Elaeganusphrigormis*	Common
34	Eragach	*Ricinus communis*	Common
35	Ganchbionihaputa	*Desmodiumlatifolium (syn. D. velutinum)*	Common
36	Genderi, Gainoli	*Premnacroymbosa*	Common
37	Gohoralota	*Myxopyrumsmilacifolium*	Common
38	Nankha-ojar-mons	*Dischindiaraffesiana*	Common
39	Haru-manimuni	*Hydrocotyle rotundifolia*	Common
40	Haut-tenga	*Cassia occidentails*	Common
41	Heko-toko	*Aphania rubra*	Common
42	Hil-kadam	*Homonia riparia*	Common
43	Hoklati	*Sambucus javanica*	Common
44	Hukta puta	*Growiuhirsuta*	Common
45	Jarmaniban	*Eupatorium odoratum*	Common
46	Jhapipat	*Acanthopanatrifoliatum (syn. A. Aculeatum)*	Common

Sl. No.	Vernacular Name	Botanical Name	Status
47	Jor-lewa	*Unonalongiflora (syn. Desmoslongiflours)*	Common
48	Kana+dimaru	*Ficus heterophylla*	Common
49	Kathandaphul	*Coffea bengalensis*	Common
50	Kath-tenga, Kukurtenga	*Leea acuminata*	Common
51	Katurui	*Curcuma aromatica*	Common
52	Kaupat	*Phryniumimbrecatum*	Common
53	Kaurikata	*Mimosa himalayana*	Common
54	Kho jo	*Pouzolziaviminea*	Common
55	Kol	*Musa sanginioa*	Common
56	Kuhila	*Aoschynomene Indica*	Common
57	Kuhum-Kenta	*Argemone mexicana*	Common
58	Makhiloti	*Desmodiumcephalotes*	Common
59	Makhiati	*lemlnglastrobillifera (syn. Moghaniastrobilifera)*	Common
60	Manmunl, Mathak-thuka	*Doringonnmrantholodos*	Common
61	Manukataphul	*Holmskiodiasanguinea*	Common
62	Matijam	*Premnaherbacea*	Common
63	Matikatota	*Bauhinia acuminata*	Common
64	Mesaki	*Sarcochlamyspucherrima*	Common
65	Moiratikoni	*Reidiahamiltonoana*	Common
66	Nangalbhanga	*Clerodendronserratum*	Common
67	Narasimha	*Murrayakoonigii*	Common
68	Ogar	*Xanthium strumarium*	Common
69	Owa	*Leeacrispa*	Common
70	Panimundi	*Glochidion sp.*	Common
71	Paniphuti	*Vibrunumcolobrookianum*	Common
72	Patidoi	*Clinogynedichotoma*	Common
73	Phuljeleng	*Baliospermummontanum*	Common
74	Phutki	*Osbeekia rostrata*	Common
75	Phutkola	*Molaslomamnlubalhricum*	Common
76	Pulikant	*Cudraniajavanensis (syn. C. cochinchinensis)*	Common
77	Soklati	*Mussaendaroxburghii*	Common
78	Sorotgach	*Dendrocnidesinuata (syn. Laporteacrenulata)*	Common
79	Tara	*Costusspeciosus*	Common
80	Thaljimura	*Cycuspectinata*	Common
81	Thowranguti	*Grewia sapida*	Common
82	Thukurakhamal	*Dischidianummularia*	Common
83	Itaphul	*Phlogacanthusthyrsiflorus*	Common
84	Tit-bhakuri	*Solanum vervascifolium*	Common
85	Ulti-hot	*Achyranthes aspera*	Common
86	Ulucha	*Desmodiumtriguetrum*	Common
87	Ursi, Takamala	*Desmodiumpulchelleum*	Common

Sl. No.	Vernacular Name	Botanical Name	Status

Climbers:

Sl. No.	Local Name	Scientific name	Status
1	BokalBih	*Milletiapachycarpa*	Common
2	Bandar kekowa	*Deysolobiumgrande (Syn mucunaprurita)*	Common
3	Bakullata	*Embeliaribes*	Common
4	Bhedelata	*Paederiascandenns*	Common
5	Bon morish	*Clematis nagushia*	Common
6	Bon pui	*Embelianagushia*	Common
7	Changa lata	*Naraveliazoylancia*	Common
8	Changalsingalata	*Myrioptornextensum*	Common
9	Chowarilowa, Bon mirica	*Embelia nutans*	Common
10	DatBijli, Laleng sari	*Dalbergia pinnata*	Common
11	DhindauBagarilata	*Tapiriahirsuta (Syn Pegia nitida)*	Uncommon
12	Ghilalata	*Entada phaseoloides (Syn E. Scandens)*	Common
13	Hatibandhalata	*Butea parviflora (Syn Spatholobusroxburghii)*	Common
14	Jakhunilata, Dhobalata	*Heptanpleurumvenulosum (Syn Schefferavenulosa)*	Common
15	Katagash, Mermerilata	*Dalbergia rimosa*	Common
16	Kharikalata	*Jasminum coarctatum*	Common
17	Kirkirilata	*Jasminum lourifolium*	Common
18	Kuchal, Kuchialata	*Acacia pinnata*	Common
19	Kukualata	*Thunbergia grandiflora*	Common
20	Kusiakait	*Acacia sinuata (syn A. Concinna)*	Common
21	Lata Dimaru	*Ficus fruticosa*	Uncommon
22	Lataguti	*Caesalpinia bonduc*	Common
23	Latasali	*Combretum roxburghii*	Uncommon
24	Nakkatilewa	*Bauhinia vahlii*	Common
25	Ow-lata	*Tetracerasermentosa*	Common
26	Padri-lewa	*Paederiafoetida (syn P. scandens)*	Common
27	Pahari-lata	*Dalhousiabracteata*	Uncommon
28	Panilata, medmedialata	*Cissus rependa (syn. Vitirependa)*	Common
29	Picholalata	*Hibiscus fragrans*	Common
30	Theboulata, topouguti	*Hodgsoniahiteroelita*	Uncommon
31	Goalporia lota	*Ampelocissus latifolia (syn. Vitis latifolia)*	Uncommon
32	Bar tubuki lota	*Stephania japonica*	Uncommon
33	Akasilota,	*Cuscutareflexa*	Common

Sl. No.	Vernacular Name	Botanical Name	Status
	Raghumala		
34	Tubuki lota	*Cissampelos pareira*	Common
35	Latumoni	*Abrusprecatorium*	Uncommon
36	Xasunilata	*Tinospora cordifolia*	Common
37	Kolmou	*Ipomea acquatica*	Common
38	Kerkerilata	*Illigerakhasiana*	Common
39	Bogasora lota	*Smilax macrophylla*	Common
40	Kolialota	*Merremiaumbellata*	Common
41	Choria-atha, Sonarupa	*Mussaenda glabra*	Common
42	Latamahudi, Gahelewa	*Croton caudatus*	Uncommon
43	Gabong-lota, Latadimeru	*Conocephalussuaveolens*	Uncommon
44	Deo-jokhola	*Bauhinia anguina*	Common
45	Hololokha	*Millettia auriculata*	Common
46	Makoi lota	*Connaruspaniculatus*	Common
47	Bijuli	*Dalbergia stipulacea*	Uncommon
48	Dhobai lota	*Heptapleurumvenulosum*	Common
49	Khamal lota	*Wattakakavolubilis*	Common
50	-	*Hoya griffithii*	Common
51	Bishsharah	*Argyreia argentea*	Common
52	Kath alu	*Dioscoreaalata*	Common

iv) List of fauna in Kamrup East Division: The Kamrup East forest division provides suitable habitat for a diverse fauna. The detail list of different fauna found in this division is shown in table iv.

Table iv: List of diverse fauna found in Kamrup East Division, Assam.

Mammals

Sl. No	English Name	Scientific Name	Status
1	Indian Elephant	*Elephas maximus*	Common
2	Leopard	*Panthera pardus*	Common
3	Jungle Cat	*Felis chaus*	Rare
4	Leopard Cat	*Felis bengalensis*	Common
5	Large Indian Civet cat	*Viverrazibentha*	Common
6	Small Indian Civet Cat	*Viverricula indica*	Common
7	Palm Civet cat	*Paradoxurus hermaphroditus*	Common
8	Barking Deer	*Muntiacusmuntjak*	Common
9	Shambar	*curvusunicolar*	Rare
10	Rhesus Macaque	*Macaca mulatta*	Common
11	Capped Langur	*Presbytis pillcatus*	Common

12	Hoolock Gibbon	*Hooolockhoolock*	Rare
13	Slow Loris	*nycticebuscoucang*	Rare
14	Indian Flying Fox	*Pteropus giganteus*	Common
15	Pipistrelle Bat	*Pipistrellus*	Common
16	Jackel	*Canis aureus*	Common
17	Serow	*Capricornissumatraansis*	Rare
18	Hoarybellied Squirrel	*Callosciuruspygerythus*	Common
19	Horseshoe Bat	*Rhinolophus*	Common
20	Small Indian Mangoose	*Herpestesjavanicus*	Common
21	Long trailed Tree Mouse	*Vandeleuria oleracea*	Rare
22	Himalayan Black Bear	*Ursus thibertanus*	Rare
23	Chinese Pangolin	*Manis pentadactyla*	Rare
24	Grey Musk Shrew	*Suncus murinus*	Common
25	Yellow House Bat	*Scotophilus*	Common
26	Binturong	*Arctictis binturong*	Rare
27	Wild Boar	*Sus scrofa*	Common
28	Yellow Throated Marten	*Martisflavigula*	Rare
29	Brush tailed Porcupine	*Atherurus*	Rare
30	Common Otter	*Lutralutra*	Rare

BIRDS

Sl. No	**Local Name**	**English Name**	***Scientific Name***	**Status**
1	Kauri	House Crow	*Corvus splendence*	Least concern
2	Dhura Kaori	Jungle Crow	*Corvus macrohyncho*	Least concern
3	Kolakhuti or Chukchoki	Tree Pie	*Dandroclttavagabunda*	Least concern
4	Bulbuli, Petuluka	Bulbul	*Molpastescafer*	Least concern
5	Dohikotora	Magpie Robin	*Copsychuscaularis*	Least concern
6	Phesu	Black Drongo or King Crow	*Dicrurusmacrooarus*	Least concern
7	Bhimraj	Racket tailed drongo	*Dissomurusparadiseus*	Least concern
8	Hokhloti, Patmadol	Golden Oriole	*Ololusoriolus*	Least concern
9	Moina	Grackle, Hill Myna	*Gracula religiosa*	Threatened
10	Kath Halika	Grey Headed Myna	*Sturniamalabarica*	Least concern
11	ChutiaHalika	Bank Myna	*Acridotheresginginianus*	Least concern
12	Kankurika	Pied Myna	*Sturnopaster contra*	Least concern
13	TokoraCharai	Baya or Weaver Bird	*Ploceusphilliplnus*	Endangered
14	Bota Charai	Munia	*Uroloncha striate*	Least concern
15	GhanChirika	House Sparrow	*Passer domesticus*	Least concern
16	Bali-mahi, Khojjan	Wagtail	*Motacilla alba*	Least concern
17	Barhoitoka,	Wood pecker	*Dryobatesmahrattensis*	Least concern

18	Heteluka	Barbet or Copper Smith	*Xantholoemahaemacophal*	Least concern
19	Keteki	Cuckoo	*Hierococcyxvairous*	Least concern
20	Kuli	Koel	*Endynamisscolopaccus*	Least concern
21	Kukuha	Crow-pheasant	*Centropussinerisis*	Least concern
22	Kaocharai	Roller or Blue jay	*Coraciesbengalansis*	Least concern
23	Bhatow	Indian Parakeet	*Psittaculacuptria*	Least concern
24	Machuruka	Pied king-fisher	*Carylerudis*	Endangered
25	Machuruka	Common King-fisher	*Alcadoatthis*	Least concern
26	Dhanesh	Hornbill	*Dickocerosbicornis*	Endangered
27	Gubar-Khusara	Hoopoe	*Upupa epops*	Least concern
28	Hudu	Great-horned owl	*Budo budo*	Rare
29	Phesa	Spotted owlet	*Athens brama*	Least concern
30	Roja-hogun	King vulture	*Sarcogyps calvus*	Rare
31	Hogun	Bengal vulter	*Pseudogyps Bengalensis*	Rare
32	Chilani	Brahminy kite	*Haliasturlndus*	Rare
33	Heh	Tawny eagle	*Aquila rapox*	Least concern
34	Moukhap	Serpent eagle	*Haemanternuscheela*	Threatened
35	Haitha	Green pigeon	*Crocopusphoenicopterus*	Least concern
36	Kopow	Ring dove	*Streptopeliadacapcto*	Least concern
37	Dorik	Partridge	*Francolinusfrancolinus*	Least concern
38	Dauk	White breasted	*Amauvornlsphoonicurus*	Least concern
39	Ganga chiloni	River tern	*Sterna aurantia*	Least concern
40	Pani kaori	Little cormorant	*Phalacrocorax carbo*	Least concern
41	Bortokola	Adjutant stork	*Leptoptilosdubius*	Endangered
42	Horubortokola	Lesser adjutant stork	*Laptoptilosjavanticus*	Least concern
43	Bogoli	Cattle Egret	*Bubulcus ibis*	Least concern
44	Konaamusari	Pond heron or paddy bird	*Ardeolagrayii*	Least concern
45	Ghilahanh	Cotton teal	*Nettapuscoromandelianus*	Least concern
46	Xorallhanh	Whistling teal	*Dondrocygnajavancla*	Least concern
47	Chakol-chokua	Brahminy duck	*Casarcafarruginea*	Rare
48	Digholihanh	Pin tail duck	*Amauvor spp.*	Endangered
49	Murgihanh	Common teal	*Anus cracca*	Least concern

Reptiles

Sl. No	English Name	Scientific Name	Status
1	Burmese Python	*Python morlurusbivittatus*	Common
2	Indian rat Snake	*Ptyas mucosa*	Common
3	Checkered keelback	*Xenochrophis piscator*	Common
4	Painted Bronzeback	*Dendrelaphis pictus*	Common
5	Red-necked Keelback	*Rhabdophissubminitus*	Common

6	Common Wolf Snake	*Lycodonaulicus*	Common
7	Common Water Snake	*Enhydrisenhydris*	Common
8	Ornate Flying Snake	*Chrysopeliaornata*	Common
9	Copper headed trinket	*Coclognathus radiata*	Common
10	Monoded Cobra	*Najakaouthia*	Rare
11	Brahminy Blind Snake	*Ramphotyphlopsbrahminus*	Common
12	Blanded Krait	*Bungarus fasciatus*	Common
13	Himalayan Keelback	*Rhabdophishimalaynus*	Rare
14	Mock Viper	*Psammodynastespulvarulentus*	Common
15	Assam Small Eater	*Pareasmonticola*	Rare
16	White Lipped Pit viper	*Trimeresurusalbolabris*	Common
17	Water Monitor	*Varanus salvator*	Rare
18	Blue throated Lizard	*Ptyctolacmusgularis*	Common
19	White Spotted Supple Skink	*Lygosomaalbopunctata*	Common
20	Many lined Grass Skink	*Eutropismultifasciata*	Common
21	Tokay Gecko	*Gekkogicho*	Common
22	Assam Day Gecko	*Cnemaspicassmensis*	Common
23	Indian garden Lizard	*Calotesversicolar*	Common
24	Yellow monitor Lizard	*Varanus flavescens*	Rare
25	Khasi Hills bent –toed Gecko	*Cyrtodactyluskhasiensis*	Rare
26	Brook's gecko	*Hemidactylus frenatus*	Common
27	Asian house Gecko	*hemidactylusfrenatus*	Common
28	Bronze Grass Skink	*Eutropismacularia*	Common
29	Fan Tailed Gecko	*Cosymbotusplafyrus.*	Common

Amphibia

Sl. No.	Common Name	Scientific Name	Status
1	Common Asian Toad	*Duttaphrynusmelanontictus*	Common
2	Common Tree Frog	*Polypedatesleucomystax*	Common
3	Indian Bull Frog	*Hoplobatrachustigerinus*	Common
4	Assam Forest Frog	*Rana leptoglossa*	Common
5	Six Lined tree Frog	*Polypedatesteraiensis*	Common
6	Red-eyed Frog	*Leptobrachiumsmithi*	Rare
7	Ornamented Pigmy Frog	*Microhylaornata*	Common
8	Indian Skipping Frog	*Euphlyctiscyanophlyctis*	Common
9	Taipeh Frog	*Hylaranataipehensis*	Common

FISHES

S.No.	Local name	*Scientific name*	Status
1	Bhangun	*Labeobata*	Least concern

2	Bahpotia	*Ailliacoilia*	Vulnerable
3	Dorikona	*Rasbora daniconius*	Least concern
4	Misa	*Pinaeus monodon*	Least concern
5	Mali	*Labeocalbasu*	Least concern
6	Botikora	*Lepidocephalus*	Least concern
7	Pabho	*Ompokpabo*	Vulnerable
8	Khalihona	*Colisafasiata*	Least concern
9	Gethu (Bagh Mass)	*Botiaderio*	Vulnerable
10	Chanda	*Chanda ranga*	Least concern
11	Khaloibhangi (Gedgedi)	*Nandus nandus*	Vulnerable
12	Chelkona	*Oxygesterbacalia*	Least concern
13	Kunhri	*Labeogonius*	Least concern
14	Cheniputhi	*Puntius sarana*	Least concern
15	Tora	*Mastoceunbalus aculeatus*	Vulnerable
16	Aari	*Aoricthyesaor*	Least concern
17	Kakila	*Xenentodoncancila*	Vulnerable
18	Goroi	*Channa punctatus*	Least concern
19	Raho	*Labeorahita*	Least concern
20	Bahu	*Catlacatla*	Least concern
21	Mirika	*Cirrhinusmrigala*	Least concern
22	Chitol	*Notopteruschitala*	Least concern
23	Kandhuli	*NotopterusNotopterus*	Least concern
24	Sol	*Channa striatus*	Least concern
25	Saal	*Channa morulius*	Least concern
26	Bami	*Mastoceunbalusarmatus*	Least concern
27	Cheng	*Channa amaphibious*	Rare
28	Chengeli	*Channa gachua*	Rare
29	Puthi	*Puntius sp*	Least concern
30	Kawoi	*Anabustesfudineus*	Least concern
31	Singi	*Heteropneutesfossilis*	Vulnerable
32	Singara	*Mystustengra*	Least concern
33	Borali	*Wallago attu*	Least concern
34	Magur	*Clariusbatrachus*	Least concern
35	Koroti	*Gudusiachapra*	Least concern

v) List of other biota inKamrup East Division:

List of other Biota found in this division is shown in table 6 and 7

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

Sl. No.	Type of lichens	Scientific Name	Occurences
1	Corticolous	*Anphracopheciumassamiense*	Rare
2	Corticolous	*Arthoniaarctata*	Least concern
3	Follicolous	*Aulaxinauniseptata*	Least concern

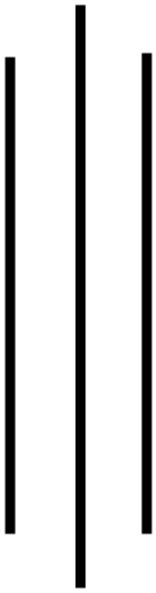
4	Corticolous	*Glyphisduriscula*	Least concern
5	Corticolous	*Melanothecacoactella*	Least concern
6	Pertusaria	*Melaspileainsitiva*	Least concern

Table 7. List of orchids found in Kamrup East Division, Assam.

Sl. No.	Scientific name	Occurrences
1	*Cymbidium aloefolium*	Common
2	*Papilionanthe teres*	Common
3	*Rhyncostylis retusa*	Common
4	*Aerides odoratum*	Scanty
5	*Cymbidium loipholium*	Common
6	*Vanda teres*	Scanty
7	*Dendrobium densiflorum*	Common
8	*Papilonthe teres (Bhatouphool)*	Common
9	*Pholidota imbricate*	Scanty

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 sixteen RFs and threePRFs of Kamrup East Division. The forests lie entirely within the Civil District of Kamrup&Kamrup (Metro) and are located within the geographical limits of longitudes 91°30'27" E to 92°10'42" E and latitudes 25°54'15" N to 26°6'45" N. Few RFs of this division are contiguous to the Sal Forests of the Khasi Hills and some of them form quite large compact blocks of Forests. Some of the RFs and PRFs, however, are isolated and surrounded by villages and cultivation. The isolated RFs and PRFs are situated within a maximum radial distance of 16 kilometers from thenearest main block.

These forests are covered in Survey of India Toposheet No. 78 (N8, N12, N15, 16, O5, O9 and O13) and 83 (B3, B4) on 1:50,000 scale. Table 1.1 shows the administrative set up of Kamrup East Division forests.Compartmentwise detailed area and the perimeter is provided in Annexure Ia. Reserve Forest Map and the Road Map of the division are provided in the Appendix I.The division is nearest to Guwahati city and it houses diverse species of flora and fauna.The forest cover of the division is 91.01 per cent.

Table 1.1: Administrative setup of the Kamrup East Division

Circle	Division	Range	RF Name	Compartments	Area (Ha)
Central Assam Circle	Kamrup East Division	Sonapur	Apricola West	APR1, APR2, APR3, APR4, APR5, APR6, APR7, APR8, APR9, APR10, APR11, and APR12.	6075.3
			Marakdola	MAR1, MAR2 and MAR3	1426.5
			Matapahar	MOT1	225
			Chamata	CHA1	27
			Teteliguri	TET1	120.58
		Palashbari	Maliata	MAL1	325.46
		South Guwahati	Garbhanga	GAR1, GAR2, GAR3, GAR4, GAR5, GAR6, GAR7, GAR8, GAR9, GAR10, GAR11, GAR12, GAR13, GAR14, GAR15, GAR16, GAR17, GAR18, GAR19, GAR20, GAR21, GAR22, GAR23 and GAR23	18860.58
		Guwahati	Fatasil	FAT1 and FAT2	670.44
			Hengrabari	HEN1	628
			Sarania Hill	SAH1	7.99
			South Kalapahar	SKA1	70
			Gotanagar	GOT1	171

			Jalukbari	JAL1	97.7
		Rani	Jarasal	JAR1, JAR2, JAR3, JAR4 and JAR5	1256
			Kawasing	KAW1, KAW2, KAW3 and KAW4	998
			Rani	RAN1, RAN2, RAN3, RAN4, RAN5, RAN6, RAN7, RAN8, RAN9 and RAN10	4370
		RF's Total Area			**35,329.55**
		Sonapur	Hahara PRF	Whole	458.46
			Garowani PRF	Whole	516
			Apricola (East) PRF	Whole	10,622
		PRF's Total Area			**11,596.46**

According to the 2011 census, Kamrup district has a population of 1,517,542. The district has a population density of 489 people per sq km, which is significantly higher than the state average, which is 397 people per sq. km. Its population growth rate over the decade 2001-2011 was 15.69%. Kamrup has a sex ratio of 949 females for every 1000 males. The demographic summary of the district shows that 41.97% of the population belongs to minority communities of which Muslims comprise 94%. Average literacy rate is 75.55%. Major proportion of the population i.e. 90.6% lives in rural area compare to urban area which is only 9.4%.

1.2 Configuration of the Ground: TheRFsand PRFs comprise spurs of the foot hills of Khasi Hill ranges protruding out into the northern plains. The isolated RFs and PRFs surrounded by cultivation are also of the same geological formation as the main block and have been shaped out of these by centuries of gradual erosion.The River Brahmaputra is the primary cause of erosion and deposition under Kamrup East Divisionand as per available statistics the erosion caused by Brahmaputra between 1977 and 2014 is 104.71 sq. km, and deposition during the period is 5.15 sq. km.

Out of the sixteen RFs of Kamrup East Division only two viz. Kawasing and Jarasal RFs are situated in the Western end of the division and have limited plains forests. The plains forests are located in alluvial terraces. The *Taris* are the result of gradual cutting and leveling of mild spurs of the foothills. These alluvial plains forests are cut-off by narrow lowlying winding tracts,which are usually above the level of nearby streams or river bed and are suitable for wet rice cultivation. The altitude of the forest areas under Kamrup East Division varies from 20 meter to 655 meter above mean sea level.

1.3 Geology, Rock and Soil: The geological formations of the Kamrup district, except the recent soil and alluvium, belong to the Archean gneisses complex as per GSI sources. The oldest formation is composed of gneissic and schist, which are extensively intruded by granites. Both the gneisses and granites are intruded by later pegmatites and quartz veins. Beds of conglomerates are frequently found at the foothills. The main block of forests of this division is situated on outlying portion of the Shillong plateau.

The principal rocks of this outlying portion are acidic and basic gneisses, which have been metamorphosed by intruded igneous rocks.The soil type mainly comprises alluvial, sandy loam and red soil. Overall, thedivision has light to medium textured soils, which are mostly acidic and the overall organic and nitrogen contents are high.

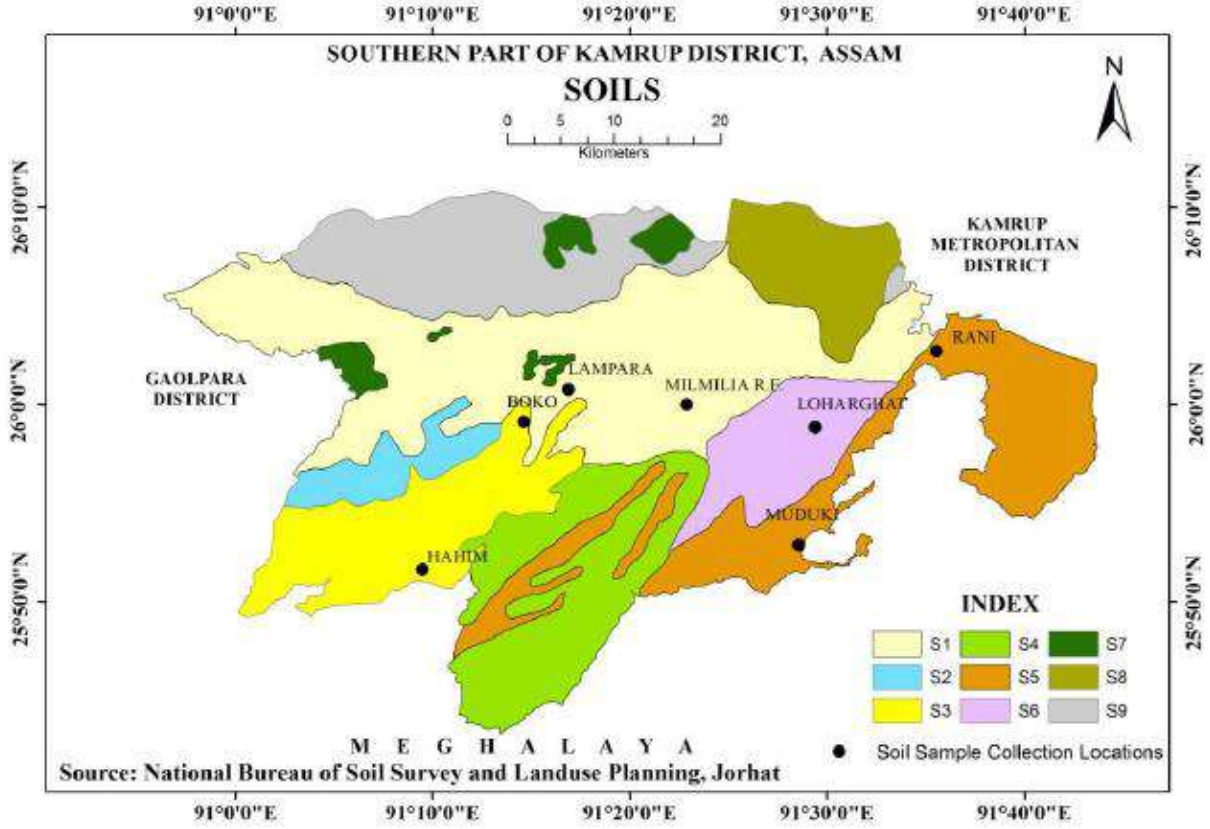
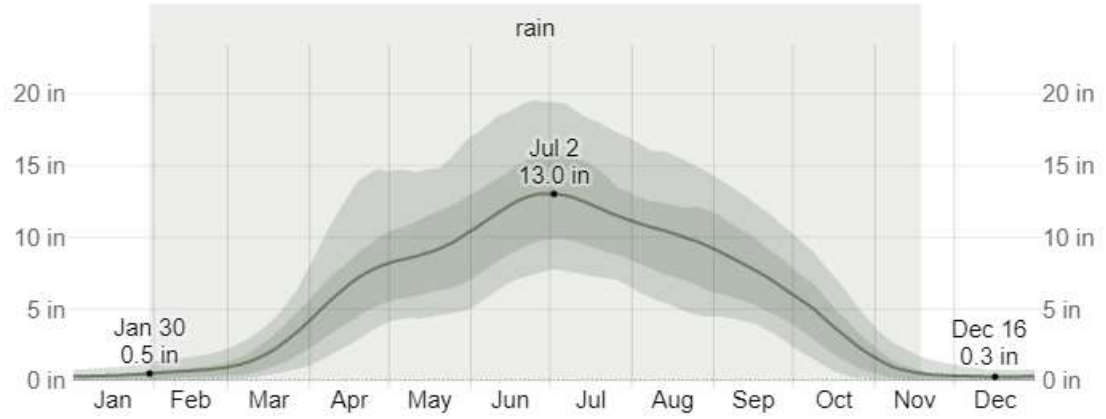


Figure 1.3: Soil map of Kamrup district.

S1	Coarse-silty, Aeric Fluvaquents associated with Sandy, Typic Udifluvents
S2	Fine, Typic Kandihumults associated with Fine, Dystric Eutrochrepts
S3	Fine, Typic Kandihumultsassociated with Fine Loamy, Typic Haplumbrepts
S4	Fine, Typic Kandihumults associated with Fine Loamy Typic Dystrochrepts
S5	Fine, Typic Kandihumults associated with Loamy skeletal Umbric Dystrochrepts
S6	Fine Loamy Buptic Alfic Eutrochrepts related to with Fine Fluventic Dystrochrepts
S7	Marshy Land
S8	Coarse, silty Aeric Fluvaquents associated with Sandy Typic Udifluvents
S9	Coarse loamy, Mollic fluvaquents associated with Coarse silty, Aeric Fluvaquents

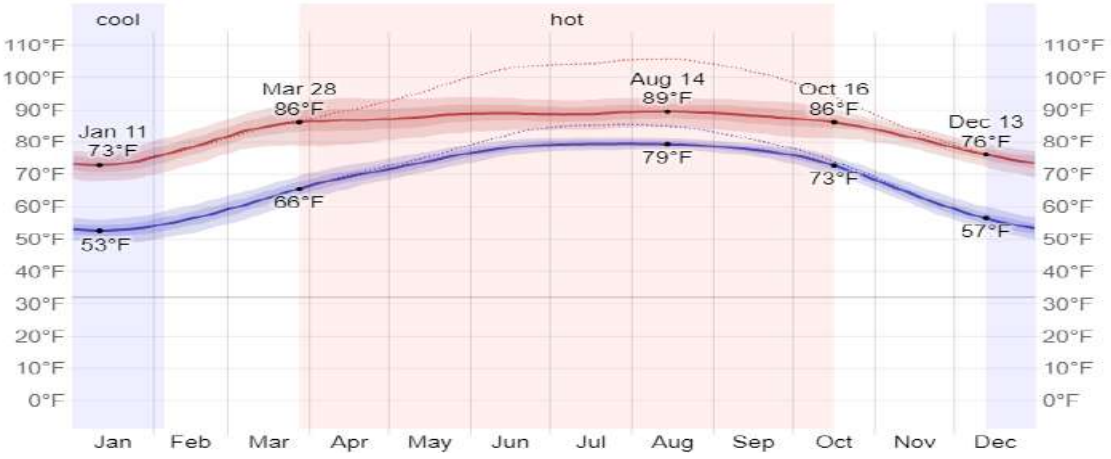
1.4 Climatic Parameters: The climate of the area is of subtropical type, characterized by excessive moisture. The rise of temperature is checked by frequent showers and thunder storms. The change of season is therefore not marked by the extreme contrasts of temperature and humidity.The annual rainfall on average varies from 144.54 mm to 241.68 mm.The rainfall pattern shows that the month of July receives the highest amount of rainfall varying on average from 62.89 mm to 57.16 mm and the month of December receiving the lowest.The data for rainfall (2002-2016) and maximum (max.) temperature, minimum (min.) temperature, and relative humidity (2003-2016) on a monthly basis are given in Figure 1.4a, 1.4b and 1.4c, respectively as per IMD sources.The data is shown in Annexure Ib.

Figure 1.4a: Monthly average rainfall (mm) in Kamrup East Division



The percentage of days in which various types of precipitation are observed, excluding trace quantities: rain alone, snow alone, and mixed (both rain and snow fell in the same day).

Figure 1.4 b: Monthly Average High and Low Temperature



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.

Average	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
High	74°F	79°F	85°F	87°F	88°F	89°F	89°F	89°F	88°F	86°F	81°F	76°F
Temp.	62°F	67°F	74°F	78°F	81°F	83°F	84°F	84°F	82°F	79°F	72°F	65°F
Low	53°F	57°F	63°F	69°F	74°F	78°F	79°F	79°F	77°F	72°F	63°F	56°F

CHAPTER 2
Maintenance / Increase in the Extent of Tree Cover

2.1 Area of Forest under Different Legal Classes: Jarasal, the oldest reserve of this division was notified under Rule 7 of Part II of the Bengal Forest Rules, 1871 and Act VII of 1865. Subsequent to the enactment of Assam Forest Rules, 1876, the Jarasal RF was notified under its Rule 8. This reserve was later brought under the purview of the Indian Forest Act VII of 1878 and the reserves viz. Rani and Kawasing were also declared reserves during 1882 and 1883 respectively under the same Act. On enactment of Assam Forest Regulation VII of 1891, these RFs subsequently, were constituted under this regulation. After 1891, all RFs were notified under section 17 of Assam Forest Regulation VII of 1891 and PRFs under section 5 of the same Act. The areas that were not notified as reserved or not came under village forest or not allotted otherwise or not leased, were defined as Unclass State Forests (USF) under this Act. All land at the disposal of the State Government, including wastelands, constitutes the USF and were jointly controlled by the revenue authorities and the Forest Department. However, after promulgation of the Forest Conservation Act, 1980, no such area can be diverted for any non-forestry activities. Most of the USF areas are un-demarcated and large-scale encroachments have taken place. Some areas like these have been surveyed and brought under PRFs for the purpose of conservation under the Assam Forest Regulation. The areas notified as reserve forest and areas notified as PRFs are shown in table 2.1.

Table 2.1: Notified forestsarea under different legal classes

Sl. No.	Name of RF	Govt. Notification No.	Area as per Reserve Register (Ha)
Reserve Forests			
1	Apricola (West)	FRS/92/82/3 dt. 7th Aug.1982	6,075.3
2	Chamata RF	FRS/594/81/44 dt. 25th Sept.1989	27
3	Fatasil RF	FRS/sett/550/61/24 dt. 21st Dec. 1966	670.44
4	Garbhanga RF	1992R dt.15th July, 1926	18860.58
5	Gotanagar RF	FRS/79/81/3 dt. 16th Mar. 1984	171
6	Hengrabari RF	FRS/256/12/8 dt. 8th Aug. 1972	628
7	Jalukbari RF	FRS/349/89/10 dt. 3rd May. 1990	97.7
8	Jarasal RF	No. 5 dt. 17th Oct. 18/8 & No. 2138R dt. 2nd May. 17 No. 859R dt. 6th Mar.1929	1,256
9	Kawasing RF	No. 12 dt. 7th Mar.1883	998
10	Maliata RF	No. 41/4R dt. 8th Sept. 1915	325.46
11	Marakdola RF	FRS/224/81/3 dt. 11th Aug.1982	1,426.5
12	Matapahar RF	FRS/351/11/82/3 dt. 14th Dec. 1982	225
13	Rani RF	No.13 dt. 26th July, 1882	4,370
14	Sarania RF	FRS/115/80/24 dt. 25th Sept. 1989	7.99
15	South Kalapahar	FRS/2182/27 dt. 25th Sept. 1989	70
16	Teteliguri RF	FRS/3/77/1 dt. 15th July, 1977	120.58
Total		--	**35,329.55**

Proposed reserve forests			
1	Hahara PRF	FRS/591/81 dt. 14th Dec. 1981	458.16
2	Garowani PRF	FRS/227/78/2 dt. 23rd Oct. 1978	516.00
3	Apricola (East) PRF	FRS/248/77/2 dt. 23rd June, 1977	10,622.00
Total		--	**11,596.16**

2.2 Forest Areas under different Working Circles: Forest areas under different working circles covered under the purview of this working plan are shown in table 2.2. The compartment-wise area allocated under different working circles is elaborated under the individual working circle chapters mentioned in Part II of the working plan. Consolidated allocation of working circles is shown in Annexure Ic. Figures 2.2a and 2.2b show allocation of forest areas in each existing compartment and recasted compartments, respectively under different working circles.

Table 2.2: Statement showing allocation of forest areas (Ha) under the RFs into different Working Circles

Sl. No.	Name of the working circle	Name of RFs and allocated compartments	Total area of the allocated compt. (Ha)	Total area allocated to the working circles (Ha)
1.	Sal Regeneration Working Circle	Apricola West RF (APR2, APR3) Garbhanga RF (GAR1, GAR2, GAR4, GAR10, GAR11, GAR12) Jarasal RF (JAR 3) Khawasing RF (JAR2, JAR 3, JAR4) Marakdola RF (MAR1)	7,101.2	7,101.2
2.	Plantation Working Circle	Apricola West RF (APR1, APR4 to APR9) Chamata RF (CHA1) Garbhanga (GAR3, GAR5 to GAR9, GAR20, GAR23, GAR24) Jarasal (JAR1, JAR2, JAR5) Mailata RF (MAL1) Motapahar RF(MOT1) Rani RF (RAN1 to RAN6, RAN9) Tetelia RF (TET1)	15,210.8	13431.00
3.	Joint Forest Management Working Circle	Apricola West RF (APR10, APR11, APR12) Fatasil RF (FAT1, FAT 2) Gotanagar RF (GOT1) Hengrabari RF (HEN1) Jarasal RF (JAR1, FV) Kawasing (KAW1) Marakdola (MAR2) Sarania (SAR1)	4,066.1	2926.00

		South Kalapahar (SKA1)		
4.	Forest Protection Working Circle	Garbhanga RF (GAR13, GAR14, GAR15, GAR16, GAR17, GAR18, GAR19) Jarasal RF (JAR4) Marakdola RF (MAR3)	Whole area	Whole area
5.	Wildlife Management and Biodiversity Conservation (Overlapping) Working Circle	Rani RF Garbhanga RF Gotanagar RF Jalukbari RF Fatasil RF	Whole area	Whole area
6.	Non Timber Forest Produce (Overlapping) and Bamboo Working Circle	a) NTFP All the RFs b) Bamboo Apricola RF (APR1 to APR12) Garbhanga RF (GAR5 to GAR19, GAR21 to GAR24) Rani RF (RAN6,RAN7)	27,945.8	*NTFP Plant = 756.00 Ha* *Bamboo plant=714.00 Ha)*

In the entire Kamrup East Division, the total productive forest area *(excluding encroachment, blank, diversion, wetlands/rivers)* is 30,476.92 Ha.

2.3 Percentage of Forest with Secured Boundaries: Most of the forest boundaries have been marked with artificial lines and are not easily traceable. The proper demarcation of forest boundaries is an essential prerequisite and will be corrected during the tenure of this working plan. One-fifth of all the boundary pillars will be renovated/newly created every five years to ensure that the boundary pillars are regularly maintained.

Statement on percentage of forests with secured boundaries is provided in table 2.3.

Table 2.3. Percentage of forests with secured boundaries

Assessment year	Total length of boundary		Total number of boundary pillars		% of Forests under secured boundary	Change in % over the plan period
	Natural (km)	Man-made (km)	Estimated (nos)	Constructed / maintained		
2015-2016	61.18	216.38	400	400	84%	84%

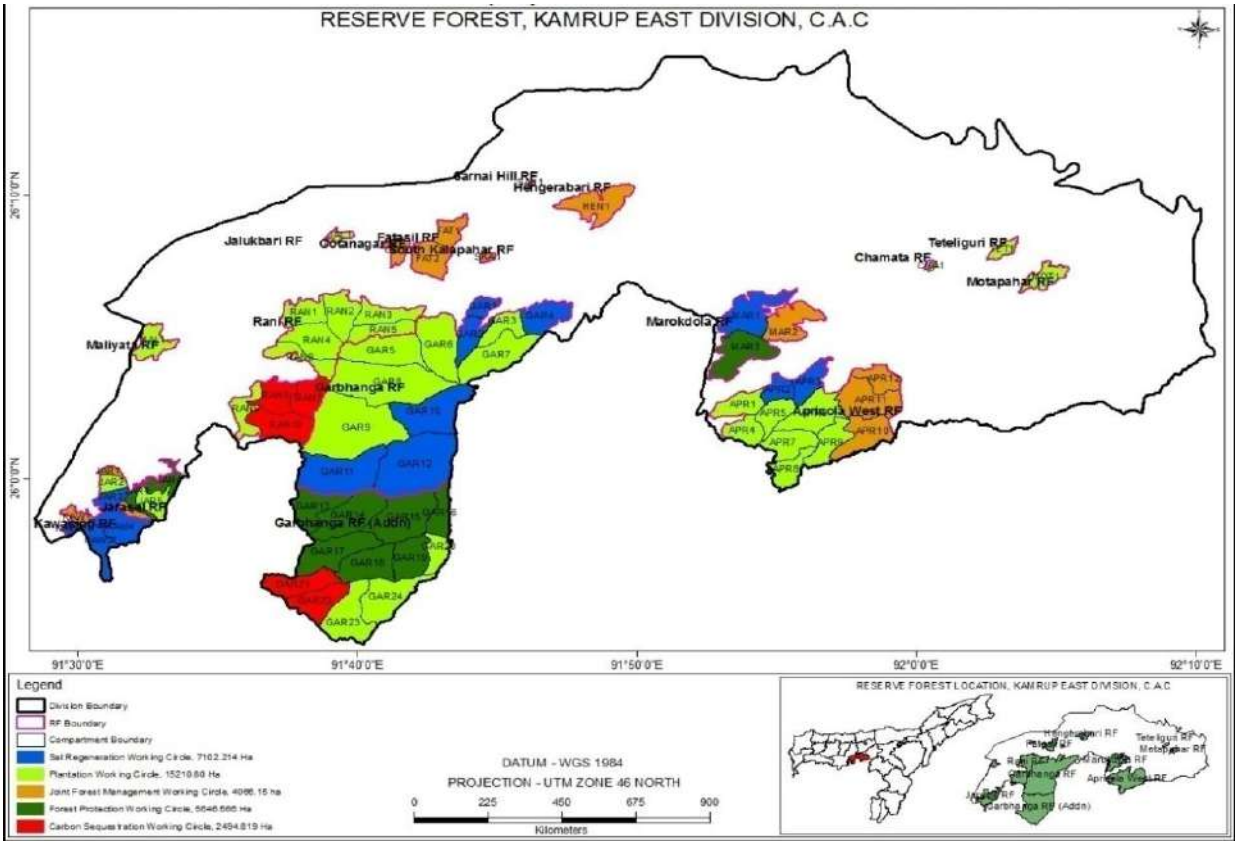


Figure 2.2a: Map showing allocation of forest areas in each existing compartments under WCs

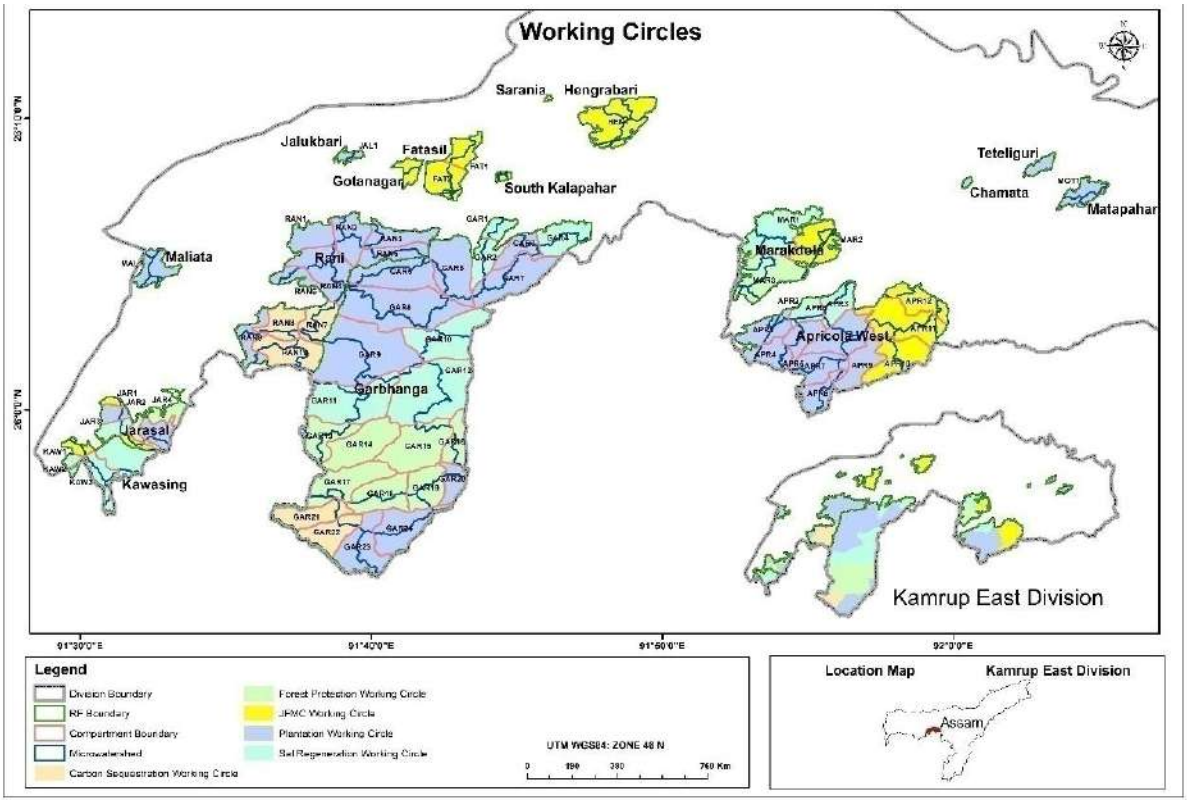


Figure 2.3b: Map showing allocation of forest areas in each recasted compartment based on microwatersheds under different working circles.

2.4 Land use, Land Use Change and Forestry (LULUCF): LISS IV satellite imagery of 5.8 m resolution at two time points 2005-2006 and 2015-2016 was analyzed and RS/GIS tools applied to map LULUCF. There are visible changes detected in land use, land use change and forestry in Kamrup East Division. The change analysis matrix is shown in table 2.4a, 2.4b for division and RF wise respectively. Changes in the area under each land use category are shown in table 2.4c for division. Increase or decrease in the extent of LULUC categories at two time points is shown graphically in Figure 2.4a. Detailed LULC maps developed at the two timepoints are shown in Figure 2.4b.

Table 2.4b: Area at two time points under each LULUCF categories of the Division.

LULCF /Year	2005-2006 (Ha)	2015-2016 (Ha)	LULUCF
Agriculture Cropland	25650.7	22454.7	3196.0
Agriculture Plantation (TE)	327	377.4	-50.4
Built Up	12488.3	12650.3	-162.0
Forest Deciduous	59130.2	55623.9	3506.3
Forest-Scrub Forest	4992.2	6743.7	-1751.5
Forest-Tree Clad Area	8737.4	12686.7	-3949.3
Grassland & Grazing land	296.7	499.2	-202.5
Shifting Cultivation	338.1	492.8	-154.7
Wastelands	116.9	411	-294.1
Waterbodies-Reservoir/Pond	46.4	47.2	-0.8
Waterbodies-River/Stream	7630.1	6799.9	830.2
Wetlands-Inland-Natural	3265.4	4232.6	-967.2
Total	**123019.4**	**123019.4**	0

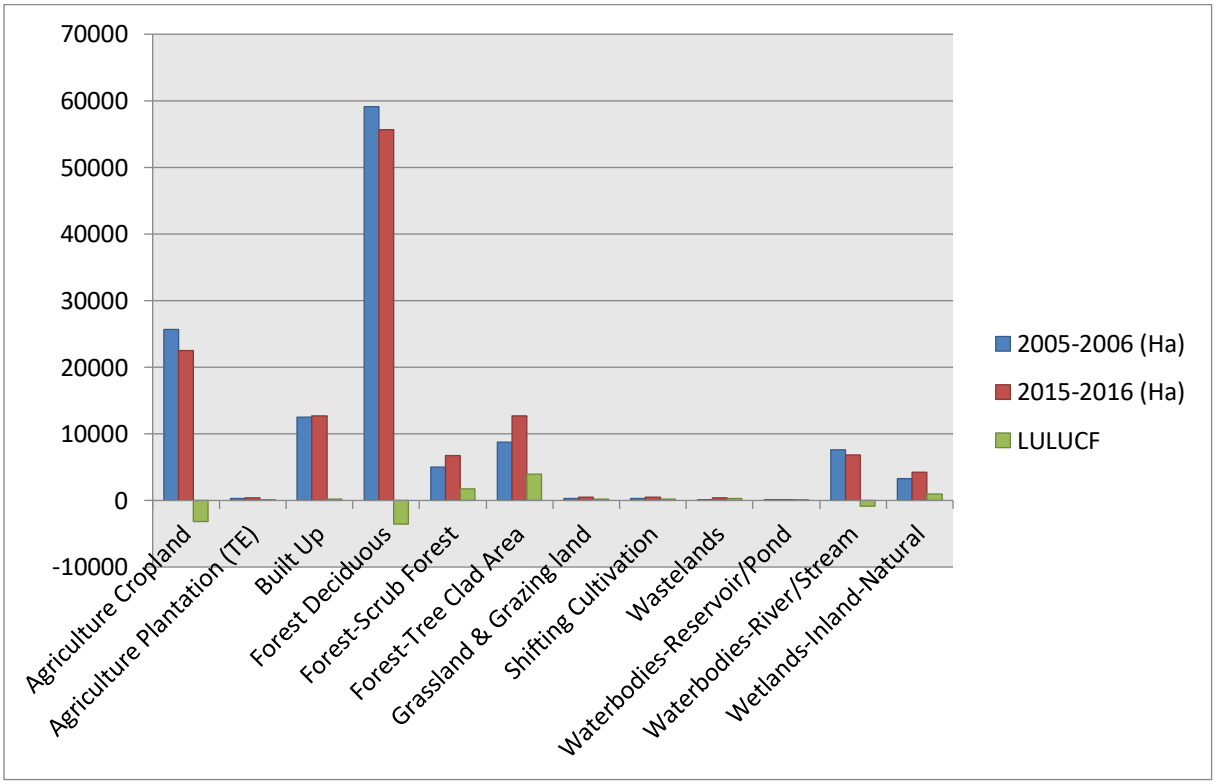


Figure 2.4a: Graph showing extent of changes (hect.) in LULC detected between 2005-2006 and 2015-2016

2.4.1 Encroachments: Encroachments recorded in the RFs are shown in table 2.4.1. Agricultural croplands, built-up areas and habitations are the main categories of encroachments. An area covering 1950.60 (5.51%) of the RFs in this division is under encroachment. This is excluding the three PRFs namely Hahara PRF, Garowani PRF, and ApricolaPRF. Encroachment map for the division is shown in Figure 2.4.1. Percentage of encroachment of reserve forest area as recorded highest in south Kalapahar RF (85.71%) followed Gotanagar RF (73.68%), Hengerabari RF (61.30%), Fatasil RF (32.81%), Matapahar RF (28.04%) and other RFs. Through this working plan, prescriptions have been given to recover the encroached areas wherever possible and gradually utilize the encroached areas through people's participation for enhancing forest productivity. A comprehensive eviction plan is given in Annexure.

Table 2.4.1:Statement showing encroached areas of RFs

Sl. No.	Name of RF	Area of the RF (In Ha.)	Encroached area (In Ha.)	Percent Encroachment
1	Maliata RF	325.46	9.5	2.91%
2	Kawasing RF	998	Nil	0%
3	Jarasal RF	1256	Nil	0%
4	Rani RF	4370	Nil	0%
5	Chamata RF	27	Nil	0%
6	Teteliguri RF	120.58	16	13.26%
7	Matapahar RF	225	6	2.66%
8	Marakdola RF	1426.5	400	28.04%
9	Sarania Hill RF	7.99	1.2	15.01%
10	Hengerabari RF	628	385	61.30%
11	Gotanagar RF	171	126	73.68%
12	Jalukbari RF	97.7	2.6	2.66%
13	Fatasil RF	670.44	220	32.81%
14	South Kalapahar RF	70	60	85.71%
15	Apricola West RF	6075.3	538.76	8.86%
16	Garbhanga RF	18860.58	185	0.98%
Total		**35329.55**	**1950.06**	**5.51%**

Table 2.4a: Kamrup East Division LULUCF matrix of two time points 2005-2006 and 2015-2016.

LULC 2005_2006/ LULC 2015_2016	Agriculture Cropland (Ha)	Tea garden (Ha)	Built Up Rural (Ha)	Forest Deciduous (Ha)	Forest Scrub (Ha)	Forest Tree Clad Area (Ha)	Grassland & Grazing land (Ha)	Shifting Cultivation (Ha)	Wastelands Scrub land (Ha)	Waterbodies (Ponds) (Ha)	Wetlands (Rivers) (Ha)	Wetlands (Natural) (Ha)	Total (Ha)
Agriculture Cropland	20332.7	1.5	1164.6	270.8	148.3	2200.3	2.9		102.9	2.3	89.2	1335.0	25650.8
Tea garden	0.2	292.6		3.1		30.2	-	-	-	-	0.7	0.1	327.0
Built-Up	209.9		10481.2	229.2	678.5	467.3	0.1	-	163.9	0.4	4.2	253.8	12488.3
Forest Deciduous	428.3	20.7	115.3	53485.0	2836.7	1950.1	0.4	284.1	0.3	-	5.6	3.7	59130.2
Forest Scrub	17.3		98.5	818.8	2803.5	1243.5	-	-	-	-	10.7	-	4992.2
Forest (Tree Clad Area)	428.0	48.3	541.9	691.5	174.4	6532.3	2.6	-	67.2	4.9	33.8	212.4	8737.4
Grassland and Grazing land	101.1	-	-	0.3	13.5	2.8	145.4	-	8.4	0.2	25.2		296.8
Shifting Cultivation	0.1	-	-	78.0	51.3	-	-	208.7	-	-	-	-	338.1
Wastelands (Scrub land)	0.1	-	-	-	-	17.4	31.2	-	44.0	-	24.0	0.1	116.9
Waterbodies (Ponds)	0.9	-	15.5	-	-	-	-	-	-	29.3	-	0.6	46.4
Wetlands (Rivers)	340.6	6.4	67.6	20.2	35.8	193.4	314.6	0.0	9.9	0.3	6602.9	38.3	7630.1
Wetlands (Inland-Natural)	595.5	7.8	165.6	26.9	1.7	49.4	2.1		14.3	9.9	3.7	2388.5	3265.4
Total	**22454.8**	**377.4**	**12650.3**	**55623.9**	**6743.7**	**12686.7**	**499.2**	**492.8**	**411.0**	**47.2**	**6799.9**	**4232.6**	**123019.5**

Area details at two time points under each LULC categories is provided in table 2.4b.

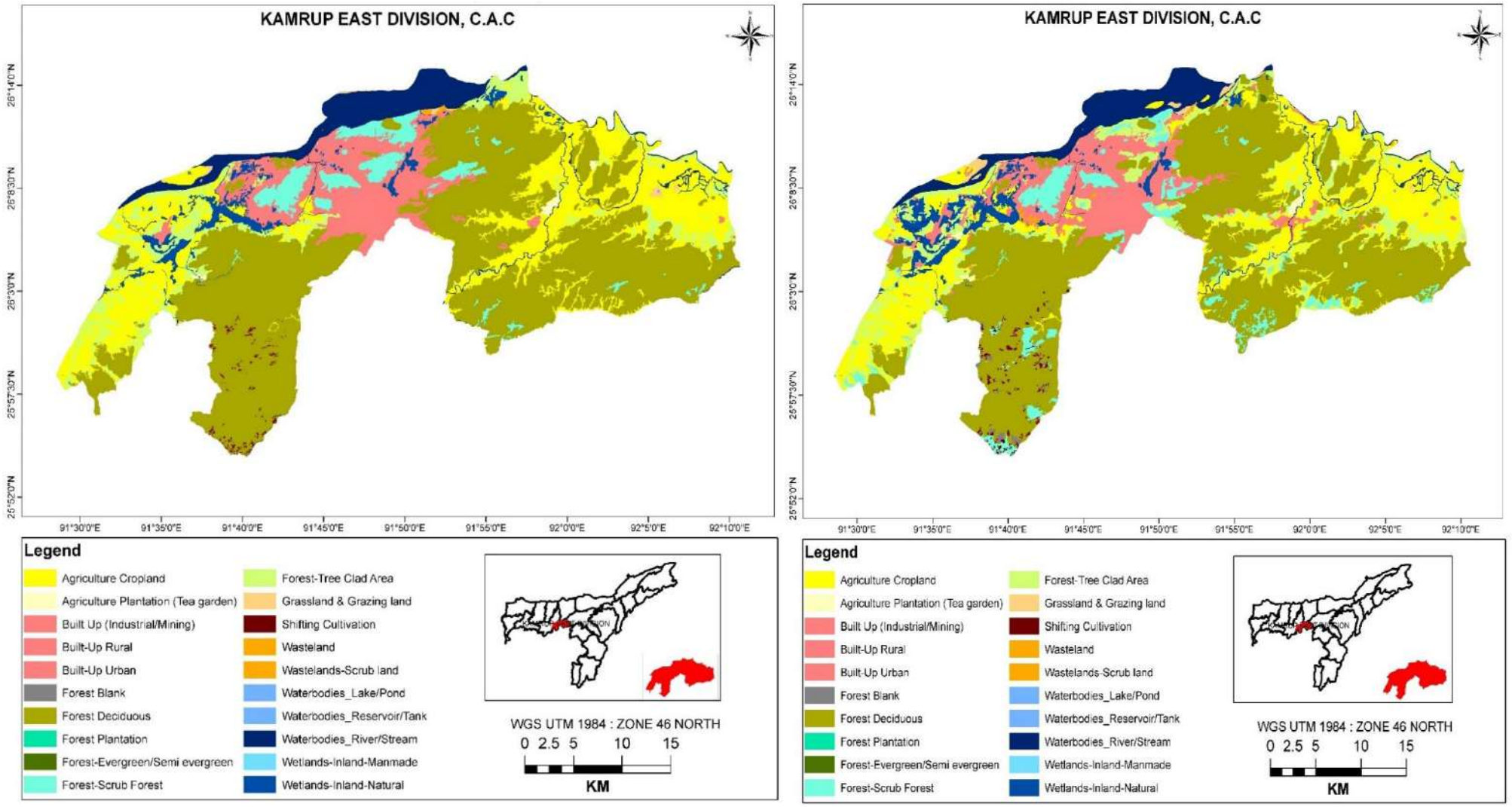


Figure 2.4b: Land Use Land Cover Map of Kamrup East Division in 2005-2006 and 2015-2016.

Table 2.4b: RF wise LULC matrix of two time points 2005-06 and 2015-16 ofKamrup East Division.

Name of the RFs	Agriculture Cropland		Builtup		Forest Blank		Forest Deciduous		Forest Evergreen / Semi		Forest Scrub Forest		Forest-Tree Clad Area		Shifting Cultivation		Stream		Wetlands - Inland Natural	
	2005-2006	2014-2015	2005-2006	2014-2015	2005-2006	2014-2015	2005-2006	2014-2015	2005-2006	2014-2015	2005-2006	2014-2015	2005-2006	2014-2015	2005-2006	2014-2015	2005-2006	2014-2015	2005-2006	2014-2015
Apricola West RF	316.35	118.90	77.08	0.00	32.33		2462.80	3852.52			1975.82	597.63	159.32	138.74			8.68		8.52	
Chamata RF		1.37		0.09				22.23			0.05			1.17						
Fatasil RF	11.68		198.50	179.62			208.03				217.94	527.16	20.31						0.22	
Garbhanga	248.39	88.01	99.77	108.22	268.12	304.03	11333.26	14977.17			2124.86	1179.16	3121.86	19.56		488.54	0.01	0.54	0.57	
Gotanagar	0.55		32.92	26.12	0.88		60.50				38.63	134.94	14.82							
Hengerabari			218.58	170.39			259.36	241.55			77.31		29.60	204.04						15.58
Jalukbari RF		3.31	7.61	28.21			33.39	46.01			1.49	5.59	35.16							4.36
Jarasal RF	195.05	141.48	25.84		6.29		562.20	754.15		3.21	23.50	85.58	299.42	88.46					0.19	
Kawasing RF	209.08	78.56	34.36				533.88	545.03			60.94	136.40	113.06	153.60			1.08		0.00	
Maliyata RF	3.98	35.79	11.87	1.43			233.28	225.34			63.24	13.56	23.76	53.39						12.90
Marokdola	67.56	150.88	39.38				1676.81	1675.48			13.11	112.30	52.10	36.46				2.91	13.96	
Motapahar	68.31	44.67	61.58	6.27			88.11	102.40			59.63			125.84					1.56	
Rani RF	68.28	41.20	35.73	12.98	13.51	13.95	2290.64	4141.70			147.50	69.86	1761.52	41.08		3.41	1.59	2.81	0.93	0.22
Sarnai Hill			1.27	8.70			2.50				0.88	2.42	1.24							
South Kalapahar			26.51				4.29				5.50	14.60	2.31	30.87						
Teteliguri RF		7.79	5.64				59.85	102.69			33.17		26.29	15.05					0.57	

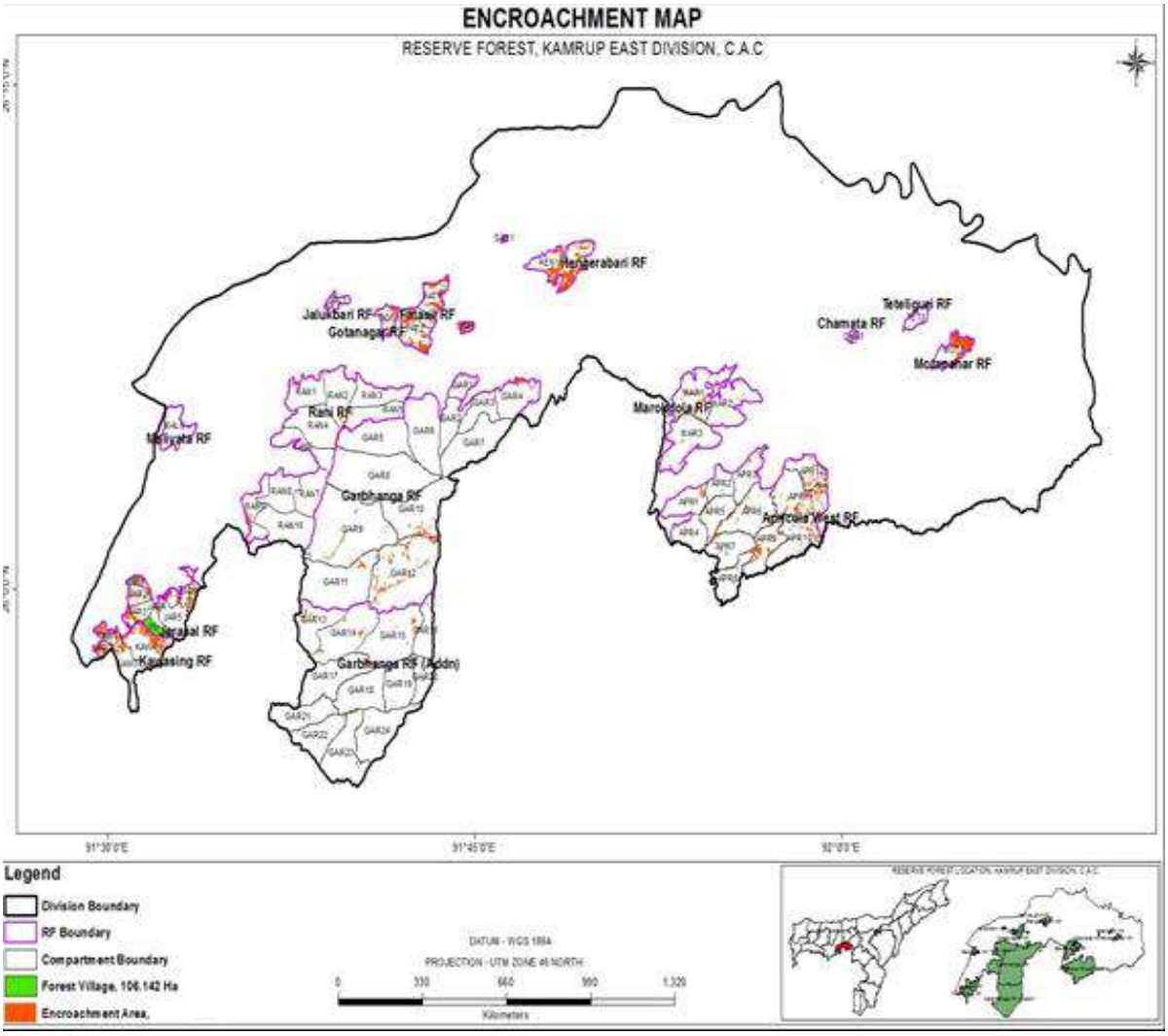


Figure 2.4.1: Map showing the areas under encroachment in reserved forests

2.4.2 Diversion of Forests:A total of 149.916 ha of reserve forest in the Kamrup East Division have been diverted to non-forestry purposes. Statement of diverted areas of RFs in the division is shown in table 2.4.2. Details of diversions under FCA are shown in following table.

Table 2.4.2: Statement of diverted areas of RFs in Kamrup East Division

Sl. No	Name of Proposal for diversion of Forests land	Name of RF	Area (in Ha)	Ministry approval letter
1	400 KV line (Tripura to New Bongaigaon)	Garbhanga& Rani	83.23	8-104/2007-FC, dt.08/05/2012
2	B.G. line (Kamakhya to Jogighopa)	Rani	4.134	No.8-18/91-FC dt. 17/11/1992
		Maliata	0.41	
3	132 KV line (Umiam to Sarusojai)	Garbhanga	9.45	8-4-21/97/RONE-AS-212-14, dt.05/05/2003
4	220 KV line (Chandrapur to Sarusojai)	Aamchang, Khanapara, Garbhanaga	32.02	8-27/87-FC, dt.12.08.1992

5	Khanapara to Dharamtul by NHAI	Khanapara& Amchang	7.021	3-ASB-002/2009-SHI/2219/21 dt. 29/12/09
6	Water Reservoir	Gotanagar	0.376	3 AS-B 041/2009-SHI/1542-44 dt. 17/09/2009
7	Water Reservoir	Jalukbari	0.505	
8	Water Reservoir	Fatasil	0.416	
9	Water Reservoir	Hengrabari	0.555	3-AS.B. 094/2008-SHI/500-502 dt. 24/06/2009
10	Water Reservoir	South Kalapahar	0.399	
11	Helagog Stone Mahal	Matapahar	0.5	3-AS-B-026/2005-SHI/5107-09 dt. 09/03/2006
12	Fatasil Stone Mahal No. 1	Fatasil RF	1	3-ASB-026/2006-SHI/2555-57 dt. 30/01/2007
13	Fatasil Stone Mahal No. 2	Fatasil RF	1	3-ASB-026/2006-SHI/2463-66 dt. 13/10/2006
14	Fatasil Stone Mahal No. 3	Fatasil RF	0.5	3-ASB-026/2006-SHI/2552-54 dt. 30/01/2007
15	Fatasil Stone Mahal No. 4	Fatasil RF	0.5	8-5-34/96/RONE-AS dt. 20/08/2003
16	Fatasil Stone Mahal No. 5	Fatasil RF	0.5	8-5-48/2003/RONE-AS dt. 20/08/2003
17	Natun Rani Stone Mahal	Rani RF	0.5	3-ASB-026(B)2005-SHI/2008-10 dt. 30/08/2006
18	Deochotal Stone Mahal No.A	Rani RF	0.5	8-9-41/2002/RONE-AS/1629-31 dt. 31/10/2002 & 8-9-41/ 2002/ RONE-AS/1882-84 dtd 16/12/2002
19	Deochotal Stone Mahal No.B	Rani RF	0.5	3-AS-B-026/2006SHI/2925-27 dt. 28/02/2008
20	Deochotal Stone Mahal No.C	Rani RF	0.5	3-AS-B-026(C)2005-SHI/2046-48 dt. 31/08/2006
21	Mainnakhurung Stone Mahal No. A	Rani RF	0.5	8-9-41/2002/RONE-AS/1629-31 dt. 31/10/2002 & 8-9-41/2002/RONE-AS/1882-84 dtd 16/12/2002
22	Mainnakhurung Stone Mahal No. B	Rani RF	0.5	3-ASB 002/2009-SHI/2219-21 dt. 29/12/2009
23	Mainnakhurung Stone Mahal No. C	Rani RF	1	3-AS-ASB 010/2007-SHI/2507-09 dt. 30/01/2011
24	Garbhanga Stone Mahal No. A	Garbhanga RF	0.5	8-9-41/2002/RONE-AS/1629-31 dt. 31/10/2002 & 8-9-41/2002/RONE-AS/1882-84 dtd 16/12/2002
25	Garbhanga Stone Mahal	GarbhangaR	0.5	-

	No.B	F		
26	Lokhra Stone Mahal N. 1	Garbhanaga RF	0.5	8-5-34/96/RONE-AS dtd 20/08/2003 for 5 years & 3-ASB/2005/2009-SHI/1685-87 dt. 13/09/2010
27	Lokhra Stone Mahal NO. 2	Garbhanaga RF	0.5	8-9-41/2002/RONE-AS/1629-31 dt. 31/10/2002 & 8-9-41/2002/RONE-AS/1882-84 dtd 16/12/2002
28	Guwahati University Bye Pass	Jalukbari	1.4	3.ASB-017/2009-SHI/1069-71 dt. 10/03/2011
Total			**149.916**	

2.5 Threats to the Forests: Threats to forests are listed below:

2.5.1 Encroachment: Population pressure and poverty are the main two factors stimulating forestland encroachment. Encroachment of forest land for cultivation and other purposes continues to be the most pernicious practice endangering forest resources. The Reserve Forests are located within and arround of Guwahati city and therefore land hungers continuously put all clandestine effort to grab forest land for settlement. The main purpose of encroachment are-

i) Land grabbing for settlement
ii) Agricultural and horticultural purposes including jhum cultivation.

2.5.2 Forest Fire: Fire occurs in winter season in almost every year in all the accessible compartments of the RFs of Kamrup East Division. Fire occurs due to negligence of some surrounding inhibitant or sometimes deliberately kindling by some people. It affects the areas under young regeneration. Staffs, with co-operation of local people take measures to control such fires.

2.5.3 Illegal felling: Illegal felling of trees and rolling it over outside the Assam State boundary is one of the major threats to the division. Porous boundaries, insufficient number of staffs in comparison to vulnerable areas, enadequate infrastructures to combat illegalities, difficult terrain etc. are the factors for failure in thwarting illegal activities of timber smugglers. However, Staffs put utmost exersion to check illegal felling. Moreover, the Division shares a lengthy interstate boundary with the State of Meghalaya and illegal felling and inter-state transport and trade of the produce become a major threat as well.

2.5.4 Lopping: Illegal lopping of poles and other trees is adversely affecting the development of forests in this division. Forest officials are always on vigil yet there exists a strong lopping pressure on the forests of this division.

2.5.5 Storms: Heavy storms, together with pre-monsoon showers that occur in the months of April and May every year, cause considerable damage to the young Sal regeneration crops. Seed bearing branches of Sal fall off prematurely. Sometimes several trees are uprooted during storms and cause permanent openings. Such permanent openings impede uniform regeneration. It also upsets marking of trees already done by the Marking Officer.

2.5.6 Non-working of Forests: Lack of approved working plan for quite a long time has hampered the development of forests in this division. Non-working of the forests has hampered regeneration and growth of stocks.

2.6 Distribution of Different Forest Types: The forests that have been dealt within this working plan have been classified into the following forest types as per revised Champion and Seth's classification (1968) of forest types of India. Distribution of forest types in this division is shown in Figure 2.6b.

i. **Eastern Hill Sal Forests- Khasi Hills Sal Type 3C/C1a(ii):** This type occurs mainly in the hilly areas of Rani, Garbhanga, Garbhanga (First Addition), Maliata and part of Jarasal and Kawasing Reserved Forests. This type is also found in very limited areas of Apricola (West) R.F. In the rest of the RFs and PRFs of this Division, this type is inconspicuous. The total area under this forest type in the division is 627.06 ha.

ii. **App. Kamrup Sal - Type 3C/C2d(iv):** Kamrup Sal is occupyingthe 2nd broadest area in this division. An area of 1097.33 ha is covered by this forest type. It occurs from the lower slopes of the foothills through the plains to the outer limit of the alluvial flood planis. Middle storey in these forests is practically absent.

iii. **East Himalayan Moist Mixed Deciduous Forests Type 3C/C3 (b):**This type of forests is characteristic of the drier slopes and ridges of the hills of this Division. This forest type coveres majority of the area in this division. A total of 20624 ha is covered by this forest type in this divison.

iv. **Secondary Moist Bamboo Brakes– Type 2/2SI:** Large tracts of bamboo brakes occur along the Moist Mixed Deciduous Forests in the hilly area. They occur in great profusion in damp locations especially along the perennial streams and nalas. The total area under this forest type in the division is 1097.33 ha.

v. **Pioneer Euphorbiaceous Scrub- Type 1/2S1:** An area of 235.57 ha is covered under this type of forest. This occurs in abandoned 'jhummed' areas left after raising 2-3 crops continuously. This type of formation comes up initially in the abandoned jhum areas of some of the RFs viz. GarbhangaandApricola.

Percentage of total area under the recorded forest type is shown in Figure 2.6 a. Area under and percentage of area under different forest types in different reserve forests of Kamrup East Divisionis shown in Table 2.6b.

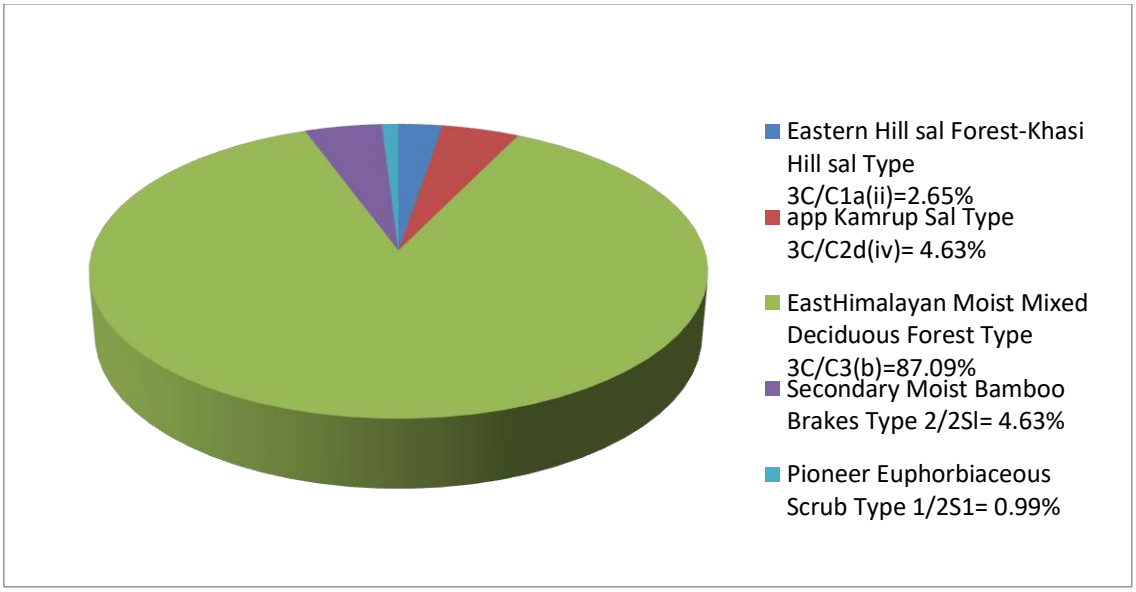


Figure 2.6a: Percentage of area under different forest types in Kamrup East Division.

Further, the areas under each reserve forest were analysed for the canopy cover.
The FSI canopy cover classes namely <10% (*scrubs*), 10% to 40% (*open forest*), 40% to 70% (*moderately dense forest*) and areas under >70% canopy cover (*very dense forest*) were delineated. Figure 2.6c shows the map of canopy cover of the reserve forest of Kamrup East

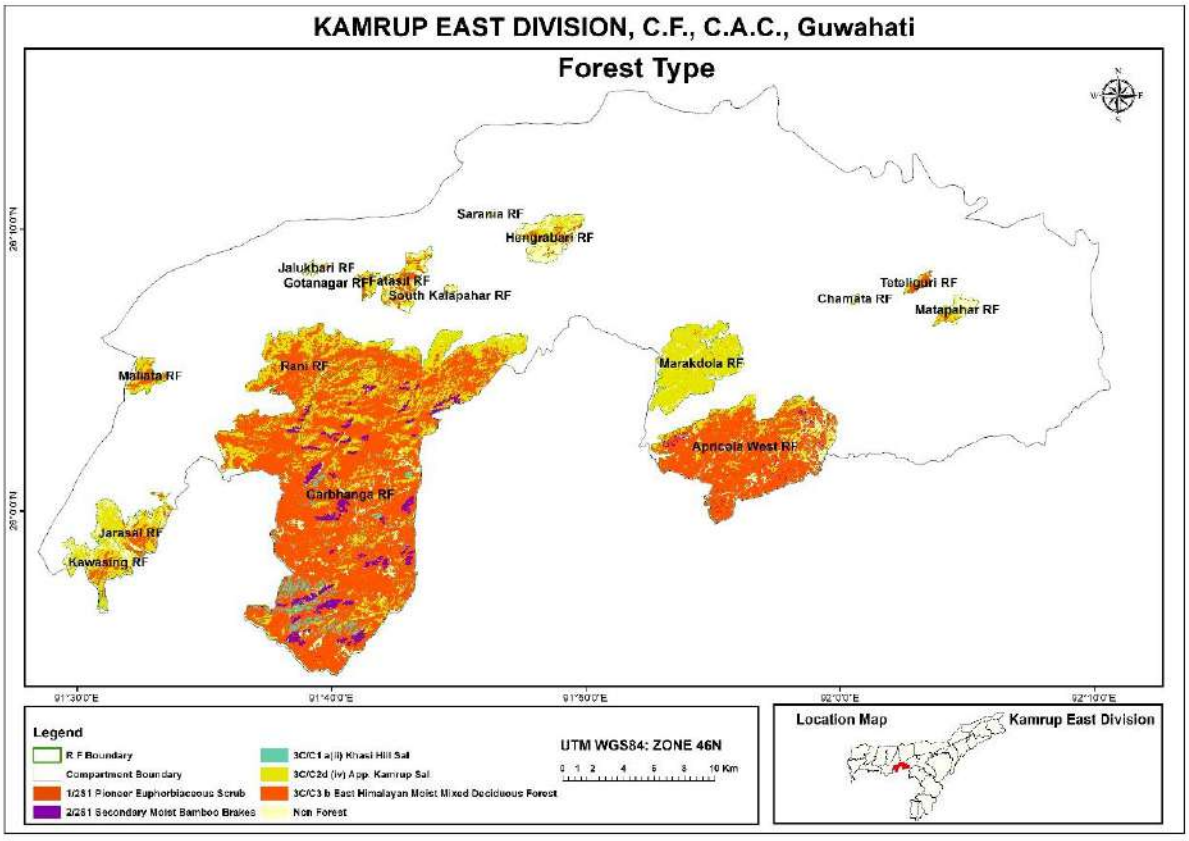


Figure 2.6b :Forest type map of Kamrup East Division.

Division. Percentage of area under open forest is found to be 58.5% followed by scrubs (14.1%), moderately dense forest (12.8%). Only 3.5% of the reserve forest area is under very very dense canopy cover. Per cent of forest type area under different canopy density is shown in Table 2.6a.

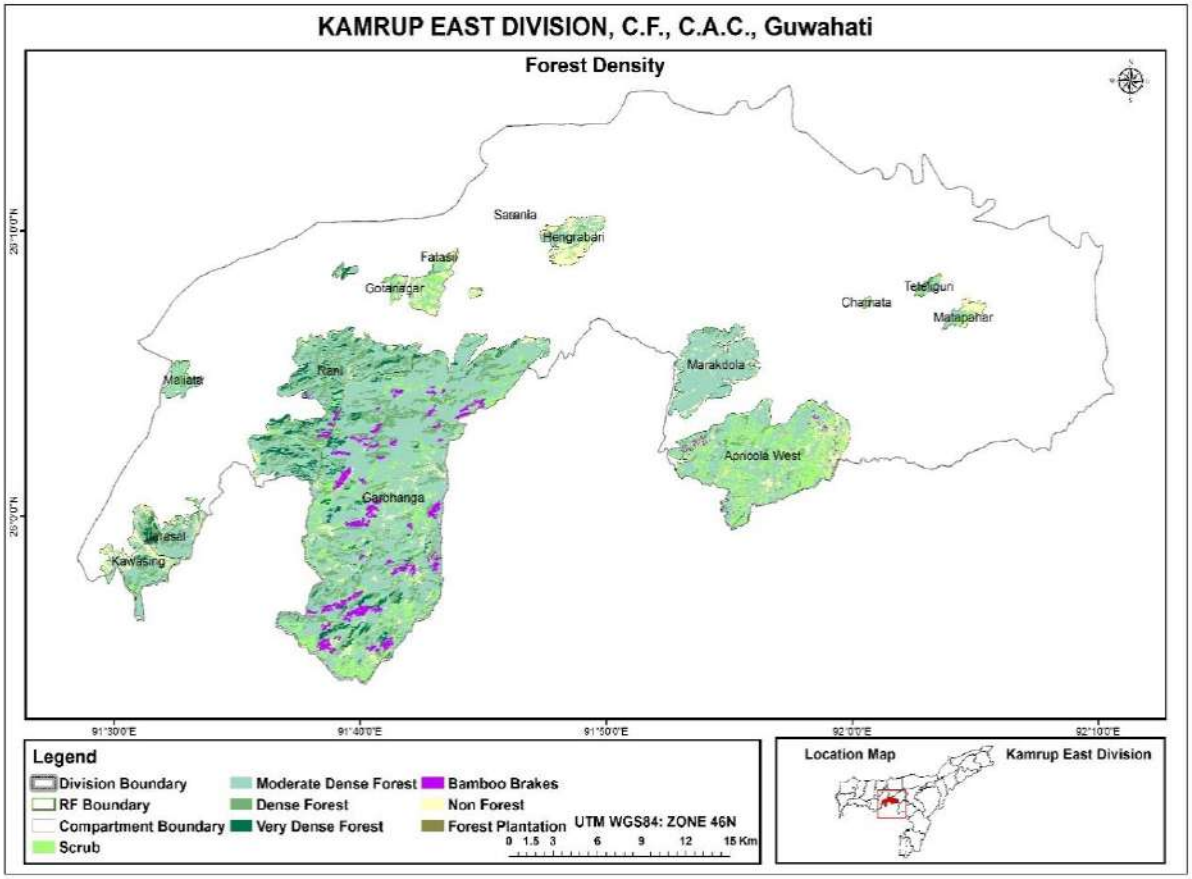


Figure 2.6c: Canopy density map of Kamrup East Division.

Table 2.6a: Percentage of the total area of reserve forests under different canopy density.

Forest types	Scrub (<10%)	Open Forest (10%-40%)	Moderately dense forest (40%-70%)	Very dense forest (>70%)
Mixed Moist Forest	11.12	38.24	8.30	2.02
Khasi Hill Sal Forest	2.86	19.49	4.04	1.23
App. Kamrup Sal Forest	0.16	0.84	0.48	0.26

Table 2.6b: Area of reserve forests under different forest types.

Reserve forest	Area of reserve forest(Ha)	Khasi Hill Sal Forest	Mixed Moist Forest	App. Kamrup Sal Forest	Pioneer Euphorbiaceous Scrub	Moist Bamboo Brakes	Grand Total(Ha)
West Apricola	6,075	646.8	4217.3	0	4.18	111.53	4979.81
Chamata RF	27	9.64	5.12	0	0	0	14.76
Fatasil RF	670.44	249.09	105.08	0	105.07	0	459.24
Garbhanga RF	18,860.58	3436.73	12708.2	585.68	2.71	869.63	17602.95
Gotanagar RF	171	76.42	1.92	0 (0)	38.95	0	117.29
Hengrabari RF	628	305.26	36.5	0	76.8	0	418.56
Jalukbari RF	97.7	36.58	4.81	0	0.58	0	41.97
Jarasal RF	1,256	0	215.49	579.58	0.58	0	795.65
Kawasing RF	998	532.71	189.8	13.29	0	0	735.8
Maliata RF	325.46	0	124.29	197.06	0.08	0	321.43
Marakdola RF	1,426.50	1919.59	21.91	0	0	0	1941.5
Matapahar RF	225	125.7	22.04	0	0	0	147.74

Reserve forest	Area of reserve forest(Ha)	Khasi Hill Sal Forest	Mixed Moist Forest	App. Kamrup Sal Forest	Pioneer Euphorbiaceous Scrub	Moist Bamboo Brakes	Grand Total(Ha)
Rani RF	4,370	1365.82	2865.3	0.18	0	52.14	4283.44
Sarania RF	7.99	7.26	0.47	0	1.11	0	8.84
South Kalapahar RF	70	11.6	0	0	5.62	0	17.22
Teteliguri RF	120.58	36.08	83.24	0	0	0	119.32
Total	**35,329.25**	**8,759.28**	**20,601.47**	**1,375.79**	**235.68**	**1,033.30**	**-**

Note: Values inside the parenthesis represents % of total area.

2.7 Tree Cover Outside Forest: 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 reserve forests 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. People mostly plant fruit bearing trees like Mango (*Mangifera indica*), Jamu (*Syzygiumcumini*), Jackfruit (*Artocarpus heterophyllus*), Jalpai*(Elaeocarpus serratus*), Amlakhi (*Phyllanthus emblica*), Silikha (*Terminalia chebula*), betel nut, banana, etc. along with patches of bamboos. People in urban areas also plant few fruit trees such as guava, mango, betel nut around their boundary or in their homesteads.

2.7.2 Unclassified State Forest (USF): USF areas are those patches under jurisdiction of the forest divisions, outside the reserve forests, that are above 10 hectares in area. These were delineated and mapped (see Figure 2.7.2). A total of 106 USF patches were delineated covering 47.9% of the total TOF area in the division. This is carried out with an attempt for a better management of USF. Since this division is the core terrestrial ecosystem services provider to the biggest city of North East India, delineation will help in initiating principles of city forests with the primary focus on maintainence of the flow of ecosystem goods and services for the city. Detailed areas of each USF patch and coordinates are shown in Annexure IIb.

2.8 Shifting Cultivation: Shifting cultivation, locally known as *jhum,* is practiced by the tribal forest dwellers inhabiting the Inter-State boundary areas of the division especially in Garbhanga RF and Kawasing RF.

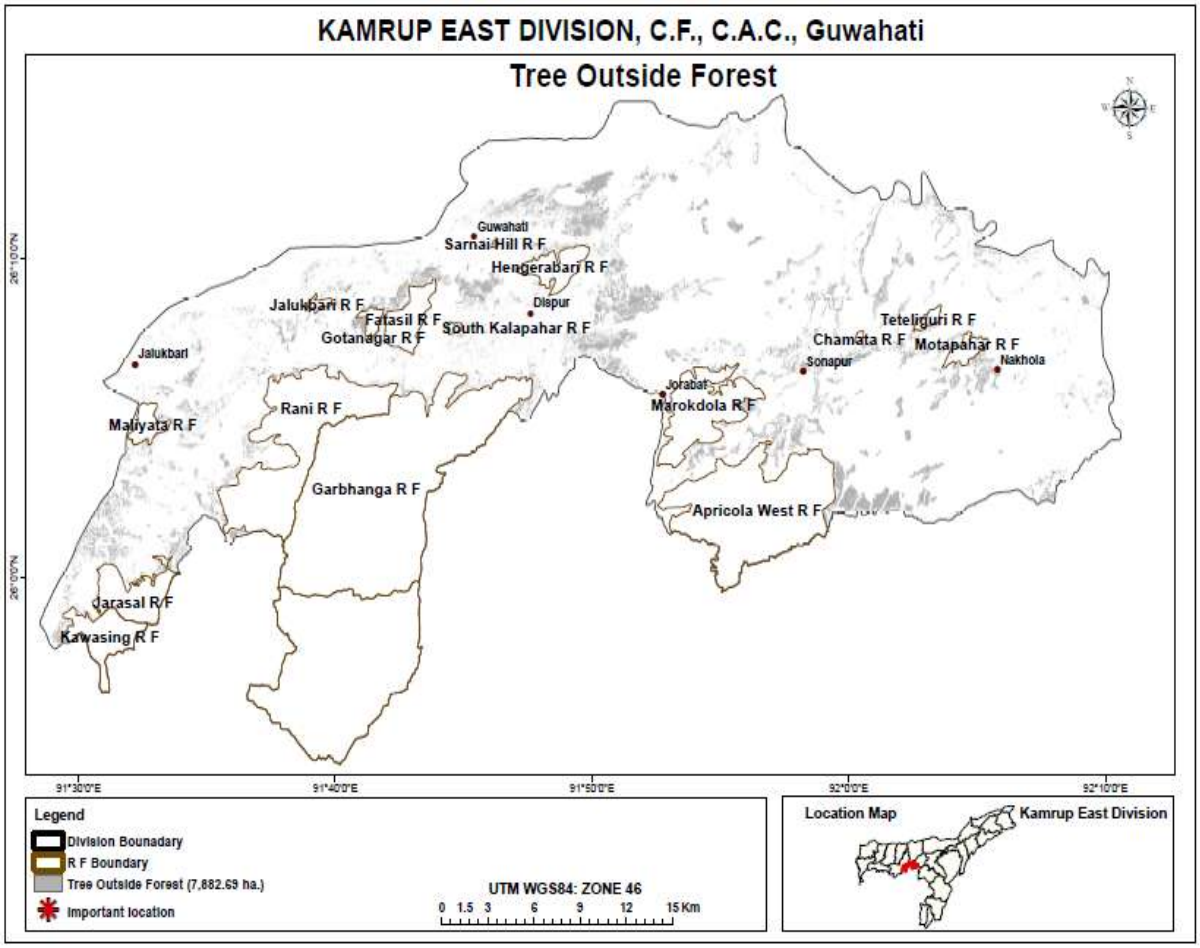


Figure 2.7.1: Map showing Trees Outside Forest in Kamrup East Division.

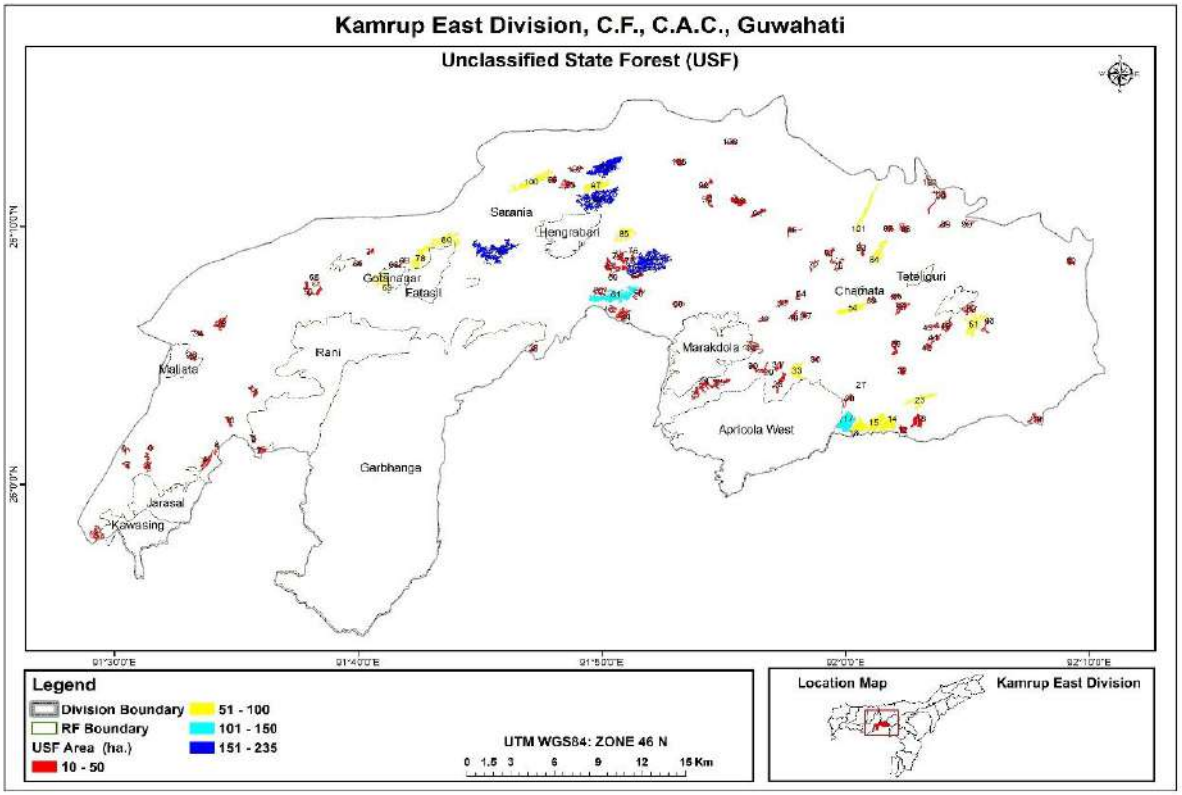


Figure 2.7.2: Unclassified Forest map of Kamrup East Division.

CHAPTER 3
MAINTENANCE, CONSERVATION AND ENHANCEMENT OF BIODIVERSITY

3.1 Forest Composition and Distribution: Forests in the hilly areas of Rani, Garbhanga, Garbhanga (First Addition), Maliata and part of Jarasal and Kawasing Reserved Forests are dominated by Eastern Hill Sal Forest - Khasi Hills Sal. This forest is also found in a very limited area of Apricola (West) RF. In the rest of the RFs and PRFs of this Division, this type is inconspicuous. It occurs right from the foot hills to the highest elevation of these hilly RFs. Pure patches and groups of Sal occur in ridges and spurs but these pure patches are interspersed by mixed deciduous forests that grow in the middle slopes and valleys, particularly on the Southern and Western aspects, and in damp localities such as the banks of perennial streams by evergreen forests. Many of these hilltops and slopes are being gradually invaded by Bamboo with the unscientific removal of trees from these areas and this may ultimately cause gradual eradication of (Khasi Hills Sal) forest- type here. As described earlier, the soil on the crests, ridges and upper slopes of some of the hills are bouldery with outcrops of rocks in places, and in such areas Sal trees are of poor quality, often characterised by poorly developed crown and low branches. However, in pockets among boulders, where there is some depth of soil, Sal trees have been found to be healthy with attainment of better girth and height. Whippy Sal saplings and poles, although less in number, are distributed on the ridges where there are openings.

Makri Sal (*Schimawalichii*) is the common associate of Sal on ridges and spurs. Other associates in the canopy are Sida, Jia, Ahoy, Paroli and Hingori etc. The middle storey is composed of Dudhkhuri, Khukhru, Bhodia, Bhatghila, Larubandha, Kuh, Gamari, Ahoi, Bhela, etc. Clumps of stunted bamboo (*Dendrocalamushamiltonii*) occur on the ridges and clumps of bigger bamboo on the slopes. In most localities this bamboo occurs in great profusion as also some fairly good trees of miscellaneous species.

The understory vegetation varies considerably according to canopy opening. On fairly open canopy and near the habitations thatch (*Imperata cylindrica*) is common. The most common undertsory vegetation in locations having close canopies is Sau-grass (*Microstegium* spp.). Other species commonly found are *Eupatorium odoratum*, *Cares stroementita*, *Thysanolaena maxima*, etc. In some localities of Northern and Eastern slopes, "Gondhkachu"- a local delicacy is found.

Some of the commonest climbers found in these forests are Dat-bijuli (*Dalbergia tamarindifolia*), Kotagach (*Dalbergia rimosa*), Lata dimoru (*Ficus scandens*), Lataguti (*Caesalpinia crista*), Deo-Jakhala (*Bauhinia anguinae*), Kharika-lata (*Jasminum coaractatum*), Bandar-kekowa (*Mucuna prusita*&*Dysolobiumgrande*), Ban-marich or Banjaluk-lata (*Clematis cadmia*), Bhedelata (*Paederia scandens*), Dhekia-lata (*Stenochleanapalustre*), etc.Only a part of Jarasal and Kawasing RFs is composed of Kamrup Sal Forest. Middle storey in these forests is practically absent. All the Sal patches falling in the Division come under this category. 60-90% area is occupied by Sal.

The RFs and PRFs situated in the Eastern part of the division are composed of moist mixed deciduous forests. These areas are devoid of Sal. The principal species occupying the top canopy are Makri Sal, Ahoi, Paroli, Bhelu, Sida, Odal, Jamu, Gamari, Amari, Salkali, Kuhir, Sam, Sopa, Siris, Amara, Poma, Koroi, Thotamala, Dimoru, Xilikha, and Seleng.Areas, which were subjected to heavy burning in the past, the middle storey is not well defined. The species found in such areas are Larubandha, Bhatghila, Dudhkhuri, Kum, Bhela, Dudhi, Amlokhi, Dol-poduli, Godhajam, Telbhuluki, Khukhru, Jorath, etc. In cooler aspects and valleys under this type of forest, the middle storey is occupied by bamboo (*Dendrocalamushamiltonii*). On the hill slopes under close canopies, Sau grass occurs as ground cover, in the lower slopes *Coffea bengalensis* occurs under close canopies. In piedmonts, plateaus and along the lower slopes of the foothills, thatch predominates as ground cover in open locations. Ground cover also consists of some other species such as *Eupatorium odoratum*, *Holmskioldiasanguines*, *Phyllanthus simplex*, *Sida* spp., etc. Climberssuch as *Butea parvidlora*, *Millelia auriculata*, *Smilex macrophylla*, *Acasia pinnata, Dalbergia rimosa* etc. are common in this Division's RFs and PRFs. The hilly areas of Garbhanga area is composed of large tracts of moist bamboo brakes. These brakes occur in great profusion in damp locations, especially along the perennial streams and nalas. They have been found to extend to the limited evergreen patches. The dominant bamboo species is Kako (*Dendrocalamushamilltonii*), while Dalu bamboo (*Neohouzeauadullooa*) is found, in sporadic and rare patches. Clumps of stunted and queachy bamboo occur mostly in open areas of Apricola (West) RF and in the north-western part of the Garbhanga RF where soil is shallow and poor.

In parts of Garbhanga, Garbhanga first addition and Apricola, the abandoned jhumed areas left after raising 2-3 crops continuously is composed of Euphorbiacea Scrub vegetation. The pioneer species is *Macaranga denticulata* followed by *Trema orientails, Albizzia chinensis, Callicarpa arborea*, etc. with occasional Kadamb. The undergrowth is composed of *Solanamkhasiana*, *Mimosa himalayana*, *Abroma augusta*, etc.
Reserve forest wise percent species composition is shown in Annexure IIIa.

3.2 Plant Species Diversity: Based on the vegetation survey, forest inventory and compartment descriptions; number of different tree species and DBH of each tree inside sample plot was recorded. These were used to calculate basal area (square meter per hectare), density (trees per ha) and frequency (number of sample plots where trees are present) in relation to total plots observed. Relative values of density, frequency and basal area were then calculated. The Importance Value Index (IVI) was calculated by adding up relative values of density, frequency and basal area. Species diversity is an expression of community structure. The number of species in a community is referred to as species richness. The relative abundance of all species is called evenness. A community demonstrates high species diversity if many equally or nearby equally abundant species are present. Communities with a large number of species, that are evenly distributed, are the most diverse. The relative values of density, frequency, basal area and IVI of important trees and shrubs per hectare found in all the reserve forests of Kamrup East Division are given below.

Statement showing the total basal area, relative density, relative frequency, relative dominanace and ivi of different species growing in the division

Species	Total Basal area	Relative Density	Relative Frequency	Relative Dominance	Importanc Value Inde
Acacia catechu (L.f.)Willd.	0.1	0.0	0.0	0.0	0.1
Aegle marmelos (L.) Correa	0.8	0.1	0.2	0.1	0.4
Aglaia hiernii King	6.7	0.5	1.1	0.7	2.3
Ailanthus integrifolia	0.4	0.1	0.2	0.0	0.3
Alangiumchinense (Lour.) Harms	0.1	0.0	0.0	0.0	0.0
Albizia chinensis (Osbeck)Merr.	0.4	0.0	0.1	0.0	0.2
Albizia lebbeck (L.) Benth.	5.9	0.4	1.0	0.6	2.0
Albizia lucidior (Steud.)I.C.Nielsen	1.5	0.4	0.7	0.2	1.2
Albizia odoratissima (L.f.)Benth.	2.4	0.3	0.8	0.3	1.3
Albizia procera (Roxb.)Benth.	16.7	1.5	2.6	1.8	5.8
Albizia saman(Jacq.)Merr.	0.1	0.0	0.1	0.0	0.1
Alstoniascholaris (L.) R. Br.	3.4	0.5	1.0	0.4	1.9
Altingiaexcelsa Noronha	0.1	0.0	0.1	0.0	0.1
Ardisia humilis Vahl	0.1	0.0	0.1	0.0	0.1
Artocarpus chaplashaRoxb.	8.3	0.5	1.1	0.9	2.4
Artocarpus lacucha Buchan	0.2	0.0	0.1	0.0	0.1
Averrhoa carambola L.	4.8	0.5	0.9	0.5	1.9
Azadirachta indica A. Juss.	0.7	0.1	0.3	0.1	0.5
Balakatabaccata (Roxb.) Esser	2.1	0.1	0.4	0.2	0.7
Bauhinia purpurea L.	20.4	2.5	2.7	2.1	7.3
Bischofiajavanica Blume	0.2	0.0	0.0	0.0	0.1
Bixa orellana L.	0.0	0.0	0.1	0.0	0.1
Bombax ceiba L.	2.9	0.2	0.4	0.3	0.9
Bridelia retusa (L.) A.Juss.	1.8	0.5	1.0	0.2	1.7
Bursera serrata Wall. ex Colebr.	6.4	0.5	1.7	0.7	2.9
Callicarpa macrophylla Vahl	0.4	0.1	0.1	0.0	0.2
Canarium bengalenseRoxb.	3.7	0.2	0.7	0.4	1.3
Careya arborea Roxb.	13.3	2.5	3.9	1.4	7.7
Cassia fistula L.	11.5	2.2	2.9	1.2	6.3
Cedrus deodara (Roxb. ex Lamb.)	0.0	0.0	0.0	0.0	0.0
Cephalanthustetrandra (Roxb.)	2.6	0.2	1.0	0.3	1.5
Chisochetoncumingianus	1.0	0.1	0.2	0.1	0.4
Chukrasiatabularis A. Juss.	0.8	0.1	0.2	0.1	0.3
Cinnamomum glaucescens(Nees)	0.1	0.0	0.1	0.0	0.1
Cinnamomum tamala (Buch.-Ham.)	0.1	0.0	0.0	0.0	0.1
Colona floribunda (Kurz) Craib	1.2	0.3	0.5	0.1	0.9
Croton persimilisMüll.Arg.	0.2	0.1	0.1	0.0	0.2

Data analysis reveals that tree species belonging to 116 different genera have been recorded in the forests of this division. The most dominant families recorded in the division are Dipterocarpaceae, Theacea, Verbenaceae, Euphorbiaceae and moracea. *Shorearobusta, Schimawallichii, Vitex altissima* and *Duabanga grandiflora* are the most frequently occupying species apart from artificially planted *Tectona grandis* in the division.

Schimawallichii and *Dilleniapentagyna*are are two important Sal associates, indicating that the division is naturally suitable for promotion of Kamrup Sal species.
Shorearobusta (Sal) has the IVI of 51.4 followed by *Tectona grandis L.f*(Teak), *Schimawalichii (DC.) Kuntze.varkhasiana (Dyer) Bloem*(44.4), *DelliniapentagynaRoxb.* (24.1) and *Lagerstroemia parviflora Roxb*(10.5). Species recorded were screened for their uniqueness with references in the literature. No species under Red Data Book was recorded. All the species recorded were abundant in nature. However, species like *Litseachinensis, Mallotusroxburghii, Aporosaaurea, Elaeocarpus robustus, Sloaneaassamica, Belischmiediaassamica, Flacourtiacataphracta a*re now rarely seen in the division.

3.3 Status of Biodiversity Conservation in Forests: The genetic, species and ecosystem diversity of forest areas of Kamrup East Division are very rich. The current studies check listed 383 species of plants, 30 species of mammals, 212 species of birds, 29 species of reptiles, 9 species of amphibians and 79 species of butterflies and many species of fungi, mosses, insects, etc. These communities of plants and animals and non-living elements are susceptible due to various man made issues that is habitat destruction by way of encroachment, illegal felling of these, change of land use pattern for settlement or growing agricultural crop, impact of introduced species, invasive species and other human introduced disaster.
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, Wildlife (Protection) Act 1972, Assam State Action Plan on Climate Change 2015-2030, etc. for conservation of biodiversity. The strategies include:

a. Protection of natural resources and restoration of ecosystem and increase the value of natural resources.
b. Restrict habitat fragmentation and loss of genetic, species and ecological diversity.
c. Promotion of natural regeration.
d. Improvement in canopy density.
e. Documentation of fauna and flora to develop scientific database.
f. Prioritising rare and endangered species conservation.
g. Provision for scientific monitoring and ecological research.
h. Involvement of local communities who are solely dependent on forest for their livelihood development.
i. Management of funds for biodiversity conservation and enhancement of related works.

However, on ground implementation of some of the activities mentioned later require to be strengthend during the tenure of this working plan. List of species that are becoming rare in this division is shown in Annexure-IV.

3.4 Status of Species Prone to Over Exploitation: Under the present system in the Division Sal, Makri Sal, Gamari and Teak are prone to over exploitation. Due to high demand for timber these important forest tree species are over exploited. The fringe villagers including Joypur forest villagers over exploited the bamboos for their daily household requirement as well as for selling at local markets in semi urban localities. The aboriginal tribal communities also collect N.T.F.P. unscientifically to sale at weekly markets, which also cause impact on both fauna and flora.

3.5 Conservation of Genetic Resources: The conservation of genetic resources is not yet documented in the division. However, preservation plots, sample plots, medicinal plant's conservation areas, community conservation areas, etc., inaddition to genetic diversity, especially of NTFPs including MAPs will be documented and monitored through research studies with the help of research organizations during the tenure of this working plan. Permanent sample plots of atleast 5.0 ha each will be demarcated in the division in consultation with the research wing of the department. Two to three sample plots may be maintained in each forest type. It is also suggested that pure stands of important species be raised and maintained as Experimental plots. Observations should be recorded periodically from these plots. The range offices have been provided with field data collection equipments Kit which includes Clinometer, Densiometer, Field Compass, Steel tapes, Altimeter, Vernier Callipers, etc. The territorial staff should maintain these Experimental plots. The data collected should be analysed for future forest management. There is need to develop Medicinal Plants Conservation Areas (MPCA), community conservation areas, etc. in the division for conservationof genetic resources.

3.6 Fauna and Their Habitats: Diverse fauna exist in the division. Different faunas and their habitats/microhabitats in the division are shown in below.

Table 3.6: List of diverse fauna found in Kamrup East Division

Mammals			
Sl.No.	Local Name	Scientific Name	Habitat / Microhabitat
1	Hati	*Elephas maximus*	Almost all over the RFs and PRFs
2	BonoriaGahori	*Sus cirstatus*	
3	Dhekia-patia Bagh	*Panthera tigris*	
4	Nahar-phutiki Bagh	*Panthera pardus*	
5	Joha Mal	*Vivorrazibotha*	
6	Gash Bhaluk	*Malurusarslnus*	
7	XugoriPohu	*Muntiacusmuntiak*	
8	Xial	*Canis aureus*	
9	Bandar	*Macca inulata*	
10	Hollo Bandar	*Hylobetes hoolock*	
11	Neul	*Herpestesspp*	
12	Ud	*Lutralutra*	
13	XohaPohu	*Lepus ruficaudatus*	
14	Kerkettua	*Dremnomyslokriah*	
15	KemtaiPohu/Bonrou	*Mains crassicaudata*	
16	KetallaPohu	*Hystrix indica*	
Birds			
1.	Kauri	*Corvus splendence*	
2.	Dhura Kaori	*Corvus macrohyncho*	
3.	Kolakhuti or Chukchoki	*Dandroclttavagabunda*	
4.	Bulbuli, Petuluka	*Molpastescafer*	
5.	Dohikotora	*Copsychuscaularis*	

6.	Phesu	*Dicrurusmacrooarus*	Almost all over the RFs and PRFs
7.	Bhimraj	*Dissomurusparadiseus*	
8.	Hokhloti, Patmadol	*Ololusoriolus*	
9.	Moina	*Gracula religiosa*	
10.	Kath Halika	*Sturniamalabarica*	
11.	ChutiaHalika	*Acridotheresginginianus*	
12.	Kankurika	*Sturnopaster contra*	
13.	TokoraCharai	*Ploceusphilliplnus*	
14.	Bota Charai	*Urolonchа striate*	
15.	GhanChirika	*Passer domesticus*	
16.	Bali-mahi, Khojjan	*Motacilla alba*	
17.	Barhoitoka,K athkhola	*Dryobatesmahrattensis*	
18.	Heteluka	*Xantholoemahaemacophal*	
19.	Keteki	*Hierococcyxvairous*	
20.	Kuli	*Endynamisscolopaccus*	
21.	Kukuha	*Centropussinerisis*	
22.	Kaocharai	*Coraciesbengalansis*	
23.	Bhatow	*Psittaculacuptria*	
24.	Machuruka	*Carylerudis*	

3.7 Threats and Challenges to Wild Life: The forest areas of Kamrup East Division are rich in both faunal and floral diversity. The species diversity and ecosystem diversity are still very healthy, which needs to be conserved for both moral and practical reasons. During last two decades the forest areas were considerably exploited by way of encroachment, illegal lopping, collection of firewood and fodder, conversion of *juliland* for agricultural practices. This has resulted changes in the behaviour of wild animals as they are dependent directly or indirectly on plants for their survival. Some significant changes of behaviour has been observed in some species. Earlier wild elephant appeared in the adjacent agricultural fields during winter season, but nowadays wild elephant starts straying out almost all the year. Similarly, due to lack of preybase in some of the reserve forests of this division attack of leopard on domestic animals has become a regular phenomena. Such type of wildlife conflict has increased mainly because of encroachment and destruction of wildlife habitat. Conflicts between human and wildlife have caused death and injury in either sides. The department is compelled to capture animals in conflict for safety of human beings. Some birds such as Greater Adjutent Stork, Black Kites are becoming more dependent on garbages then their natural food. Forest destruction resulting in conflicts and changes in behaviour of wildlife is the major threat and challenges that needs to be addressed on priority basis.

3.8 Protection and Management of Fauna: The proper understanding of wildlife and its scientific management is essential to know the biological background for management of fauna. Reserve forest areas under Kamrup East Division having diverse mega species like elephant, endangered species like hoolock gibbon, leopard, leopard cat, serow, adjutant stork, lineated barbet, trogon, white rumped vulture, long billed vulture, broadbills, etc. needs to be well protected. This Division have 7 Ranges, 23 Beats, 3 Sub-beats and 5 camps for protection of fauna and flora. There are two protected areas on close proximity to the forest

areas of Kamrup East Division i.eAmchang Wildlife Sanctuary and DeeparBeel Wildlife Sanctuary which are under the direct control of Guwahati Wildlife Division.

The rapid change of land use pattern on the fringe areas, development of roadways and railways, heavy movement of vehicular traffic, installation of electric transmission lines, encroachment, air and noise pollution are the major threat to wildlife of this division. Wild animals quite often stray out from the forested areas to human habitation due to man made reasons increases man-animal conflict. Driving back and rescue of such animal are the harqulious task for the front line staff of the division. The species frequent to human habitation are Asian elephant, Leopard, Leopard cat, three species of Civet Cat, Barking deer, Geckos, Python and other venomous and non venomous snakes.

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CHAPTER 4
MAINTENANCE AND ENHANCEMENT OF FOREST HEALTH AND VITALITY

4.1Status of Regeneration: Past record on regeneration is lacking. During the tenure of this Working Plan prescription, it is proposed to initiate regeneration assessment studies. In areas under Sal, natural regeneration is adequate on forest gaps with scattered mother trees. In other areas its natural regeneration is scanty as seeds fail to reach the ground due to thick undergrowth. Another important factor that affects natural regeneration of Sal in this division is the unsuitable environmental conditions, especially during germination period and seedling establishment phase. The germination of fresh seeds is high during June and July, attaining a peak during August. Seedling population decreases after the rainy season with high mortality during the dry winter season. Reduced seedling numbers is due to drought stress associated with limited rainfall and low temperatures. Lowest survival of Sal germinated seedlings was mainly during the dry winter seasons in the division.

Although naural regeneration of other species exists, survival of saplings is poor due to biotic interferences. To supplement artificial natural regeneration of trees through plantation covering 2,378.50 hectares of land have been undertaken with the locally available tree species in the past. Abstract of plantation raised in the past in the division is shown in Vol-II.

The natural bamboo regeneration is in substantial areas due to non-working of bamboos in the bamboo brakes, especially in areas of Garbhanga RF. In order to increase area under bamboo, 657 ha of bamboo plantations (Annexure VII) have been carried out in the division in the past.

Table 4.1: Compartment wise growing stock of wood in cu.m.

Comp no	Forest Type	Forest Density	Diameter Class						Total
			D1	D2	D3	D4	D5	D6	
APRICOLA WEST RF									
APRK 1	Mixed Moist Forest	OF	0.52	25.24	608.97	1570.68	514.93	238.03	2958.37
		MDF	0.00	0.00	101.63	330.91	121.91	0.00	554.45
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Kamrup Sal Forest	OF	7.09	75.59	117.63	189.29	112.01	233.42	735.03
		MDF	0.98	12.99	38.71	108.32	22.12	72.98	256.10
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total		8.59	113.82	866.94	2199.20	770.97	544.43	4503.95
APRK 2	Mixed Moist Forest	OF	0.46	22.22	536.11	1382.76	453.33	209.55	2604.43
		MDF	0.00	0.00	11.07	36.04	13.28	0.00	60.39
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Kamrup Sal Forest	OF	6.19	66.03	102.75	165.35	97.84	203.91	642.07
		MDF	0.61	8.04	23.94	66.99	13.68	45.13	158.39
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total		7.26	96.29	673.87	1651.14	578.13	458.59	3465.28
	Mixed	OF	0.61	29.15	703.14	1813.58	594.56	274.84	3415.88

APRK 3	Moist Forest	MDF	0.00	0.00	15.93	51.86	19.10	0.00	86.89
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Kamrup Sal Forest	OF	8.72	93.04	144.77	232.97	137.86	287.29	904.65
		MDF	0.84	11.14	33.18	92.85	18.96	62.55	219.52
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total		10.17	133.33	897.02	2191.26	770.48	624.68	4626.94
APRK 4	Mixed Moist Forest	OF	0.91	43.61	1052.11	2713.67	889.65	411.24	5111.19
		MDF	0.00	0.00	74.86	243.75	89.80	0.00	408.41
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Kamrup Sal Forest	OF	1.47	15.70	24.42	39.30	23.26	48.47	152.62
		MDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total		2.38	59.31	1151.39	2996.72	1002.71	459.71	5672.22
APRK 5	Mixed Moist Forest	OF	0.58	27.83	671.34	1731.57	567.68	262.41	3261.41
		MDF	0.00	0.00	201.95	657.58	242.26	0.00	1101.79
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Kamrup Sal Forest	OF	2.73	29.08	45.25	72.82	43.09	89.80	282.77
		MDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total		3.31	56.91	918.54	2461.97	853.03	352.21	4645.97
APRK 6	Mixed Moist Forest	OF	1.28	61.43	1482.10	3822.74	1253.25	579.32	7200.2
		MDF	0.00	0.00	91.14	296.78	109.34	0.00	497.26
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Kamrup Sal Forest	OF	5.55	59.20	92.13	148.25	87.73	182.82	575.68
		MDF	0.36	4.73	14.09	39.44	8.05	26.57	93.24
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total		7.19	125.36	1679.46	4307.21	1458.37	788.71	8366.3
APRK 7	Mixed Moist Forest	OF	0.97	46.65	1125.42	2902.76	951.64	439.90	5467.3
		MDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Kamrup Sal Forest	OF	1.71	18.29	28.47	45.81	27.11	56.49	177.88
		MDF	0.02	0.29	0.86	2.40	0.00	0.00	3.57
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total		2.70	65.23	1154.75	2950.97	978.75	496.39	5648.9
APRK 8	Mixed Moist Forest	OF	0.76	36.48	880.14	2270.12	744.24	344.03	4275.7
		MDF	0.00	0.00	30.01	97.71	36.00	0.00	163.72
		VDF	7.01	13.16	25.63	12.06	2.39	0.00	60.25
	Kamrup Sal Forest	OF	0.03	0.37	0.57	0.92	0.00	0.00	1.89
		MDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total		7.80	50.01	936.35	2380.81	782.63	344.03	4501.6
	Mixed Moist Forest	OF	0.76	16.50	220.10	1070.20	301.40	144.03	1752.9
		MDF	0.00	0.00	30.01	97.71	36.00	0.00	163.72

APRK 9		VDF	7.01	13.16	25.63	12.06	2.39	0.00	60.25
	Kamrup Sal Forest	OF	0.00	0.37	0.57	0.92	0.00	0.00	1.86
		MDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total		7.77	30.03	276.31	1180.89	339.79	144.03	1978.8
APRK 10	Mixed Moist Forest	OF	0.81	38.88	938.09	2419.57	793.23	366.68	4557.6
		MDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Kamrup Sal Forest	OF	0.11	1.18	1.83	2.94	1.74	3.63	11.43
		MDF	0.80	10.50	31.29	87.56	17.88	58.99	207.02
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total		1.72	50.56	971.21	2510.07	812.85	429.30	4775.7
	Mixed Moist Forest	OF	1.27	61.04	1472.63	3798.31	1245.24	575.62	7154.1
		MDF	0.00	0.00	28.97	94.34	34.76	0.00	158.07
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
APRK 11	Kamrup Sal Forest	OF	7.12	76.00	118.26	190.30	112.61	234.67	738.96
		MDF	0.00	1.07	3.18	8.89	1.81	5.99	20.94
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total		8.39	138.11	1623.04	4091.84	1394.42	816.28	8072.08
APRK 12	Mixed Moist Forest	OF	0.53	25.48	614.76	1585.63	519.83	240.29	2986.52
		MDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Kamrup Sal Forest	OF	7.53	80.36	125.04	201.22	119.07	248.14	781.36
		MDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total		8.06	105.84	739.80	1786.85	638.90	488.43	3767.88
MALIATA RF									
MAL1	Mixed Moist Forest	OF	24.65	143.23	162.01	135.07	59.88	46.00	570.84
		MDF	37.86	73.52	68.22	73.67	25.51	0.00	278.78
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Kamrup Sal Forest	OF	48.20	206.91	339.54	429.28	233.70	544.89	1802.52
		MDF	11.77	24.81	17.48	31.14	5.27	110.79	201.26
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total		122.48	448.47	587.25	669.16	324.36	701.68	2853.4
MARAKDOLA RF									
MARK 1	Mixed Moist Forest	OF	0.00	0.98	23.58	30.82	19.94	9.22	84.54
		MDF	0.00	0.00	0.99	3.22	1.19	0.00	5.40
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Kamrup Sal Forest	OF	78.44	536.78	902.10	635.83	439.90	238.91	2831.96
		MDF	3.92	51.79	154.29	231.70	88.15	90.84	620.69
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total		82.36	589.55	1080.96	901.57	549.18	338.97	3542.59
	Mixed	OF	0.00	1.12	26.91	69.40	22.75	10.52	130.70

MARK 2	Moist Forest	MDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Kamrup Sal Forest	OF	62.51	666.85	837.67	669.65	488.10	353.42	3078.20
		MDF	0.44	5.86	17.45	48.82	9.97	12.89	95.43
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total		62.95	673.83	882.03	787.87	520.82	376.83	3304.33
MARK 3	Mixed Moist Forest	OF	0.00	0.70	16.78	43.28	14.19	6.56	81.51
		MDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		OF	85.47	911.79	1418.81	2283.20	1351.04	2815.52	8865.83
		MDF	0.53	7.03	20.95	58.60	11.97	39.48	138.56
	Kamrup Sal	VDF	9.61	29.13	51.99	30.49	11.68	8.78	141.68
	Total		95.61	948.65	1508.53	2415.57	1388.88	2870.34	9227.58
MOTAPAHAR RF									
MOT1	Mixed Moist Forest	OF	1.72	10.02	11.33	9.45	4.19	3.22	39.93
		MDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Kamrup Sal Forest	OF	24.01	103.07	129.13	183.84	116.41	166.22	722.68
		MDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total		25.73	113.09	140.46	193.29	120.60	169.44	762.61
CHAMATA RF									
CHA1	Forest Plantation		0.00	33.52	33.00	0.00	0.00	0.00	66.52
	Total		2.7	15.3	9.23	3.67	0	0	30.9
TETELIGURI RF									
TET1	Mixed Moist Forest	OF	89	90	53	25	12	8	277
		MDF	44	35	13	8	2	0	102
		VDF	0	0	0	0	0	0	0
	Kamrup Sal Forest	OF	9	12	10	7	2	2	42
		MDF	122	77	36	19	6	11.25	271.25
		VDF	0	0	0	0	0	0	0
	Total		264	214	112	59	22	21.25	692.25
GARBHANGA RF									
GAR1	Mixed Moist Forest	OF	0.46	2.64	2.99	2.49	1.11	0.00	9.69
		MDF	0.91	2.26	3.98	2.07	1.06	0.35	10.63
		VDF	0.68	1.28	2.49	1.17	0.00	0.00	5.62
	KamrupSal Forest	OF	91.79	407.78	691.11	560.07	130.69	150.38	2031.82
		MDF	22.08	64.04	98.62	29.87	28.33	19.75	262.69
		VDF	4.96	15.03	26.83	15.73	6.03	4.53	73.11
	Total		120.88	493.03	826.02	611.40	167.22	175.01	2393.56
	Mixed	OF	46.11	267.92	303.06	252.67	112.01	86.05	1067.82

GAR2	Moist Forest	MDF	57.69	143.55	253.04	132.03	67.54	22.42	676.27
		VDF	12.30	23.11	45.00	21.17	4.20	0.00	105.78
	KamrupSal Forest	OF	83.20	369.63	626.45	507.67	118.46	136.31	1841.72
		MDF	44.18	128.12	197.31	59.75	56.69	39.51	525.56
		VDF	14.23	43.13	76.97	45.13	17.29	12.99	209.74
	Total		257.71	975.46	1501.83	1018.42	376.19	297.28	4426.89
		OF	44.80	260.31	294.45	245.49	108.82	83.61	1037.48
GAR3	Mixed Moist	MDF	121.10	301.32	531.15	277.13	141.77	47.06	1419.53
		VDF	5.35	10.04	19.55	9.20	1.82	0.00	45.96
	KamrupSal Forest	OF	49.58	220.27	373.32	302.54	70.60	81.23	1097.54
		MDF	51.00	147.90	227.77	68.98	65.44	45.61	606.70
		VDF	13.57	41.11	73.36	43.02	16.48	12.38	199.92
	Total		285.40	980.95	1519.60	946.36	404.93	269.89	4407.13
GAR4	Mixed Moist Forest	OF	35.25	204.81	231.67	193.15	85.62	0.00	750.50
		MDF	18.72	46.58	82.10	42.84	21.92	0.00	212.16
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	KamrupSal Forest	OF	170.50	757.41	883.67	240.27	142.74	279.31	2473.90
		MDF	57.99	168.18	259.00	78.44	74.42	51.86	689.89
		VDF	6.08	18.44	32.90	19.29	7.39	5.55	89.65
	Total		288.54	1195.42	1489.34	573.99	332.09	336.72	4216.10
GAR5	Mixed Moist Forest	OF	145.78	846.98	958.07	798.76	354.08	272.05	3375.72
		MDF	75.54	187.96	331.32	172.87	88.44	29.35	885.48
		VDF	10.67	20.03	39.00	18.35	3.64	0.00	91.69
	KamrupSal Forest	OF	125.16	556.00	942.32	763.65	178.19	205.04	2770.36
		MDF	76.01	220.41	339.44	102.80	97.53	67.97	904.16
		VDF	11.81	35.79	63.86	37.45	14.34	10.78	174.03
	Total		444.97	1867.17	2674.01	1893.88	736.22	585.19	8201.44
GAR6	Mixed Moist Forest	OF	162.17	742.24	865.81	888.60	393.91	302.64	3355.37
		MDF	117.63	292.69	515.94	269.20	137.71	45.71	1378.88
		VDF	15.05	28.27	55.05	25.90	5.14	0.00	129.41
	Kamrup Sal Forest	OF	112.04	497.70	643.52	583.58	139.51	123.54	2099.89
		MDF	95.54	277.06	426.69	129.22	122.60	85.44	1136.55
		VDF	9.81	29.72	53.04	31.10	11.91	8.95	144.53
	Total		512.24	1867.68	2560.05	1927.60	810.78	566.28	8244.63
GAR7	Mixed Moist Forest	OF	149.53	768.76	682.70	519.31	363.19	179.04	2662.53
		MDF	122.42	304.62	536.96	280.16	143.33	47.57	1435.06
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	KamrupSal Forest	OF	80.23	356.41	404.05	389.51	114.23	131.43	1475.86
		MDF	39.59	114.81	176.81	53.55	50.80	35.41	470.97
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total		391.77	1544.60	1800.52	1242.53	671.55	393.45	7653.17
		OF	312.40	1115.06	1153.12	811.74	558.80	582.99	4534.11
		MDF	491.14	1222.07	1289.60	823.97	575.00	190.86	4592.64

GAR8	Moist Mixed	VDF	30.16	56.63	110.28	51.89	10.29	0.00	259.25
	KamrupSal Forest	OF	121.37	539.18	613.81	540.54	172.80	198.84	2186.5
		MDF	205.90	597.11	619.56	278.48	264.21	184.14	2149.4
		VDF	30.44	92.23	104.58	96.51	36.97	27.78	388.51
	Total		1191.41	3622.28	3890.95	2603.13	1618.7	1184.61	14110.5
GAR9	Mixed Moist Forest	OF	333.51	1937.71	2091.85	1827.40	710.07	622.38	7522.9
		MDF	201.36	501.03	883.19	460.81	235.74	78.25	2360.4
		VDF	130.15	244.42	475.96	223.94	44.41	0.00	1118.9
	KamrupSal Forest	OF	166.08	737.80	1150.45	1013.35	236.46	244.81	3548.9
		MDF	116.04	336.50	518.22	156.94	148.89	103.77	1380.4
		VDF	59.04	178.89	319.23	187.19	71.70	53.88	869.93
	Khasi Hill Sal Forest	OF	5.93	27.30	17.89	13.84	14.32	0.00	79.28
		MDF	5.96	23.06	0.00	0.00	0.00	0.00	29.02
		VDF	1.69	9.88	0.00	0.00	0.00	0.00	11.57
	Total		1019.76	3996.59	5456.79	3883.47	1461.5	1103.09	16921.9
GAR10	Mixed Moist Forest	OF	193.45	723.93	571.34	459.95	369.86	161.00	2479.5
		MDF	151.15	376.09	462.95	245.90	106.95	38.74	1381.8
		VDF	15.13	28.41	55.32	26.03	5.16	0.00	130.05
	KamrupSal Forest	OF	95.52	124.35	219.19	112.83	96.00	56.49	704.38
		MDF	45.74	92.63	44.25	31.86	28.69	10.90	254.07
		VDF	0.46	1.38	2.46	1.44	0.00	0.00	5.74
	Khasi HillSal Forest	OF	2.49	11.45	7.50	4.80	4.01	0.00	30.25
		MDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total		503.94	1358.24	1363.01	882.81	610.67	267.13	4985.8
GAR11	Mixed Moist Forest	OF	219.66	1276.23	1443.62	1203.58	533.54	409.92	5086.55
		MDF	159.77	397.56	700.79	365.64	187.05	62.09	1872.90
		VDF	122.16	229.41	446.73	210.19	41.68	0.00	1050.17
	Kamrup Sal Forest	OF	42.97	190.88	323.51	262.17	61.18	70.39	951.10
		MDF	26.28	76.21	117.36	35.54	33.72	23.50	312.61
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Khasi Hill Sal Forest	OF	10.15	46.69	30.59	23.67	24.49	0.00	135.59
		MDF	1.88	7.26	0.00	0.00	0.00	0.00	9.14
		VDF	3.98	23.23	0.00	0.00	0.00	0.00	27.21
	Total		586.85	2247.47	3062.60	2100.79	881.66	565.90	9445.27

GAR12	Mixed Moist Forest	OF	321.91	1870.30	1115.60	763.83	481.89	110.73	4664.26
		MDF	177.81	442.44	779.91	406.92	208.17	69.10	2084.35
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Kamrup Sal Forest	OF	100.78	447.72	558.81	314.93	70.49	65.11	1557.84
		MDF	3.52	10.21	15.72	4.76	4.52	3.15	41.88
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Khasi Hill Sal Forest	OF	10.39	47.80	31.31	24.23	25.07	0.00	138.80
		MDF	5.09	19.67	0.00	0.00	0.00	0.00	24.76
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total		619.50	2838.14	2501.35	1514.67	790.14	248.09	8511.89
GAR13	Mixed Moist Forest	OF	118.57	688.92	779.27	649.70	288.00	221.28	2745.74
		MDF	137.57	342.30	603.40	314.83	161.06	53.46	1612.62
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	KamrupSal Forest	OF	0.23	1.02	1.73	1.40	0.00	0.00	4.38
		MDF	0.22	0.64	0.98	0.00	0.00	0.00	1.84
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Khasi Hill Sal Forest	OF	0.61	2.81	1.84	1.43	1.48	0.00	8.17
		MDF	0.18	0.69	0.00	0.00	0.00	0.00	0.87
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total		274.21	1146.72	1512.78	1106.15	464.69	274.74	4779.29
GAR14	Mixed Moist Forest	OF	171.42	695.97	826.60	739.27	416.37	219.90	3069.53
		MDF	250.44	623.16	998.47	573.13	293.20	97.32	2835.72
		VDF	47.28	88.78	172.88	81.34	16.13	0.00	406.41
	KamrupSal Forest	OF	27.29	121.24	105.48	66.52	18.86	24.71	364.10
		MDF	4.24	8.31	8.95	3.74	3.45	1.79	30.48
		VDF	0.41	1.23	1.20	1.29	0.00	0.00	4.13
	Khasi HillSal Forest	OF	2.94	13.52	8.86	6.85	7.09	0.00	39.26
		MDF	1.85	7.15	0.00	0.00	0.00	0.00	9.00
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total		505.87	1559.36	2122.44	1472.14	755.10	343.72	6758.63
GAR15	Mixed Moist Forest	OF	192.02	1115.65	1261.98	1052.14	466.40	358.34	4446.53
		MDF	275.28	684.96	1207.40	629.97	322.28	106.97	3226.86
		VDF	45.28	85.04	165.60	77.92	15.45	0.00	389.29
	Kamrup Sal Forest	OF	52.85	134.77	197.89	122.45	75.24	46.58	629.78
		MDF	9.65	17.98	23.10	13.05	12.38	5.63	81.79
		VDF	0.42	1.28	1.29	1.34	0.00	0.00	4.33
		OF	5.73	8.39	7.29	3.38	3.84	0.00	28.63
	Khasi HillSal	MDF	2.07	8.00	0.00	0.00	0.00	0.00	10.07
		VDF	0.09	0.54	0.00	0.00	0.00	0.00	0.63
	Total		583.39	2056.61	2864.55	1900.25	895.59	517.52	8817.91
	Mixed Moist	OF	67.85	394.20	445.91	271.76	104.80	96.62	1381.14
		MDF	132.99	330.90	483.29	304.34	105.69	51.68	1408.89

GAR16	Forest	VDF	1.19	2.23	4.33	2.04	0.40	0.00	10.19
	KamrupSal Forest	OF	13.26	58.89	99.81	80.88	18.87	21.72	293.43
		MDF	4.26	12.35	19.02	5.76	5.47	3.81	50.67
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total		219.55	798.57	1052.36	664.78	235.23	173.83	3144.32
GAR17	Mixed Moist Forest	OF	140.74	817.72	724.96	671.17	341.85	162.65	2859.09
		MDF	174.59	434.42	665.77	399.55	204.40	67.85	1946.58
		VDF	30.41	57.10	111.20	52.32	10.37	0.00	261.40
	KamrupSal Forest	OF	9.63	42.78	72.50	58.75	13.71	15.78	213.15
		MDF	0.31	0.91	1.40	0.00	0.00	0.00	2.62
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Khasi HillSal Forest	OF	40.32	185.58	121.57	94.06	97.34	0.00	538.87
		MDF	30.25	117.00	0.00	0.00	0.00	0.00	147.25
		VDF	4.16	24.25	0.00	0.00	0.00	0.00	28.41
	Total		430.41	1679.76	1697.40	1275.85	667.67	246.28	5997.37
GAR18	Mixed Moist Forest	OF	123.86	719.66	814.05	678.70	230.86	191.15	2758.28
		MDF	86.41	215.02	379.02	197.76	101.17	33.58	1012.96
		VDF	125.77	236.18	459.92	216.39	42.91	0.00	1081.17
	Kamrup Sal Forest	OF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		MDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Khasi Hill Sal Forest	OF	10.71	49.29	32.29	24.98	25.85	0.00	143.12
		MDF	4.98	19.27	0.00	0.00	0.00	0.00	24.25
		VDF	5.58	32.56	0.00	0.00	0.00	0.00	38.14
	Total		366.02	1333.57	1723.03	1148.17	470.79	264.73	5306.31
GAR19	Mixed Moist Forest	OF	95.68	555.92	628.84	524.28	232.41	178.56	2215.69
		MDF	174.26	433.59	764.32	398.79	204.01	67.72	2042.69
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	KamrupSal Forest	OF	3.62	16.08	27.26	22.09	5.15	5.93	80.13
		MDF	1.05	3.05	2.70	1.42	1.35	0.00	9.57
		VDF	25.49	77.24	137.84	80.83	0.00	23.27	344.67
	Khasi Hill Sal Forest	OF	0.13	0.58	0.00	0.00	0.00	0.00	0.71
		MDF	0.79	2.06	0.00	0.00	0.00	0.00	2.85
		VDF	0.89	2.18	0.00	0.00	0.00	0.00	3.07
	Total		301.91	1090.70	1560.96	1027.41	442.92	275.48	4699.38
GAR20	Mixed Moist Forest	OF	62.62	363.84	311.56	243.13	112.11	76.86	1170.12
		MDF	68.85	71.30	30.97	15.55	8.60	6.75	202.02
		VDF	11.09	20.83	30.57	9.09	3.79	0.00	75.37
	KamrupSal Forest	OF	11.05	9.10	8.22	7.44	5.74	8.11	49.66
		MDF	0.82	2.37	3.65	1.11	0.00	0.00	7.95
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total		163.55	676.74	900.09	647.16	252.24	161.72	2801.50

GAR21	Mixed Moist Forest	OF	95.01	551.99	624.38	520.57	230.76	47.30	2070.01
		MDF	106.60	165.24	167.55	103.95	94.80	21.42	659.56
		VDF	3.00	5.63	10.97	5.16	0.00	0.00	24.76
	KamrupSal Forest	OF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		MDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Khasi HillSal Forest	OF	30.69	141.22	62.51	51.57	54.07	0.00	340.06
		MDF	15.70	60.71	0.00	0.00	0.00	0.00	76.41
		VDF	0.78	4.53	0.00	0.00	0.00	0.00	5.31
	Forest Plantation		0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total		265.67	1136.61	1292.58	940.68	429.63	218.72	4283.89
GAR22	Mixed Moist Forest	OF	63.12	366.72	414.82	345.85	153.31	117.79	1461.61
		MDF	33.36	83.01	146.32	76.34	39.06	12.96	391.05
		VDF	57.39	107.77	209.86	98.74	19.58	0.00	493.34
	Khasi Hill Sal Forest	OF	10.32	47.51	31.12	24.08	24.92	0.00	137.95
		MDF	6.31	24.41	0.00	0.00	0.00	0.00	30.72
		VDF	14.49	84.54	0.00	0.00	0.00	0.00	99.03
	Total		204.71	873.92	971.31	729.32	236.87	130.75	3146.88
GAR23	Mixed Moist Forest	OF	113.33	658.47	744.83	620.98	275.28	211.50	2624.39
		MDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		VDF	112.08	210.47	409.85	192.84	38.24	0.00	963.48
	KamrupSal Forest	OF	0.54	2.38	4.04	3.27	0.00	0.00	10.23
		MDF	84.15	244.02	375.80	113.81	107.97	75.25	1001.00
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		OF	7.39	33.99	22.27	17.23	17.83	0.00	98.71
		MDF	3.45	13.33	0.00	0.00	0.00	0.00	16.78
	Khasi Hill Sal	VDF	5.62	32.78	0.00	0.00	0.00	0.00	38.40
	Total		359.71	1481.14	1909.94	1352.91	439.32	286.75	5829.77
GAR24	Mixed Moist Forest	OF	113.33	658.47	744.83	620.98	275.28	211.50	2624.39
		MDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		VDF	112.08	210.47	409.85	192.84	38.24	0.00	963.48
	KamrupSal Forest	OF	0.54	2.38	4.04	3.27	0.00	0.00	10.23
		MDF	84.15	244.02	375.80	113.81	107.97	75.25	1001.00
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Khasi Hill Sal Forest	OF	7.39	33.99	22.27	17.23	17.83	0.00	98.71
		MDF	3.45	13.33	0.00	0.00	0.00	0.00	16.78
		VDF	5.62	32.78	0.00	0.00	0.00	0.00	38.40
	Total		359.71	1481.14	1909.94	1352.91	439.32	286.75	5829.77
HENGRABARI RF									
	Mixed Moist	OF	10.18	59.15	66.91	55.79	24.73	19.00	235.76
		MDF	8.36	16.23	15.06	16.26	5.63	0.00	61.54
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00

HEN1	Kamrup Sal Forest	OF	82.11	352.47	578.40	731.28	398.11	928.22	3070.59
		MDF	27.59	58.16	40.97	73.00	12.35	259.71	471.78
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Forest Plantation		0.00	0.00	0.00	536.20	0.00	0.00	536.20
	Total		128.24	486.01	701.34	1412.53	440.82	1206.93	4375.87
SARANIA HILL RF									
SAH1	Mixed Moist Forest	OF	0.17	1.01	1.14	0.95	0.00	0.00	3.27
		MDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Kamrup Sal Forest	OF	1.13	4.87	7.98	10.09	5.50	12.81	42.38
		MDF	4.65	9.81	6.91	0.00	0.00	43.79	65.16
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total		5.95	15.69	16.03	11.04	5.5	56.6	110.81
SOUTH KALAPAHAR RF									
SKA1	Kamrup Sal Forest	OF	2.09	6.97	12.10	8.60	7.12	3.60	40.48
		MDF	3.98	4.61	7.19	2.83	2.68	2.31	23.60
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total		8.07	21.66	23.6	34.43	12.81	79.93	64.08
JARASAL RF									
		OF	5.36	19.19	26.97	14.20	7.63	7.66	81.01
		MDF	0.41	1.81	3.10	0.43	0.00	0.00	5.75
JAR1	Mixed Moist	VDF	1.00	3.00	2.90	1.27	0.00	0.00	8.17
	Kamrup Sal Forest	OF	118.26	395.52	408.87	323.90	201.71	188.96	1637.22
		MDF	2.04	4.41	10.34	2.57	1.25	26.57	47.18
		VDF	1.05	4.04	9.23	2.17	0.00	34.58	51.07
	Forest Plantation		75.93	658.65	838.54	335.16	281.98	0.00	2190.26
	Total		204.05	1086.62	1299.95	679.70	492.57	257.77	4020.66
JAR2	Kamrup Sal Forest	OF	159.80	534.46	1133.53	707.92	272.57	1741.73	4550.01
		MDF	145.67	314.86	737.33	183.13	89.47	1895.59	3366.05
		VDF	82.04	315.61	720.67	169.66	0.00	2698.75	3986.73
	Total		387.51	1164.93	2591.53	1060.71	362.04	6336.07	11902.8
JAR3	Mixed Moist Forest	OF	8.20	29.33	41.22	21.71	11.66	11.71	123.83
		MDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Kamrup Sal Forest	OF	152.75	510.86	1083.48	676.66	260.53	1664.82	4349.10
		MDF	106.42	230.01	538.64	133.78	65.36	1384.78	2458.99
		VDF	235.72	906.86	2070.77	487.51	0.00	7754.58	11455.5
	Total		503.09	1677.06	3734.11	1319.66	337.55	10815.8	18387.4
	Mixed Moist	OF	78.14	279.58	392.94	206.94	111.14	111.58	1180.32
		MDF	80.61	351.63	603.70	83.57	49.17	136.46	1305.14

JAR4	Forest	VDF	0.48	1.45	1.40	0.00	0.00	0.00	3.33
	Kamrup Sal Forest	OF	418.95	1401.18	2971.76	1855.94	714.59	4566.25	11928.7
		MDF	99.97	216.07	505.99	125.67	61.40	1300.85	2309.95
		VDF	31.12	119.71	273.34	64.35	0.00	1023.62	1512.14
	Forest Plantation		22.39	194.23	955.04	541.18	142.14	0.00	1854.98
	Total		731.66	2563.85	5704.17	2877.6	1078.44	7138.76	20094.5
JAR5	Mixed Moist Forest	OF	28.81	167.40	189.35	157.87	69.98	53.77	667.18
		MDF	64.00	159.25	280.71	146.46	74.93	24.87	750.22
		VDF	18.91	35.51	69.15	32.54	6.45	0.00	162.56
	Kamrup Sal Forest	OF	76.57	340.15	576.50	467.19	109.02	125.44	1694.87
		MDF	13.31	38.60	59.45	18.00	17.08	11.91	158.35
		VDF	3.61	10.94	19.53	11.45	4.39	3.30	53.22
	Forest Plantation		8.72	75.60	371.73	210.65	55.32	0.00	722.02
	Total		213.93	827.45	1566.42	1044.6	337.17	219.29	4208.42
KAWASING RF									
	Mixed Moist Forest	OF	1.62	5.80	8.15	4.29	2.30	2.31	24.47
		MDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
KAW1	Kamrup Sal Forest	OF	159.60	533.79	1132.12	707.04	272.23	1739.56	4544.34
		MDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Forest Plantation		0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total		161.22	539.59	1140.27	711.33	274.53	1741.87	4568.81
KAW2	Mixed Moist Forest	OF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		MDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Kamrup Sal Forest	OF	101.20	338.47	717.86	448.32	172.61	1103.02	2881.48
		MDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total		101.20	338.47	717.86	448.32	172.61	1103.02	2881.48
KAW3	Mixed Moist Forest	OF	88.06	315.05	442.80	233.20	125.24	125.73	1330.08
		MDF	94.99	414.37	711.40	98.48	57.94	160.81	1537.99
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Kamrup Sal Forest	OF	550.63	1241.57	1905.80	1439.7	739.18	817.64	6694.09
		MDF	18.15	39.23	91.88	22.82	11.15	236.21	419.44
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Khasi Hill Sal Forest	OF	6.95	31.97	20.94	16.20	16.77	0.00	92.83
		MDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total		758.78	2042.19	3172.82	1809.9	950.28	1340.39	10074.4
	Mixed	OF	89.25	319.33	448.81	236.37	126.94	127.44	1348.14

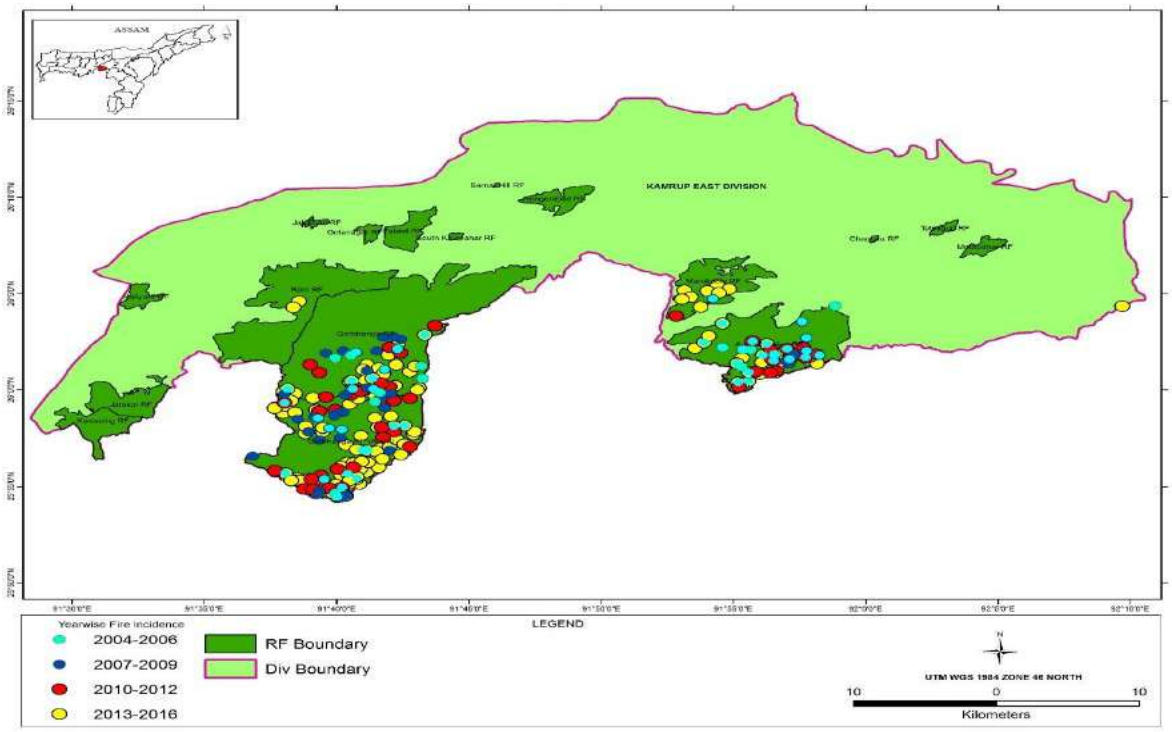
KAW4	Moist Forest	MDF	120.26	524.61	900.67	124.69	73.36	203.59	1947.18
		VDF	19.67	59.00	56.91	24.99	0.00	25.54	186.11
	Kamrup Sal Forest	OF	688.14	2301.46	4881.19	3048.43	1173.72	7500.18	19593.2
		MDF	70.41	152.18	356.36	88.51	43.24	916.16	1626.86
		VDF	32.42	124.72	284.80	67.05	0.00	1066.50	1575.49
	Total		1020.15	3481.30	6928.74	3590.04	1417.26	9839.41	26276.9
RANI RF									
RAN1	Mixed Moist Forest	OF	42.49	246.89	279.27	232.84	103.21	79.30	984.00
		MDF	72.19	179.63	316.64	165.21	84.52	28.05	846.24
		VDF	12.71	23.86	46.47	21.86	4.34	0.00	109.24
	Kamrup Sal Forest	OF	74.38	330.42	560.01	453.82	105.90	121.85	1646.38
		MDF	99.66	289.01	445.08	134.79	127.88	89.13	1185.55
		VDF	3.77	11.44	20.41	11.97	4.58	3.44	55.61
	Total		305.20	1081.25	1667.88	1020.4	430.43	321.77	4827.02
RAN2	Mixed Moist Forest	OF	54.13	314.47	355.72	296.57	131.47	101.01	1253.37
		MDF	130.62	325.00	572.89	298.91	152.92	50.76	1531.10
		VDF	42.91	80.59	156.93	73.84	14.64	0.00	368.91
	Kamrup Sal Forest	OF	65.77	292.18	495.20	401.30	93.64	107.75	1455.84
		MDF	167.84	486.72	749.56	227.00	215.36	150.10	1996.58
		VDF	30.96	93.81	167.40	98.16	37.60	28.26	456.19
	Total		492.23	1592.77	2497.70	1395.7	645.63	437.88	7061.99
RAN3	Mixed Moist Forest	OF	54.97	319.40	361.29	301.21	133.53	102.59	1272.99
		MDF	97.06	241.52	425.73	222.13	113.64	37.72	1137.80
		VDF	24.79	46.54	90.64	42.65	8.46	0.00	213.08
	Kamrup Sal Forest	OF	56.88	252.67	428.23	347.03	80.98	93.18	1258.97
		MDF	103.10	298.99	460.45	139.44	132.30	92.20	1226.48
		VDF	23.20	70.29	125.44	73.56	28.17	21.17	341.83
	Total		360.00	1229.41	1891.78	1126.2	497.08	346.86	5451.15
RAN4	Mixed Moist Forest	OF	91.09	529.24	598.65	499.11	221.25	169.99	2109.33
		MDF	250.81	624.07	1100.07	573.97	293.63	97.46	2940.01
		VDF	117.70	221.03	430.41	202.51	40.16	0.00	1011.81
	Kamrup Sal Forest	OF	36.14	160.56	272.12	220.52	51.46	59.21	800.01
		MDF	55.73	161.62	248.90	75.38	71.51	49.84	662.98
		VDF	68.16	206.54	368.58	216.13	82.78	62.21	1004.40
	Total		619.63	1903.06	3018.73	1787.6	760.79	438.71	8528.54
RAN5	Mixed Moist Forest	OF	59.43	345.29	390.57	325.63	144.35	110.90	1376.17
		MDF	151.77	377.65	665.70	347.33	177.69	58.98	1779.12
		VDF	51.26	96.26	187.45	88.20	17.49	0.00	440.66
	Kamrup Sal Forest	OF	18.77	83.40	141.35	114.55	26.73	30.76	415.56
		MDF	62.50	181.26	279.15	84.54	80.20	55.90	743.55

		VDF	36.62	110.96	198.01	116.11	44.47	33.42	539.59
	Total		380.35	1194.82	1862.23	1076.3	490.93	289.96	5294.65
RAN6	Mixed Moist Forest	OF	51.24	297.68	336.72	280.73	124.45	95.61	1186.43
		MDF	105.06	261.42	460.82	240.44	123.00	40.83	1231.57
		VDF	41.70	78.32	152.51	71.76	14.23	0.00	358.52
	Kamrup Sal Forest	OF	38.76	172.19	291.83	236.50	55.19	63.50	857.97
		MDF	51.31	148.81	229.17	69.40	65.85	45.89	610.43
		VDF	55.74	168.88	301.37	176.72	67.69	50.87	821.27
	Total		343.81	1127.30	1772.42	1075.5	450.41	296.70	5066.19
RAN7	Mixed Moist Forest	OF	58.98	342.71	387.65	323.20	143.27	110.08	1365.89
		MDF	162.55	404.45	712.94	371.98	190.30	63.17	1905.39
		VDF	59.63	111.98	218.06	102.60	20.35	0.00	512.62
	Kamrup Sal Forest	OF	18.95	84.17	142.65	115.60	26.97	31.04	419.38
		MDF	38.69	112.21	172.81	52.33	49.65	34.60	460.29
		VDF	29.69	89.96	160.54	94.14	36.06	27.10	437.49
	Total		368.49	1145.48	1794.65	1059.8	466.60	265.99	5101.06
RAN8	Mixed Moist Forest	OF	52.51	305.08	345.09	287.71	127.54	97.99	1215.92
		MDF	169.31	421.28	742.61	387.46	198.22	65.79	1984.67
		VDF	133.23	250.19	487.21	229.24	45.46	0.00	1145.33
	Kamrup Sal Forest	OF	21.26	94.46	160.10	129.74	30.27	34.84	470.67
		MDF	48.53	140.74	216.75	65.64	62.28	43.40	577.34
		VDF	49.50	150.00	267.68	156.97	60.12	45.18	729.45
	Total		474.34	1361.75	2219.44	1256.7	523.89	287.20	6123.38
RAN9	Mixed Moist Forest	OF	49.10	285.25	322.66	269.01	119.25	91.62	1136.89
		MDF	61.49	153.00	269.71	140.72	71.99	23.90	720.81
		VDF	45.11	84.71	164.95	77.61	15.39	0.00	387.77
	Kamrup Sal Forest	OF	32.46	144.19	244.38	198.04	46.21	53.17	718.45
		MDF	15.80	45.81	70.54	21.36	20.27	14.13	187.91
		VDF	30.78	93.26	166.43	97.59	37.38	28.09	453.53
	Total		234.74	806.22	1238.67	804.33	310.49	210.91	3605.36
RAN10	Mixed Moist Forest	OF	99.41	577.60	653.35	544.72	241.47	185.52	2302.07
		MDF	153.71	382.46	674.19	351.76	179.95	59.73	1801.80
		VDF	290.52	545.56	1062.38	499.86	99.12	0.00	2497.44
	Kamrup Sal Forest	OF	57.29	254.48	431.30	349.52	81.56	93.85	1268.00
		MDF	55.98	162.35	250.02	75.72	71.84	50.07	665.98
		VDF	25.09	76.01	135.64	79.54	30.47	22.90	369.65
	Total		682.00	1998.46	3206.88	1901.2	704.41	412.07	8904.94
GOTANAGAR RF									
GOT1	Mixed Moist Forest	OF	0.08	0.47	0.54	0.45	0.20	0.15	1.89
		MDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Kamrup	OF	18.84	80.89	132.73	167.82	91.36	213.01	704.65
		MDF	15.30	32.26	22.72	40.48	6.85	144.03	261.64

	Sal Forest	VDF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Forest Plantation		0.00	35.05	222.41	72.96	8.19	0.00	338.61
	Total		34.22	148.67	378.40	281.71	106.60	357.19	1306.79
JALUKBARI RF									
	Mixed Moist Forest	OF	1.03	5.98	6.76	5.64	2.50	1.92	23.83
		MDF	0.35	0.67	0.62	0.67	0.23	0.00	2.54
		VDF	0.73	1.37	2.67	1.26	0.25	0.00	6.28
JAL1	Kamrup Sal Forest	OF	10.27	44.09	72.35	91.47	49.80	116.10	384.08
		MDF	0.88	1.86	1.31	2.34	0.40	8.31	15.10
		VDF	0.28	0.64	0.53	1.22	0.00	6.38	9.05
	Forest Plantation		331.69	980.37	2574.16	3164.7	751.54	58.72	7861.21
	Total		345.23	1034.98	2658.40	3267.3	804.72	191.43	8302.09

4.2 Areas affected by forest fires: Forest fire assessment for 2015 and 2016 shows that Sonapur, Rani, South Guwahati and Palasbari Ranges were affected due to fire incidences during 2015-2016 impacting a total area of 5005 ha. The detailed statement is shown in Annexure VIII. The forest fire incidences map based on MODIS data provided by FSI is shown in Fig 4.2. Rani, Garbhanga, Marakdola, and Apricola West RFs are ususally affected due to unattended fire spreading from jhum fields of the neighboring State.

Figure 4.2: Map showing fire incidences in Kamrup East Division.



4.3. Areas damaged by Natural Calamities: The forests experience high rainfall, occasional storms, erosion but there are no major damages in the division.

4.5 Lopping practices: Similar to grazing lopping is also not permitted in the reserve forests of this division. However, rights and concessions was also provided in some of the reserve forests for collection of fodder, firewood, housepost, bamboos and canes. The reserve forests are Garbhanga, Rani, Matapahar, Teteliguri, Marakdola, Maliata, and Apricola west lopping exists in the division.

4.6 Areas infested by invasive weed species in forests: Large tracts of the forests are covered by invasive weed species, which hinders growth and development of young seedlings as well as the forest stand. Weeding practices are carried out from time to time to check growth of weeds. Wide adaptability, high seed bearing capacity and fast growth has helped weeds species to invade gaps quickly. Table 4.6 shows areas affected due to the invasive weed species.

Table 4.6: Total area infested by weeds in Kamrup East Division.

Assessment year	Name of species	No. of compartments/ forest areas effected		Type of Forest effected	Treated compartment / Forest area
2015-2016	*Mikania micrantha*, *Eupotarium odoratum*, *Lantanacamara*, *Ageratum conizoides*	Compartments 6 nos. &Maliata RF, Jalukbari RF, Fatasil RF &Hengrabari RF	1676.50 ha	Moist mixed decidouses Forest	Weeding operations are carried out regularly.

Pests and diseases have been recorded in the forest stands of Sal, Teak and Gamari. Sal borers *(Hoplocerambyxspinicornis*) are ocassionally found on wounded Sal trees. Occassional die-back of Sal seedlings is observed in artificially raised seedlings, especially during hot days followed by heavy rains. Teak leaf defoliator (*Hyblaeapurera*), Gamari leaf defoliator (*Calopeplaleayana*) has also been observed in the division. However, incidences of pest and disease are not significant in the division.

Table 4.7. Pest and disease incidents in the division

Assessment year	Name of insect pest / disease	Major species damaged	Compartments / Beat	Epidemics occurred in the past
2015-2016	Teak leaf defoliator (*Hyblaeapurera*) Gamari leaf defoliator (*Calopeplaleayana*)	Teak and Gamari	Garbhanga C_1C_2 Rani C_1C_2 Nalapara C_1C_2 Jalukbari RF	Nil

4.8 Forest degradation and its drivers: Forest loss in Kamrup East Division is mainly due to anthropogenic pressure-Encroachments for agriculture and settlements, habitations, illegal

felling are the main drivers of forest degradation. Significant portion of almost all the RFs have been encroached. The level of degradation can be assessed from the LULUCF assessment done for two time point's i.e 2005-2006 and 2013-2014 as depicted in table 2.4.b The encroached area can be seen in table 2.4.1 and figure 2.4.1.

4.9 Pollution control and protection of environment: There are industries like coke and cement near the reserve forests. The fly ash type of pollutant coming out from the insdustries gets deposited on the tree leaves. Ocassional illegal dumping of wastes are also observed in the vicinity of the forests. Table 4.9 lists industries nearby the reserbe forest of this division.

Table 4.9: List of industries nearby the reserve forest

Sl. No.	Name oftheUnit	MainProduct
1	M/S PrideCokePvt.Ltd. Aurbhes12thmile,Jorabat	CokeProduct(Hard&Breeze)
2	M/S K.D.Coke,Amerigog, 11thMile, Jorabat	CokeProduct(Hard&Breeze)
3	M/SMortexCokeIndustries,Kamarkuchi, Tepesia, Kamrup	Coke
4	M/SMortexCokeIndustries,Kamarkuchi, Tepesia, Kamrup	Coke
5	M/S PoulujiCoke, Industriof 15thmileByrnihat,Kamrup	Coke
6	M/S Jul CokeCompany, Burni, 15thMile,Byrnihat,G.S. Road	Mfg.Coke
7	M/S Global Coke,ProductsAmbher, 12thMile	Mfg.Coke
8	M/S K.D.Cokes, Amerigog, 11thmile,Jorabat	Mfg.Coke

-SSS-

CHAPTER 5

CONSERVATION AND MAINTENANCE OF SOIL AND WATER RESOURCES

5.1 Areas treated under Soil and Water Conservation Measures:

The RFs of the division are hilly, barring a limited portion of plains forest. The RFs of the division form only a small part of the catchment areas of the rivers and streams flowing through and around the division. The sources of most of these rivers and streams are from the state of Meghalaya. Jhuming prevalent in some of the RFs of the division is less damaging than that in the hills of Meghalaya, through which a major portion of these streams and rivers flows. Hence, for an effective management of soil and water, a watershed-planning approach needs to be adopted involving the neighbouring state. Fortunately, the climatic conditions of the region are such that the abandoned jhum areas gets quickly covered up by ferns, weeds, other shrubs and gregarious dendrocalamushamiltoni, resulting in lesser quantum of soil loss through runoff. Pure teak plantations raised on the hills of these RFs have very thin undergrowth and results in gully formation. Emphasis made through this working plan to replace teak with endemic species for soil and moisture conservation in such areas. Erosion of soil erosion and runoffs is common in the jhum areas of the division. After heavy showers, the gush of water that flows down the streams and small rivers, carries considerable amount of silt, resulting in raising of river beds and silting-up of low-lying swamps and depressions around these RFs, which have served as reservoirs and reduced the impact of flash floods in the past .Restricted felling and least disturbance can result in development of good watershed catchment areas. The congested teak plantations need to be thinned out to encourage undergrowth beneath the teak trees for prevention of erosion and top soil runoff.

5.2 Duration of Water flow in the selected seasonal streams:

The total area of the division covered by rivers/ streams is 7,550.77 Ha of which 6.26 Ha areas falls inside the RFs. The division occupies a part of the basin formed by River Brahmaputra passing through its northern boundary with a westerly course. Major tributaries like Digaru, Basistha, Apricola, Keelling, Pasdhara, Bharalu, Kopili, and Kalapani etc. drain the division and join the River Brahmaputra. Water flow in the seasonal streams is shown in Annexure IX. Map showing the rivers and streams is shown in Fig 5.2.

5.3 Wetlands in Forest Areas: Wetlands play a major role in conservation of faunal and floral diversity of reserve forests under Kamrup East Division. There is around 29 small to medium size wetlands anong with many streams, nullah, swamps and low lying areas. The important rivers and streams are Basistha, Panchdhora, Jakoikona, Umthana, Killing, Kopili, Sukurberia, and Apricola. These wetlands provide very ideal habitats for many faunal species. During recent studies migratory birds were also recorded in various wetlands.

the wetland area of the division. The Beel supports the large herbivorous species inhabitating in the Rani Garbhanga Reserve Forest. DeeporBeel supports a highly concentrated and diverse indigenous freshwater fish population. The wetland is a major fish breeding and nursery ground, which supplies

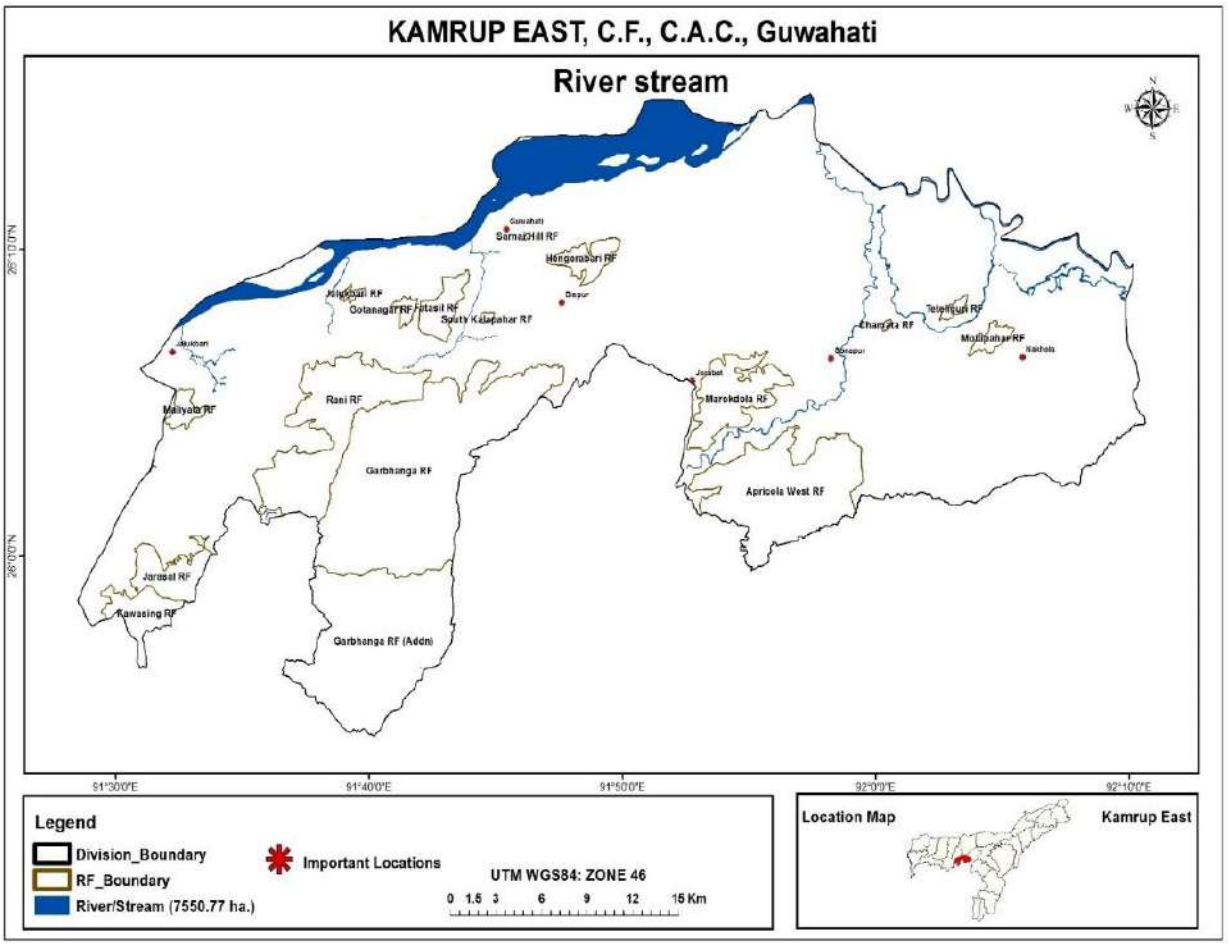


Figure 5.2: Map Figure 5.2: Map showing river and streams in Kamrup East Division.

stocks to other nearby wetlands and rivers. Local people have been fishing in this wetland since ages, but after it was declared a sanctuary fishing is regulated.
During winter large numbers of waterbodies were dried up resulting movement of many animals including Asian elephant to Deeparbeel. DeeparBeel is the biggest perennial waterbody covering anarea of10.10 sq. km. in close proximity of Rani Reserve forest. There are a narrow strips of revenue land and PWD road in between.

The total area occupied by wetlands in this division is 4358.04 ha of which 4.14 sq. km. has already been declared as DeeparBeel Wildlife Sanctuary and brought under direct control of Guwahati Wildlife Division. The map of Wetland of Kamrup East divison is shown in Fig 5.3.

5.4 Water level in the Wells in the vicinity of the forest area: The following table shows the water level in the wells in different seasons in the vicinity upto 5 km of the forest area. The water level in the well is dependant on the periodic rainfalls. The average water level during January, May and September months are 2.4 m, 5.0 m and 3.4 m respectively. The average depth of wells in the division is 9.9 m. Details of depth of water levels in the wells in the vicinity of the division is given in Annexure X.

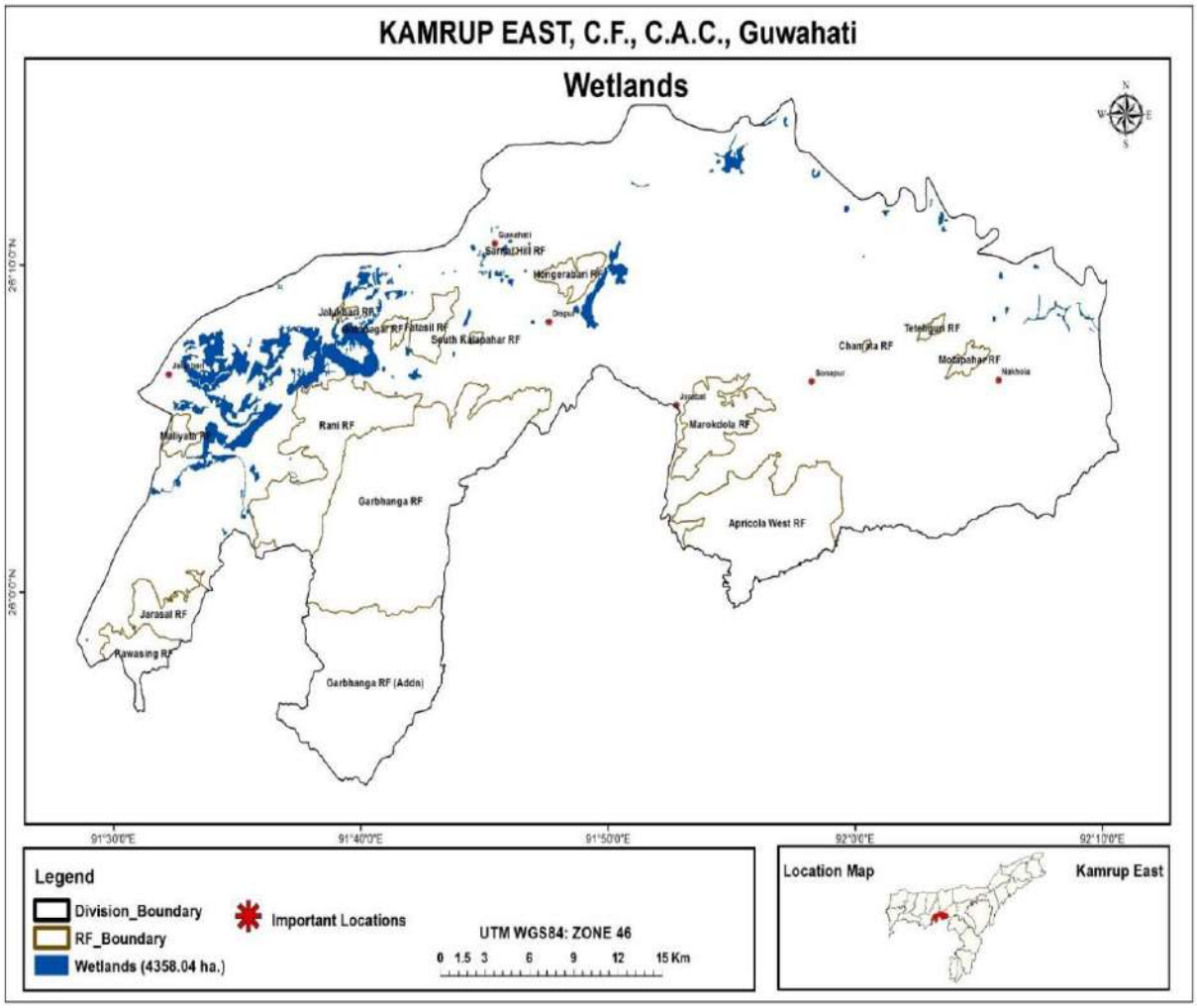


Figure 5.3: Map showing the wetlands in Kamrup East Division.

Table 5.4: Water level in the wells in the vicinity of the division (2016-17)

Sl. No.	Name of the selected village and distance from the forests	Water level in the well from the surface (meter)			Depth of the well (meter)	Change in the quality of the water(physical, chemical, biological)	No. of soil and moisture conservation work undertaken in thecatchment
		Jan	May	Sept			
1	Bhogdoba, 1.90 Km.	1.50	7.00	3.00	12.00	No Change	NIL
2	Garopara, 2.00Km.	1.60	7.20	2.50	10.00		
3	Nalpara, 1.00 Km.	1.80	7.00	4.00	9.00		
4	Mirza, 2.50Km.	2.00	6.00	5.00	13.00		
5	Joypur, 1.80Km.	2.00	7.50	4.50	9.00		
6	Chakradeo, 1.00 Km	1.70	6.40	5.00	11.00		
7	Pamohi, 1.00 Km	1.80	4.50	2.70	10.00		
8	Mainakhurung, 1.00 Km	1.60	6.00	2.40	10.50		
9	Garoghuli, 1.50 Km	2.40	3.60	3.00	7.50		

10	Beharbari, 1.00 Km	2.60	3.50	2.90	11.00		
11	Madhabnagar, 1.00 Km	1.00	6.50	2.00	15.00		
12	Hengrabari, 1.30 Km	1.00	3.00	1.80	15.00		
13	Jalukbari, 1.00 Km	1.80	4.50	3.00	7.50	No Change	NIL
14	Barbari, 2.00 Km	2.10	6.00	4.60	9.00		
15	Tamulikuchi, 0.800 Km	3.00	4.50	3.50	10.50		
16	Kamalabari, 2.00 Km	2.70	4.50	3.00	9.00		
17	Korce, 3.50 Km	3.00	6.00	3.30	12.00		
18	Hahara, 2.00 Km	2.75	4.35	3.00	5.50		
19	Barakasarange, 1.80 Km	3.00	4.50	3.50	4.20		
20	Helagog, 2.00 Km	2.75	5.00	3.75	10.00		
21	Chamata, 2.00 Km	3.00	2.50	2.30	12.00		
22	Topatoli, 1.20 Km	2.40	4.50	3.00	9.00		
23	Markang, 1.40 Km	6.00	2.00	4.50	14.00		
24	Maupur, 2.00 Km	3.00	3.50	3.00	6.00		
25	Fatasil, 2.00 Km	1.50	4.00	3.00	2.50		
26	Marogdola, 1.50 Km	4.00	6.00	5.00	15.00		

5.5 Status of aquifers: The main block of forests of this division, within this area, is situated on outlying portion of the Shillong plateau. The principal rocks of this outlying portion are acid and basic gneisses, which have been metamorphosed by intruding igneous rocks. In the alluvial plain, groundwater occurs in regionally extensive aquifers down to the depth of 305 m and has a very good yield prospect. The aquifers here consist of sands of various grades with gravel and are suitable for construction of both shallow and deep tube wells. Groundwater occurs under unconfined-to-semiconfined condition occupying an area of about 200 sq. km. The water level rests at shallow depth and in major portion rests between 2 m - 5 m below ground level during the premonsoon period. During the last ten years the water level trend shows no significant change in rise or fall in its level. The shallow tube wells tapping aquifers within 50 m depth are capable of yielding about 10 liters per minute(lpm) in major places, deep tube wells constructed within 95 m depth tapping about 30 m granular zones are yielding 10 - 20 lpm . The transmissivity of the aquifer ranges from 41 to 6162 sq.m per day and the permeability varies from 10 to 59 m/day. In hard rock, the yield of bore well constructed in greater Guwahati area ranges from 4 to 300 liters per minute.

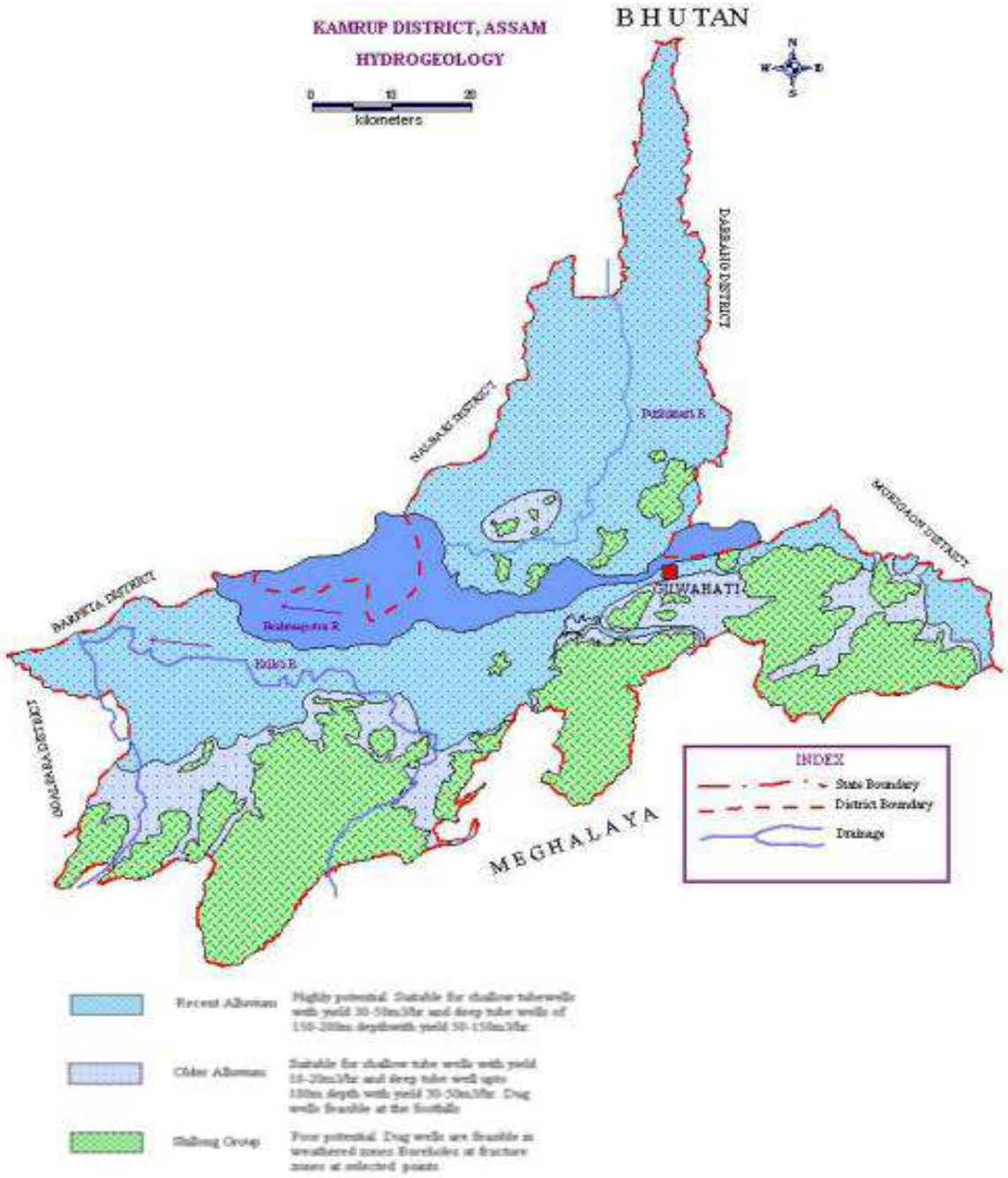


Figure 5.4: Hyderogeology map of Kamrup district showin the aquifers.
(Map Source: Groundwater Information Booklet of Kamrup District, Central Ground Water Board)

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 sustained flow of income and ecosystem services to local communities while 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 Fig 6.1. 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. 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.
Sample points were allocated by North East Space Application Center adopting the grid based systematic stratified random sampling design as recommended in the National Working Plan Code 2014. 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. Map showing the sample plots are shown in Fig 6.1.

Information on regeneration status of forest species, injury to forest species, grazing incidencse, 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.

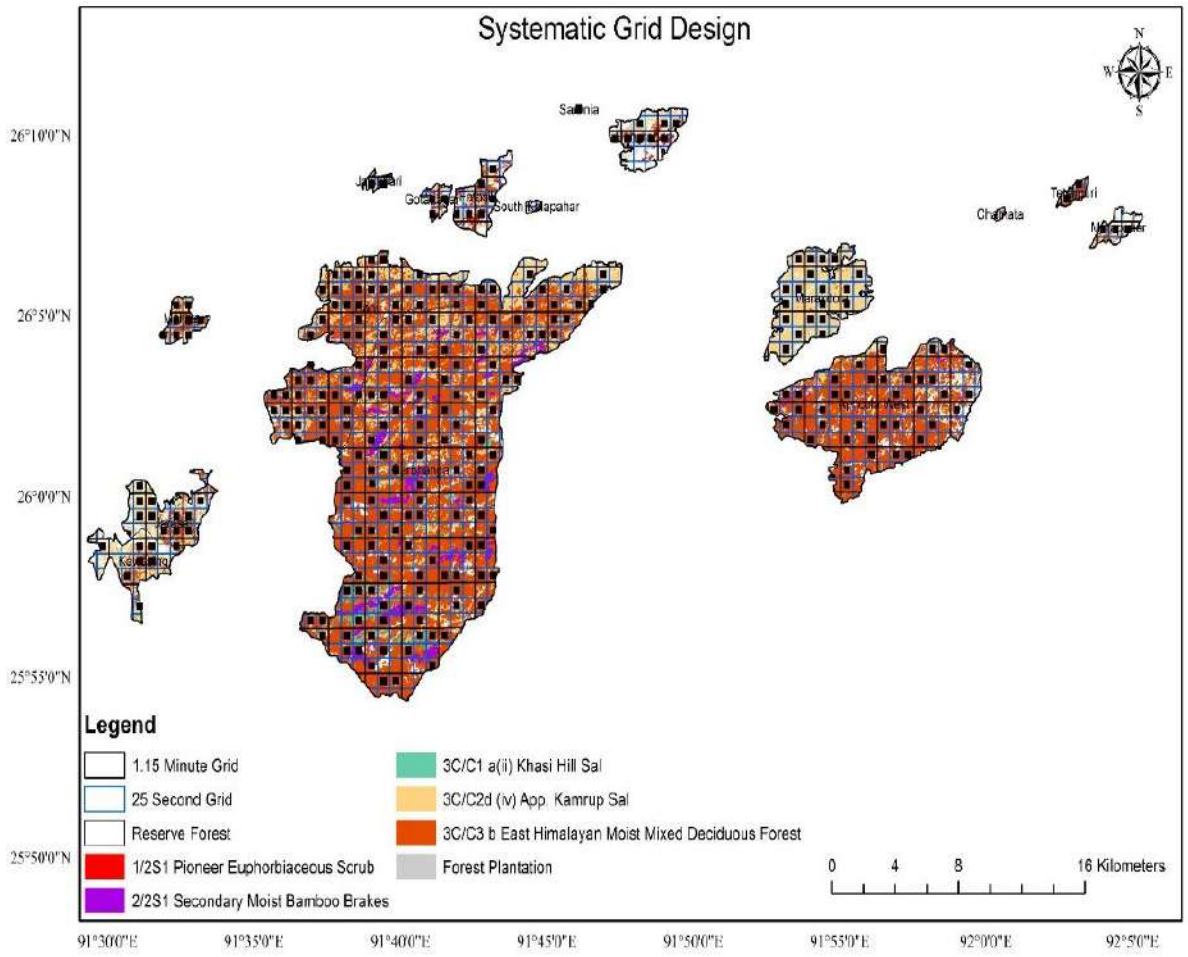


Figure 6.1: Map showing the sample plots in Kamrup East Division.

Sample plot wise volume is given in Annexure XII.Growing stock analysis is a representation of 115 different tree species recorded in the sample plots. The most predominant species in terms of number of individuals are *Shorearobusta*(Sal), *Tectona grandis* (Teak) *and Schimawallichi* (Makrisal). *Shorearobusta* and *Tectona grandis* contributed 22.87 per cent and 21.87 per cent, respectively to the total growing stock. Other dominant species are *Lagerstroemia parviflora* (Sidha), *Dilleniapentagyna* (Okshi), *Toona ciliate* (Poma), *Terminalia bellirica* (Bhomora), *Careya arborea* (Kum) and *Vitex altissima* (Ahoi). Contribution of *Shorearobusta* and *Tectona grandis* to the total volume is 26.14 per cent and 24.74 percent, respectively. Contriution of *Schimawalichii* (Makri Sal) to the total volume is 9.23 per cent. All other recorded species contribute to the remaining 39.83 per cent of the total timber volume. It indicates that the forest area is predominated by the young age class of trees and matured age class is deficient.

Compartment wise growing stock (cu.m./ha) and number of trees per hectare in Kamrup East divison is shown in Tables 6.1. Compartment wise volume in each diameter class is provided in Annexure XIII.

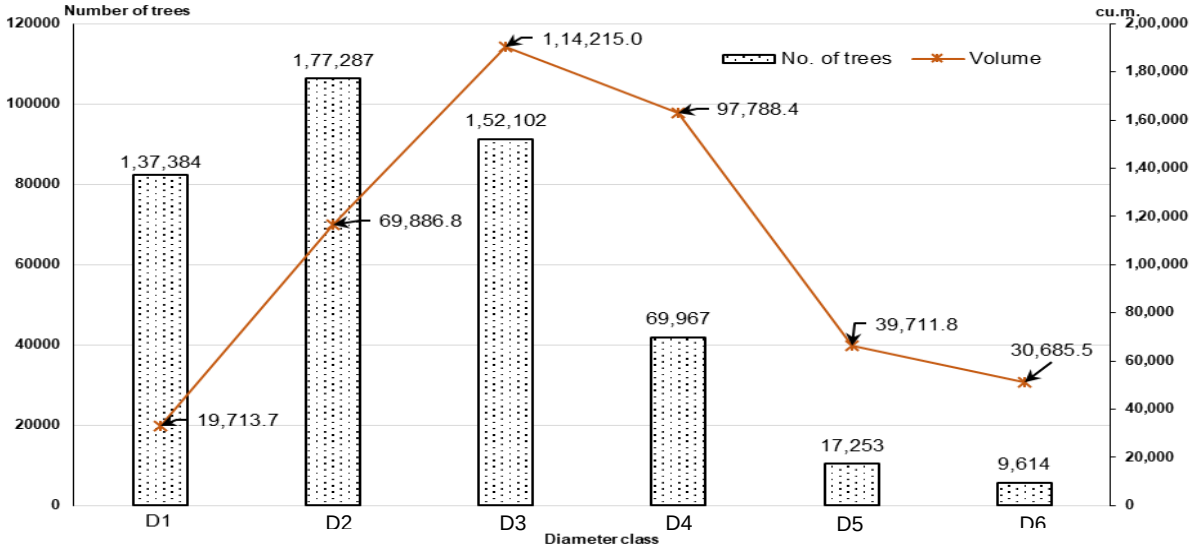
Table 6.1a: Statement showing total growing stock (number of trees)

Range	Name of the RF	Comp. No.	Growing stock (cu.m./ha)
Sonapur	Apricola (East) RF	APR1	21.30
		APR10	20.66

Range	Name of the RF	Comp. No.	Growing stock (cu.m./ha)
		APR11	20.41
		APR12	22.28
		APR2	20.81
		APR3	21.86
		APR4	25.61
		APR5	29.08
		APR6	26.01
		APR7	23.07
		APR8	22.67
		APR9	24.50
	Marakdola RF	MAR1	5.09
		MAR2	5.81
		MAR3	21.14
	Matapahar RF	MOT1	3.15
	Chamata RF	CHA1	10.14
	Teteligrui RF	TET1	5.51
Palashbari	Maliata RF	MAL1	13.01
South Guwahati	Garbhanga RF	GAR1	2.68
		GAR10	3.05
		GAR11	8.77
		GAR12	7.07
		GAR13	8.32
		GAR14	5.62
		GAR15	3.67
		GAR16	5.46
		GAR17	3.64
		GAR18	2.38
		GAR19	3.25
		GAR2	3.43
		GAR20	1.96
		GAR21	3.49
		GAR22	3.71
		GAR23	4.44
		GAR24	5.51
		GAR3	6.55
		GAR4	0.47
		GAR5	4.47
		GAR6	6.47
		GAR7	5.54
		GAR8	9.19
		GAR9	9.35
Guwahati	Fatasil	FAT1	1.31
		FAT2	1.52
	Hengrabari RF	HEN1	15.69
	Sarania RF	SAH1	9.00
	South Kalapahar RF	SKA1	5.53
	Gotanagar RF	GOT1	11.01
	Jalukbari RF	JAL1	71.66
Rani	Jarasal RF	JAR1	49.90

Range	Name of the RF	Comp. No.	Growing stock (cu.m./ha)
		JAR2	204.01
		JAR3	54.15
		JAR4	37.25
		JAR5	39.48
	Kawasing RF	KAW1	4.15
		KAW2	4.71
		KAW3	29.18
		KAW4	75.99
	Rani RF	RAN1	20.60
		RAN10	37.60
		RAN2	23.97
		RAN3	20.63
		RAN4	28.03
		RAN5	28.42
		RAN6	21.44
		RAN7	23.85
		RAN8	25.75
		RAN9	16.42

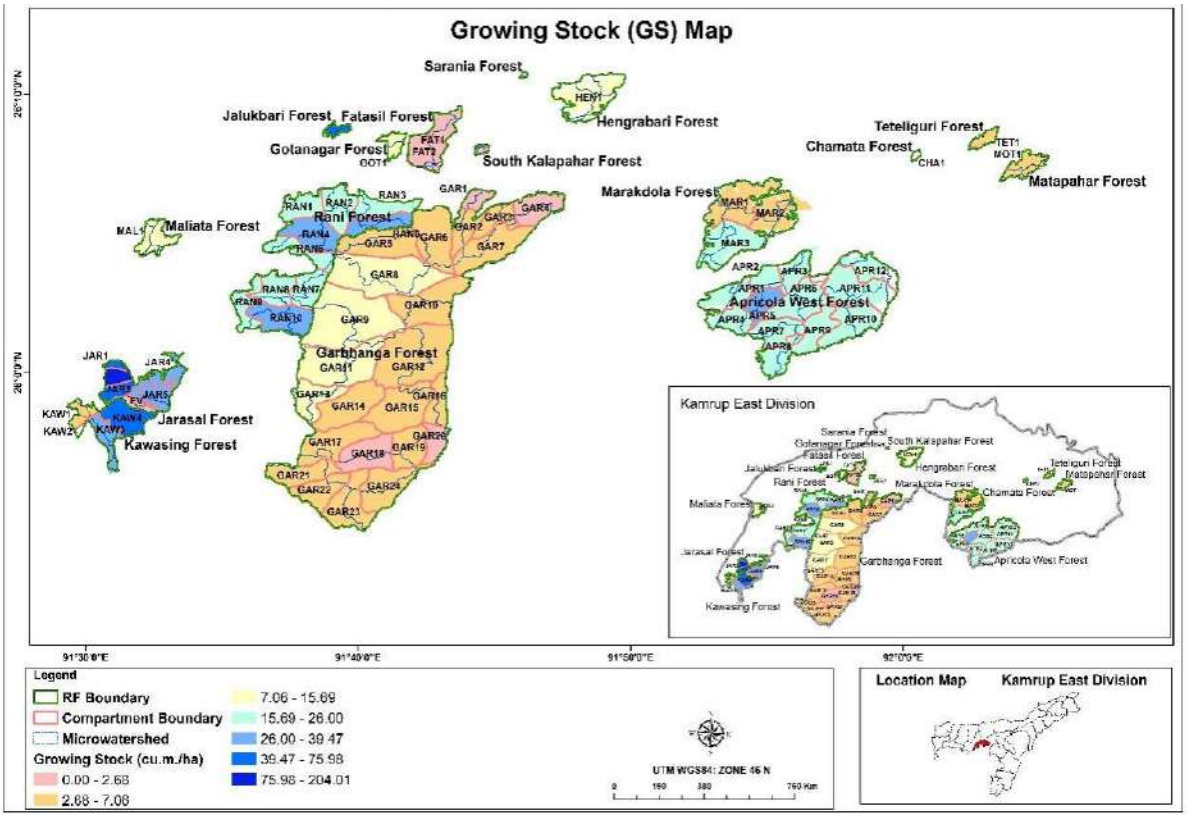
Figure 6.1a: Total number *of trees and total volume in cu.m.* in each diameter class



In the division, 31.46 % of the total trees of Kamrup East Division are in the D2 (*20 cm - 30 cm*) dia class. D3 dia class i.e. 30 cm to 40 cm comprises 26.99% of the total trees. 12.41% and 24.38% of the total trees are within the dia classes D4 (*30 cm - 40 cm*), and D1 (*10 cm - 20 cm*), respectively. Few trees were observed falling in the higher dia classes. 2.9% and 1.6% of the total trees are distributed in D5 (*50 cm - 60 cm*) and D6 (*>60 cm*) dia classes, respectively. It indicates very dense stands in D2 followed by D1 dia. class i.e. lower diameter classes and sparse trees in the other classes. Quantification of the number of trees that can be accommodated in the higher diameter classes cannot be reflected by this graph. Keeping in line with the past management practices, structure and composition of the forests in this division, it will be advisable to prescribe thinning in the areas with dense trees in the lesser diameter classes namely 20 cm to 30 cm, 30 cm to 40 cm and 10 cm to 20 cm with

simultaneous gap filling and assisted artificial regeneration of endemic species in the higher diameter classes to get good distribution of trees at all diameter classes.

6.1b: Map showing growing stock(cu.m.) as per the recasted compartment based on microwatersheds



6.2 Growing Stock of Bamboo: Table 6.2 shows growing stock of secondary moist bamboo brakes during 2015-16. Major distribution of bamboo stocks is mostly in Garbhangha Reserve Forest areas followed by the FDA areas. However, there are considerable bamboo stocks in Apricola West RF and Rani RF. Table 6.3 describes the Reserve Forest wise distribution and quantity of bamboo stocks available.

Table 6.2. Growing stock of bamboo in Kamrup East Division.

Year	Forest type (as per the champion and Seth)	Working circle	Name of the major trees species	Area (Ha.)	Growing stock as per the unit (cmt)/ha/yr)	Change to the bench mark data (norms)
2015-16	Secondary moist Bamboo brake	Bamboo Overlapping Working Circle	Sal, Makari Sal, Gamari,Bhumora, Karoi, Khakon, Sonaru, Sida, Nahar, Ajhar, Oxi, etc.	1136.00	24.75 cum. per Ha.	Nil

Table 6.3 Reserve forest wise bamboo stock in Kamrup East Division

Reserve Forest	Area (in ha)	Quantity (in tons)

Apricola West	113.5169	143.0305
Garbhanga	931.6634	1173.895
Rani	52.1498	65.70835
Kamrup East FDA	607	764.82

6.3 Increment in Volume of Identified Timber Species: The following table shows the local volume table prepared from previous data of various species in the division.

Table. 6.3.1. Local volume table of different species in Kamrup East Division.

Species	Volume in cubic meters for different diameter classes in cm											
	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100	100-110	110-120	>120
Bonsum	0.29	0.53	0.79	1.12	1.65	2.49	3.32	4.20	5.12	5.98	6.92	8.09
Sopa	0.57	1.02	1.48	1.94	2.42	3.1	4.1	5.40	0.94	8.4	9.97	12.0
Simul	0.35	0.62	0.94	1.32	1.76	2.34	3.38	4.68	6.22	-	-	-
Amari	0.38	0.66	0.95	1.38	1.75	2.25	2.93	3.64	4.34	4.94	5.64	6.23
Sida	0.30	0.52	0.77	1.20	1.89	2.60	3.24	-	-	-	-	-
MakriSal	0.21	0.43	0.75	1.25	1.94	2.65	3.34	4.10	4.87	-	-	-
Koroi	0.41	0.74	1.06	1.37	1.78	2.88	3.83	-	-	-	-	-
Poma	0.50	0.85	1.20	1.58	1.99	2.70	3.95	5.45	-	-	-	-
Kuhir	0.19	0.34	0.55	0.84	1.31	1.95	2.57	-	-	-	-	-
Jia	0.36	0.63	0.91	1.20	1.55	1.86	2.61	3.37	4.43	5.74	-	-
Bogipoma	0.21	0.44	0.72	1.08	1.41	1.94	2.56	3.46	4.40	5.57	6.80	8.06
Aam	0.15	0.36	0.54	0.82	1.11	1.74	2.40	3.17	4.09	5.11	6.10	7.10
Haldu	0.31	0.48	0.76	0.98	1.42	1.63	2.04	2.86	-	-	-	
Khokon	-	-	-	-	1.38	2.04	2.72	3.3	3.92	-	-	-
Jamuk	0.37	0.59	0.83	1.12	1.48	2.68	3.80	-	-	-	-	-

6.4 Efforts towards enhancement of forest productivity through quality plantation activities: Efforts to enhance forest productivity have 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. A total area covering 5029.50 ha (see table 6.4.1) was brought under ANR operations and appropriate Silvicultural operations. The details of plantations area are provided in tables Annexure XIV (A), (B) and (C).

Table 6.4.1. showing areas brought under plantations for enhancement of forest productivity

Assessment year	Category	Efforts/techniques	No./ Area (Ha.)	Productivity (increment)	Budget allocated and utilized (Rs)	Norm/ remarks
2015-2016	ANR, RDF, Revolving Fund, Misc. And APFBC, CAMPA,	Nursery /Economic species /Plantation techniques Maintenance/	5029.50	--	3,67,22,335	--

	CM's BikasYojona, NAP	Operation				

An area of 2050 ha has been earmarked for seed production of important tree species in the division. The total annual seed production is reported to be 525 kg.

6.5 Carbon Stock: 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 ha 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 Indian Institute of Remote Sensing (IIRS), the Indian Institute for Sciences (IISc), and the Indian 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 divisions carbon emissions and storage in forests, which requires compartment specific information. A credible monitoring system that shall measure, report and verify carbon in the forests is a very critical element for the mitigation activities. 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 SDC goals.

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 are intended to provide unbiased estimates. Accuracy and precision

should, in general, to 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 Kamrup East 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. 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.

(ii) Carry out assessment for the relevant LULUCF categories. Within the key categories, carry out an assessment on which non-CO_2 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-CO_2 gases and carbon pools that are significant are to be selected. As per the forestry regime in Kamrup East division, no non-CO_2 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 minimum* 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.

6.5.2 Calculation of Forest carbon:

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 mercantile 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 mercantile 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

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: $C_{living} + C_{dead} + C_{soil}$ = Total Carbon content

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) data. 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.

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

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

(ii) 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.
(iii) 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.

6.5.3 Forest Carbon stock of the Division: The forests in Kamrup East Division are exposed to deforestation and forest degradation, which results in decreasing the Carbon content of the forest area in the 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 the division is 19.51 tons per hectare in the living biomass of the natural forest and forest plantation area. The carbon stock under secondary moist bamboo brakes in the division is 0.6 tons per hectare in the living biomass. Compartment wise carbon stock (tons/ha) is shown in table 6.5a. Total forest carbon under different forest types and bamboo brakes is shown in table 6.5b and 6.5c, respectively. Compartment wise carbon (tons per ha) is shown in Figure 6.5a.

Table 6.5a. Table showing the total forest carbon stock under different forest types

Forest type	Area (Ha)	Total number of trees (nos)	Total carbon stock (in tons)
i) East Himalayan Moist Mixed Deciduous Forest (3C/C3b)	20,601.47	3,33,538	3,23,012.5
ii) Khasi Hill Sal (3C/C1a(ii))	9,535.92	2,34,577	2,58,795.8
iii) App. Kamrup Sal (3C/C2 d (iv))	599.15	6,147	3,422.6
iv) Forest plantations	140.15	17,349	17,477.95
Total	**30,876.69**	**5,91,611**	**6,02,708.9**

Table 6.5b. Table showing the total bamboo carbon stock of Kamrup East Division.

Forest type	Area (Ha)	Total biomass (tons)	Total carbon stock (in tons)
i) Secondary Moist Bamboo Brakes (2/2S1)	1,033.30	1239.96	619.98

Table 6.5.c: Total carbon (tons) in different compartments in kamrup east division

Reserve Forest	Compt.	Carbon (tons)		Reserve Forest	Compt.	Carbon (tons)
	Apr-01	4539.39			GAR7	12902.21
	Apr-10	3585.23			GAR8	32315.99
	Apr-11	7038.46			GAR9	33140.68
	Apr-12	3875.01		Gotanagar	GOT1	2108.15
	Apr-02	3556.54		Hengrabari	HEN1	8858.41
	Apr-03	4818.15		Jalukbari	JAL1	1065.24
	Apr-04	4449.92		Jarasal	JAR1	909.47
	Apr-05	3901.00			JAR2	4670.95
	Apr-06	7091.89			JAR3	7961.81

Apricola West	Apr-07	4450.56
	Apr-08	3390.69
	Apr-09	4245.28
Fatasil	FAT1	2626.25
	FAT2	3849.61
Garbhanga	GAR1	4651.50
	GAR10	16372.06
	GAR11	16401.24
	GAR12	22345.26
	GAR13	7398.53
	GAR14	13054.34
	GAR15	15551.04
	GAR16	5483.93
	GAR17	10558.43
	GAR18	8622.37
	GAR19	7263.22
	GAR2	8308.96
	GAR20	4450.51
	GAR21	6518.18
	GAR22	4406.92
	GAR23	7998.64
	GAR24	7807.18
	GAR3	7564.51
	GAR4	10661.98
	GAR5	15656.16
	GAR6	16696.19
	JAR4	6389.17
	JAR5	6044.82
Kawasing	KAW1	1310.30
	KAW2	821.06
	KAW3	6201.95
	KAW4	8826.08
Maliata	MAL1	6280.09
Marakdola	Mar-01	18632.14
	Mar-02	13970.14
	Mar-03	19413.76
Matapahar	MOT1	2326.68
Rani	RAN1	8400.42
	RAN10	14718.48
	RAN2	12628.51
	RAN3	9949.33
	RAN4	15350.45
	RAN5	9460.50
	RAN6	10221.34
	RAN7	8748.11
	RAN8	10782.14
	RAN9	7151.92
Sarania	SAH1	219.70
South Kalapahar	SKA1	329.92
Teteliguri	TET1	1927.20
Total		**583226.23**

6.5.4 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. 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 forest also. This can eventually help in state-wide reporting of contribution to national NDC goals.

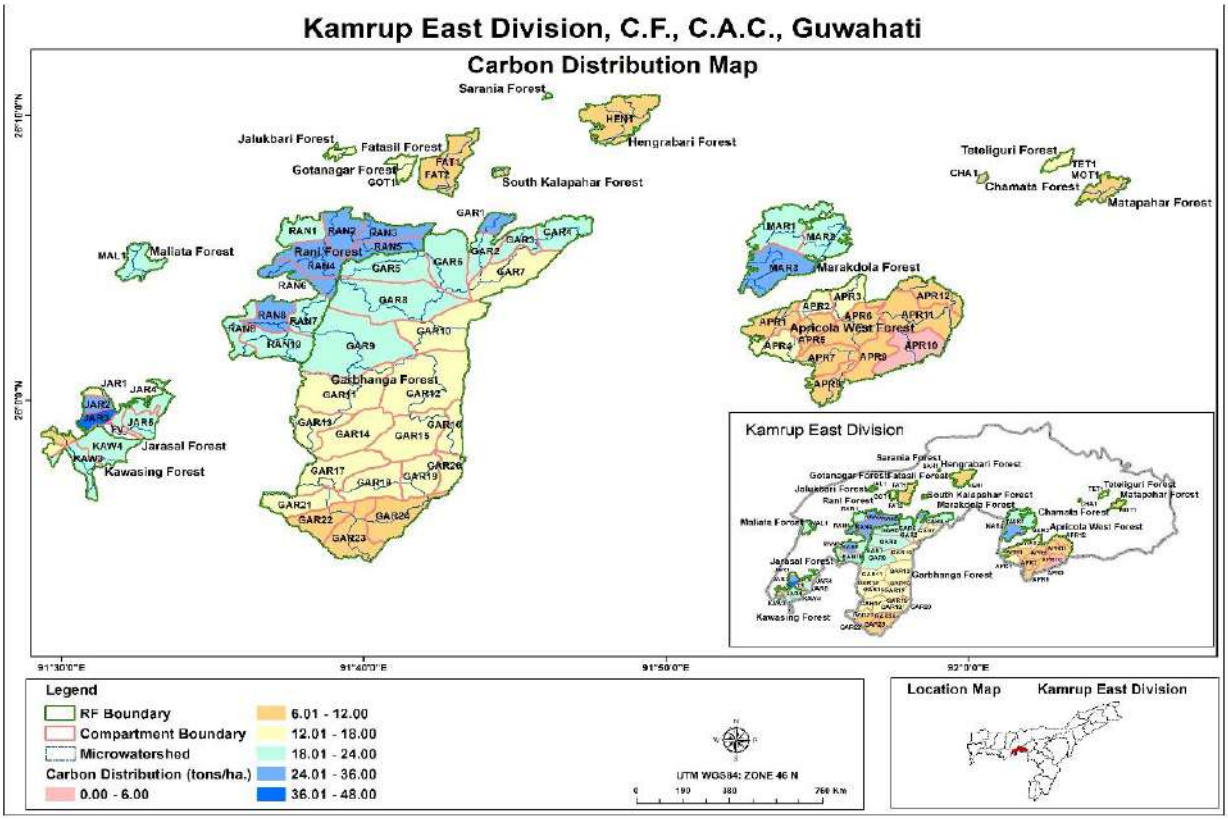


Figure 6.5a: Recasted micro watershed based compartment wise carbon stock (tons/ha) map.

6.6 Carbon sequestration and mitigation:

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'.

Trees use the energy from sunlight to convert CO_2 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 CO_2. This way trees and forests act as a major sink of carbon in the natural carbon cycle. Destruction of forests leads to release of CO_2 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. 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, CO_2, CH_4, SF_6, HFCs, PFCs and O_3 (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).

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 agrosilvipastoral 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 aboveground and belowground 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 MtCO2 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.

Enhancements in biomass productivity etc. result 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.

6.6.1 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. 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 forest also. This can eventually help in state-wide reporting of contribution to national SDC goals.

6.6.2 Enhanced Carbon Sequestration: In Kamrup East Division, during the tenure of this working plan some innovative and suitable practices of Silvicultural, Eco-restoration of Degraded/ Mined out Forest lands, Improved Biomass Productivity, etc. which will result in improving forest health and vitality and enhanced carbon sequestration will be undertaken. Forest conservation and enhancement activities such as Afforestation, Assisted Natural Regeneration, Restoration, REDD+, Rehabilitation of shifting cultivation and mining areas, agroforestry, etc. will be carried out. 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 be 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. These activities will not only help in carbon sequestration and storage but also other co-benefits in terms of community and biodiversity.

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CHAPTER 7
OPTIMIZATION OF FOREST RESOURCES UTILIZATION

7.1 Recorded removal of Timber:

Due to hon'ble Supreme Court's ban on WP(C) 202 on Godavaran case 1995, harvesting of timber and other forest produces were stoped and prescription of previous Working Plan was not followed in toto. As such the record of removal of timber is available only from the timber that is either wind-fallen or/and seized in the Ranges under Kamrup West Division and is shownbelow (Table 7.1.a). Major portion of timber had been removed by timber smugglers. The following figure is just a tip of iceberg.

Since 1988, there is no operative working plan for Kamrup East Division hence there are no recorded details about removal of timber from this division. The tables showing the average volume of timber dispatched from different Ranges and Beats of the Division is furnished in Table 7.1a and details on illegal felling and wind fallen is shown in table 7.1 b.

Table: 7.1a. Recorded removal of timber(2009-2010 to 2013-2014).

Reporting year	Wood	
	Type / quality	Extraction from illegal felling & windfallen (cft)
2009-2010	Sal	20.568
	Teak	102.904
	Non-Sal	402.519
	Fire wood	---
2010-2011	Sal	247.287
	Teak	90.966
	Non-Sal	141.542
	Fire wood	---
2011-2012	Sal	7.533
	Teak	8.612
	Non-Sal	110.407
	Fire wood	---
2012-2013	Sal	12.727
	Teak	82.906
	Non-Sal	52.041
	Fire wood	---
2013-2014	Sal	60.694
	Teak	40.582
	Non-Sal	76.687
	Fire wood	---

Table: 7.1b. Recorded removal of timber (2014-2015 to 2017-2018).

Reporting year	Wood		Forest Diversion
	Illegal Felling	Wind Fallen	
2014-2015	95.429	101.703	Nil
2015-2016	71.299	Nil	Nil

2016-2017	335.093	47.406	Nil
2017-2018	240.879	462.178	Nil

7.2 Recorded removal of Fuel Wood: There is no extraction/removal of fuel wood from the forest areas of this Division. As per the right and concession provided in the Govt. notification fuel wood were collected by the villagers for their daily consumption.

7.3 Recorded removal of Bamboo/Rattans: No such departmental extraction /removal of bamboo/rattans took place in the forest areas of Kamrup East Division. Only the villagers are allowed to extract bamboo/rattans as per the Govt. notification where right and concession were provided.

7.4 Recorded removal of locally important NTFPs including MFPs: There is no record available on removal of all the locally important NTFPs. However, data of phuljharu (broom) extracted from this division is shown int table 7.4.

Table 7.4: Total collection of broom and budget allocation for NTFP management in K.E. Division.

Reporting year	Name of the major NTFP/spp.	Total collection (kg., metric tones, std. Bags)	Measures taken maintaining the productivity	Budget allocation for NTFP management (`)
2015-2016	Phuljharu	4580 Kg.	Root stock planting with regular weeding and fire protection measures	5,50,000/-

7.5 Demand and supply of timber and important Non Forest Produce: Over exploitation of timber during last few decades led forests to such a deplorable conditions that Hon'ble Supreme Court had to intervene (1995). The apex court put restrictions on felling of trees and ordered closing down all sawmills and plywood mills of the state except a few. After this ban, the normal operation of timbers was virtually put to an end, resulting in acute shortage of timber in all the markets including this division. On the other hand, there is high demand of timber and other construction materials like sand, gravel and stones etc. in the markets of Guwahati city itself, where heavy construction works are going on everywhere. A huge gap is created thereby between demand and supply. This high demand is being met by timber coming from neighboring states as well as by that illegally collected from the forests. The demand for stone, gravel and sand were met from the sand mahals and stone queries running in this division. Kamrup East Forest division earlier comprised 7 sand mahals, 2 stone quarries located outside the RF, 14 stonequarries and 6 sand mahals within the RFs. As some part of the Kamrup East Forest division falls under ecosensitive zones, only one stone quarry is in operation now. There is no demand/supply of NTFPs recorded in this Division.

7.5.1 Agricultural Customs and Wants of the Population: The economic prosperity of the surrounding population is intimately tied to the proper management of these RFs. The surrounding population is mainly comprises Assamese Hindus, Rabhas, Kacharis, Kochs, and to a lesser extent, of Khasis, Karbis, Garos and ex-tea-garden labourers. Although their agricultural customs vary, all of them cultivate paddy in the low-lying lands adjoining the forest reserves. They generally raise only one crop in a year, viz *Salidhan* crop; and are engaged in agricultural activities in connection with growing this crop from June-July to December. As many of the reserve forests of this division are situated near Guwahati city the gateway of North East India people living in fringe villages change their livelihood from agriculture to Govt/private job, business etc. The requirement of forest products of the people residing in the rural and interior areas has so far been firewood, tree pole for house posts, bamboos, thatch, cane, ekra, timber, etc. and for agricultural implements like nangal, dheki etc., Most of the villagers adjoining the reserves depend on the reserves for grazing their cattle, either legally or illegally.

7.5.2 Markets and marketable Produce: All types of forest produces, for the purpose of trade, are sold on a competitive scale to contractors or mahaldars, who collect the produce in depots at suitable places. Depots are generally near the Range or Beat Head Quarters. These depots also serve as markets to the public to buy directly from them. The Guwahati and Palasbari are the principal timber markets. Both the major and minor forestproducts are mainly utilised within the division and adjoining towns and some timber are exported. State Public Works Department and other development agencies consume some timber for bridge and building construction. Bamboos are mainly consumed locally.

7.6 Import and export of Wood and Wood Products: Earlier this division used to export valuable timber-species like Sal, Teak, Gamari, etc. on regular basis both in log and sawn form. After the ban imposed by the Apex Court, the State of Assam, including this Division, is facing acute shortage of timber. As a result, instead of exporting timber, this division imports timber from the neighbouring states. Some of these timbers converted to sawn timber and plywoodand finished products are exported to other states.

7.7 Import and export of NTFPs: Different varieties of cane are imported from Arunachal Pradesh, Nagaland etc. and are generally used for making various types of cane furniture and some of them are exported as well. Mulibamboos are imported from Mizoram and Barak Valley for making bamboo mats which are locally consumed. Broom-stock &Tezpata are imported from Meghalaya and exported to other states. Other NTFPs available in the local market are locally consumed.

7.8 Removal of fodder: Since collection of fodder is banned in the State, its removal has not been reported in the Division.

7.9 Valuation of the Products: List of wood based and plywood industries under Kamrup Division is shown in table 7.9a and 7.9.b. respectively.

Table 7.9.a. List of Wood-based Industry under Kamrup East Division.

Sl. No.	Name of Saw Mill	Name of Place
1	M/s. Purbanchal Saw Mill	PachimBoragaon
2	M/s. Sanjoy Saw Mill	Palasbari
3	M/s. Kedia Timber Industry	PachimBoragaon
4	M/s. Popular Saw Mill	Sonapur
5	M/s. Sonapur Saw Mill	Sonapur
6	M/s. Rajib Saw Mill	Palasbari
7	M/s. Janata Saw Mill	Palasbari
8	M/s. Biswanath Saw Mill	Palasbari
9	M/s. Sur Saw Mill	Palasbari
10	M/s. Kar Guha & Co. Saw Mill	Palasbari
11	M/s. Durga Saw Mill	Palasbari
12	M/s. Janapriya Saw Mill	Palasbari
13	M/s. Senimai Saw Mill	Palasbari
14	M/s. Joy Saw Mill	Palasbari
15	M/s. Jonty Saw Mill	Palasbari
16	M/s. Choudhury Saw Mill	Kokjar, Mirza

Table 7.9.b. List of Plywood Industry under Kamrup East Division.

Sl. No.	Name of Plywood Industry	Name of Place
1	M/s. Cent Ply (a Division of Century Ply Boards)	Palasbari
2	M/s. Kamlang Saw & Veneer Mills Pvt. Ltd.	Palasbari
3	M/s. Gitanjali Udhyog	Palasbari
4	M/s. Shree Bhawani Ply-wood Industry	Palasbari
5	M/s. Kaziranga Wood Products Pvt. Ltd.	PachimBoragaon
6	M/s. Khandelwal Saw Mill.	Palasbari
7	M/s. Dhubri Ply-wood Factory	Palasbari
8	M/s. Purbanchal Timber Industry	Palasbari

Statement showing the 'in operation'existing Mahal, quantity and area under Kamrup East Division is shown in Table 7.9.c.

Table 7.9.c. Area under different Mahals in Kamrup East Division.

Sl. No.	Name of Mahal	Type of Mahal	Area (Ha)	Annual stipulated Quantity	Reasons for non operation of Mahal
1	Mainakhurung Stone Mahal No.A	Stone	0.5	1500 M^3	Falls under Eco-sensitive Zone, The mahal having MoEF clearance upto 15/12/2022
2	Mainakhurung Stone Mahal No.B	Stone	0.5	1600 M^3	Falls under Eco-sensitive Zone, The mahal having MoEF clearance expired on 28/12/2014

Sl. No.	Name of Mahal	Type of Mahal	Area (Ha)	Annual stipulated Quantity	Reasons for non operation of Mahal
3	MainakhurungStone Mahal No.C	Stone	1.0	2500 M^3	Falls under Eco-sensitive Zone, The mahal having MoEF clearance expired on 22/01/2016
4	Deochotal Stone Mahal No. A	Stone	0.5	2500	Falls under Eco-sensitive Zone, The mahal having MoEF clearance upto 15/12/2022
5	Deochotal Stone Mahal No. B	Stone	0.5	2100	Falls under Eco-sensitive Zone, The mahal having MoEF clearance expired on 27/02/2013
6	Deochotal Stone Mahal No. C	Stone	0.5	3000	Running lease period upto 03/07/2018
7	Garbhanga Stone Mahal No. A	Stone	0.5	3000	Falls under Eco-sensitive Zone, The mahal having MoEF clearance upto15/12/2022
8	Garbhanga Stone Mahal No. B	Stone	0.5	2500	Falls under Eco-sensitive Zone, The mahal having MoEF clearance upto 15/12/2022
9	Lakhra Stone Mahal No. 1	Stone	0.5	2500	Falls under Eco-sensitive Zone, The mahal having MoEF clearance expired on 12/09/2015
10	Lakhra Stone Mahal No. 2	Stone	0.5	2500	Falls under Eco-sensitive Zone, The mahal having MoEF clearance upto 15/12/2022
11	Fatasil Stone Mahal No.1	Stone	1.0	3200	Due to construction of overhead tank under GMDA Project.
12	Fatasil Stone Mahal No.2	Stone	1.0	3700	Due to construction of overhead tank under GMDA Project.
13	Fatasil Stone Mahal No.3	Stone	0.5	2000	Due to construction of overhead tank under GMDA Project.
14	Helagog Stone Mahal	Stone	0.5	--	Lease period expired on 12/04/2016.

Sl. No.	Name of Mahal	Type of Mahal	Area (Ha)	Annual stipulated Quantity	Reasons for non operation of Mahal
15	Digaru Sand Mahal No.1	Sand	5.1	3500	Falls under Eco-sensitive Zone, new proposal initiated but matter kept pending as area falls under Eco-sensitive Zone.
16	Digaru Sand Mahal No.2	Sand	5.04	4500	Falls under Eco-sensitive Zone, new proposal initiated but matter kept pending as area falls under Eco-sensitive Zone.
17	Digaru Sand Mahal No.3	Sand	5.0	3500	Falls under Eco-sensitive Zone, new proposal initiated but matter kept pending as area falls under Eco-sensitive Zone.
18	Digaru Sand Mahal No.4	Sand	5.0	2500	Falls under Eco-sensitive Zone, new proposal initiated but matter kept pending as area falls under Eco-sensitive Zone.
19	Digaru Sand Mahal No.5	Sand	5.0	3000	Falls under Eco-sensitive Zone, new proposal initiated but matter kept pending as area falls under Eco-sensitive Zone.
20	Kurkuria Sand Mahal	Sand	0.5	2500	Falls under Eco-sensitive Zone, new proposal initiated but matter kept pending as area falls under Eco-sensitive Zone.
21	Chandrapur Sand Mahal	Sand	0.5	2500	Falls under Eco-sensitive Zone, new proposal initiated but matter kept pending as area falls under Eco-sensitive Zone.
22	Rani Sand Mahal	Sand	---	1500	Mahal expired on 13/11/2011
23	Baruapara Silt Permit Area	Silt	5.0ha	10000	Lease period expired during Nov,2015, Court Case.
24	Thakuriapara Silt Permit Area	Silt	5.0ha	10000	Lease period expired during Nov,2015,
25	Rajapara Silt Permit Area	Silt	5.0ha	10000	Lease period expired during Nov,2015, Court Case.

Sl. No.	Name of Mahal	Type of Mahal	Area (Ha)	Annual stipulated Quantity	Reasons for non operation of Mahal
26	Rajbari Ghat	Silt	5.0ha	10000	Mahal settle with the bidder on 17/12/2013 but as per direction of PCCF&HoFF settlement order has been withdrawn due to area falls under Eco-sensitive Zone.
27	Panikhaity Ghat	Silt	5.0ha	10000	Mahal settle with the bidder on 18/12/2013 but as per direction of PCCF&HoFF settlement order has been withdrawn due to area falls under Eco-sensitive Zone.
28	Dumpara Ghat	Silt	5.0ha	10000	Mahal settle with the bidder on 19/12/2013 but as per direction of PCCF&HoFF settlement order has been withdrawn due to area falls under Eco-sensitive Zone.

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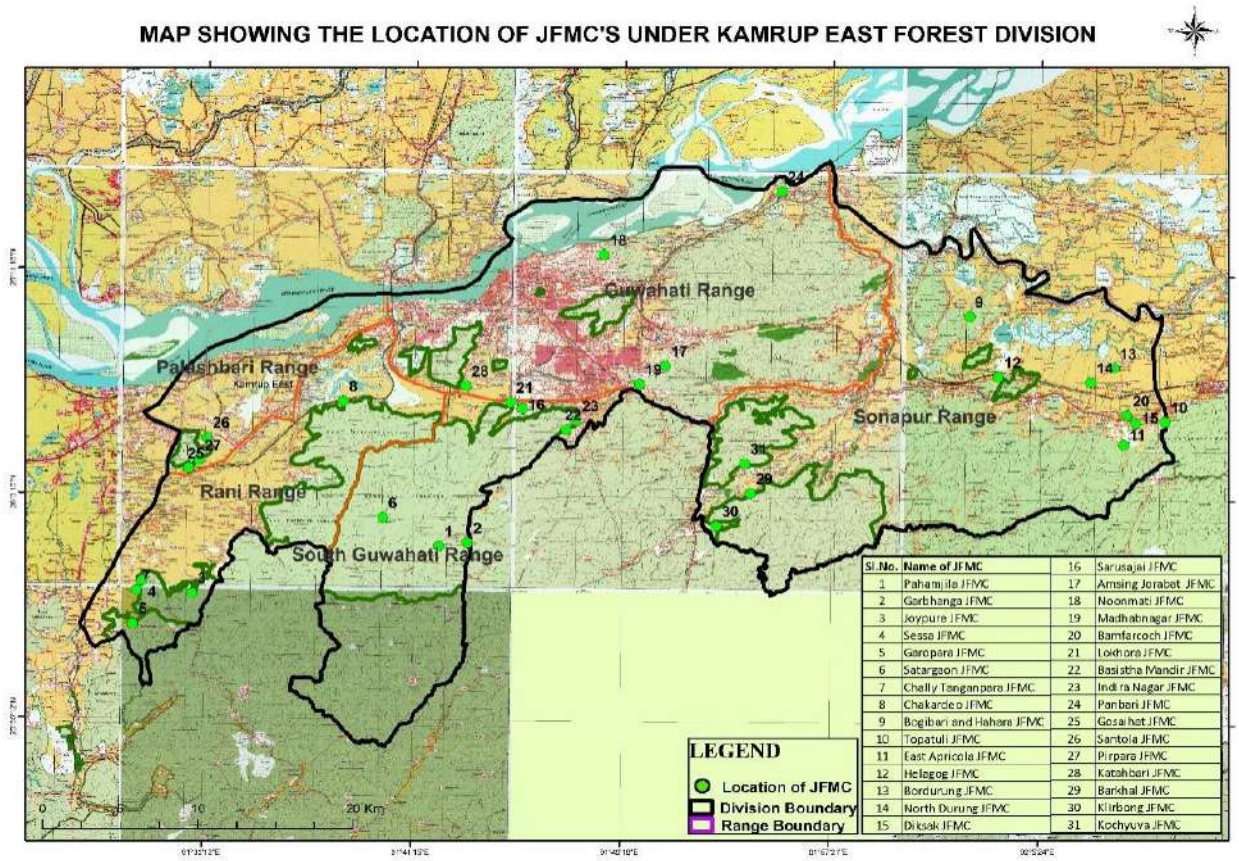
CHAPTER 8
MAINTENANCE OF SOCIAL, ECONOMIC, CULTURAL AND SPIRITUAL BENEFITS

As per the National Forest Policy of India 1988, the participation of local communities 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 forestlands with the help of the local community and voluntary organizations. Communities organize themselves into a Joint Forest Management Committees (JFMCs) to protect and manage forests. They, in turn, benefit from the 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, wildlife habitat 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 form the basis of forest management in the State.
Hence, the working plan will make all necessary provisions for participation of Forest Fringe Communities in such sustainable forest management practices, which also benefit these communites.

8.1 Number of JFMCommittees and area (s) Protected by them: JFMC committees and area protected by them and their status is shown in Annexure (Volume-II).



Sl.No.	Name of JFMC		
1	Pahamjila JFMC	16	Sarusajai JFMC
2	Garbhanga JFMC	17	Amsing Jorabat JFMC
3	Joypure JFMC	18	Noonmati JFMC
4	Sessa JFMC	19	Madhabnagar JFMC
5	Garopara JFMC	20	Bamfarcoch JFMC
6	Satargaon JFMC	21	Lokhora JFMC
7	Chelly Tanganpara JFMC	22	Basistha Mandir JFMC
8	Chakardeo JFMC	23	Indira Nagar JFMC
9	Bogibari and Hahara JFMC	24	Panbari JFMC
10	Topatuli JFMC	25	Gosaihat JFMC
11	East Apricola JFMC	26	Santola JFMC
12	Helagog JFMC	27	Pirpara JFMC
13	Bordurung JFMC	28	Katahbari JFMC
14	North Durung JFMC	29	Barkhal JFMC
15	Diksak JFMC	30	Klirbong JFMC
		31	Kochyuva JFMC

8.2 Status of empowerment of JFMCs: A total of 32 JFMCs have been constituted at village level with the aim of decentralizing the decision-making process and to ensure community involvement in planning, implementation and management of forests in

KamrupEast Division. Brief details on regular meetings at the community level, participation of members in JFMCs and their role in functioning of the forest development agency are given in table 8.2a, reflecting the the status of JFMC's empowerment. Due to non availability of adequate funds for JFMC activities, some of the JFMC Committees are not functional. Therefore, a Comprehensive Action Plan will be prepared in consultation with JFMCs during the first year of Working Plan implementation and thereafter all the JFMCs will be reactivated accordingly.

Table 8.2a. Status of people's participation in management

Reporting year	JFMC meetings		Attendance in the GBM		No. of EC meeting		Grading the JFMCs		
	No. / periodicity	Agenda	% of attendance	Minutes approved	% of attendance	Minutes approved	A	B	C
2015-16	96	Discussed and approved	80%	Approved	65%	Approved	Not graded		

Table 8.2b. People's benefit sharing

Reporting year	Type of benefit	Sharing %	Existence of conflict and management
2015-16	Monitary benefit earned by rendering in plantation works and usufructs benefit	25% of yield from thinnings 25% of yield from final harvest	As per the JFMC rule

8.3 Labour Welfare: Minimum wage provided to labour employed by forest department in the division is Rs 240 per day per person.

8.4 Use of Indigenous Knowledge: There are many local and traditional practices followed by the tribals and the people living in vicinity of the forest areas. Documentation of these indigenous traditional knowledge and incorporation of the same in the micro-plans is under process.Documentation of the indigenous traditional knowledge and incorporation of the same in the micro-plans are being done by agencies appointed by the Head of the Programmes.

8.5 Extent of Cultural/Sacred Groves: The Bhimashankar area near Pamohi in South Guwahati Range is revered by locals as the 10thJyotir Linga and a sacred site for devotees of Lord Shiva. The biodiversity of the entire area in protected by the locals and there is no illegal extraction.

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 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 alongwith 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.

Fair scope for ecotourism exists in Kamrup East division. Large number of people, mostly from Guwahati city, visits these places every year during the winter months from November to January for picnics. These places can be transformed into Eco-tourism spots by undertaking improvement works including development of road communication sanitary system, shades etc. Involvement of Local NGOs and JFMCs need to be ensured. Natural attributes viz. landscape, waterscape and wildlife and also the humanscape need to be enlisted and explained and documented for effective Ecotourism Management. Members of JFMC need to be trained on the line of ecotourism i.e., as guide for trekking, bird watching and identification of common flora and fauna in the forests by which they can earn their livelihood. This will boost the economy of the villagers residing in the fringe of the Reserve forests. Apart from DeeparBeel Sanctuary EDC which is managed by Guwahati Wildlife Division, the following places, located within the Kamrup East Division having scenic beauty are identified for developing as eco-tourism spots. The places are having great potential and feasibility in as much as these are already being used as picnic spots attracting tourists.

Rani Range:

1) **Sukurberia**: Located at Assam Meghalaya border, the place is of natural beauty. The place is already being used as Picnic Spot.
2) **Rani Kapili**: It is a picnic spot having natural beauty. The Kapili River flowing through it enhances its beauty to attract tourists.
3) **Sattargaon**: Located in Rani RF it is a beautiful place having a water fall in it. The place may be used for nature trail.

Guwahati Range:

Umananda Island (from AssameseUma, another name for the Hindu goddessParvati, the wife of Shiva; and ananda, "happiness") is the smallest river island in the midst of river Brahmaputra flowing through the city of Guwahati. The British named the island Peacock Island for its structure. The island can be reached via 10 minute ferry, available from Umananda Ghat (Kachari ghat) located near Kamrup CJM Court. According to Hindu mythology, Shiva created the island for his wife Parvati's happiness and pleasure. Shiva is said to have resided here in the form of Bhayananda. According to a myth in Kalika Purana, Shiva burnt Kamadeva with his third eye on Umananda when he interrupted Shiva's deep meditation, hence its alternative name Bhasmachal (Assamese: bhasma, "ash"; and achal, "hill"; literally, "hill of ashes"). In 1897, an earthquake damaged the temple heavily, but was later repaired by a local merchant. The temple displays mixture of both Hindu Vaishnavism and Shaivism. There are Assamese craftings of Ganesha, Shiva, Parvati, Vishnu, and other Hindu deities. During the repairing work of the temple some new Vaishnavi scripts were written on the walls. Craftsmen also carved figures out of rock on the island. Maha

Shivaratriis widely celebrated in Umananda. Monday is considered to be the holiest day in the temple and the new moon brings bliss to the pilgrims. Umananda Island was the home to the species of the endangered golden langur, introduced to the island in the 1980s, with the last one dying in 2020.The island is dotted with Tamarind trees.

Umananda is a very much potential place for eco tourism. Chars in River Brahmaputra may also be promoted for eco-tourism.

South Guwahati Range:

1) **Garbhanga**: Garbhanga is a beautiful place adjacent to Guwahati city. The place is very much potential for hill trekking and nature trail. It is a habitat of Hoolck Gibbon which also attracts tourists.
2) **Bhimasankar**: Located in the northern periphery of Garbhanga R.F. near Moinakhurung Beat Office, it is a religious place having the only Jyotirlingam of north-east. Tourists visit this place for worshiping lord Bhimasankar.

Sonapur Range

1) **Topatoli**: Located at Assam Meghalaya border, it is a place of scenic beauty. The River Umsiang flows through it. The place is being used as picnic spot.
2) **Markam-Komarghuli**: Located Assam-Meghalaya border amidst hills, this is a beautiful place near Guwahati city to attract nature loving tourist. Three aboriginal tribes, Khasi, Garo and Karbi people dominate the area enhancing its tourism potential as visitors come here to enjoy ethnic culture of the tribals.
3) **Tegheria**: Tegheria is a village near Khetri. It is a beautiful place. Water falls existing in this spot attracts tourists in the winter season.

8.7 Social Customs: Guwahati cosmopolitan city falls within Kamrup East Division. This division embraces people of all the major religions of India including Hinduism,Islam, Christianity, Buddhism and Animism. Besides, several tribal communities like Rabha, Bodo, Garo, Khasi, Karbi, Tiwa etc. have been living in different parts of the division from time immemorial. All these people of different religions, castes and creeds have their own social customs.

Agrarian customs

The agricultural customs vary in different parts of the division and "Sali" (June-July to November – December) and "Bao" (April-May to November-December) paddy is the main crop in the area. Although the agricultural practice had tended gradually to be intensive in other parts of the division, usually in most of the areas in the neighbourhood of the forests the people still depend on the main crop of paddy and field lie inactive during the rest of the season.

"Ahu" (March-April to June-July) paddy is also raised by the farmers to a certain extent in the division. Where there is a ready source of perennial water nearby spring paddy (Boro) is also raised. Mustard, wherever feasible is invariably raised. During winter some amount of potatoes and vegetables are also raised by the villagers. Some of the enlightened farmers have gone for cultivation of high-yielding verities of rice in which case three crops can be raised in a year, and keeps the cultivator engaged throughout the year.

The low-lying lands in the "Julis" in the forest have been brought under the plough and are crop of paddy is raised in such areas. Garos and Mikirs indulge in shifting cultivation in some of the Reserved forests indicated earlier. Ahu-paddy, maize, vegetables etc. are grown in such Jhums. In the villages adjoining the reserved forests large herbs of cattle (of rather poor breed) are maintained and these are entirely dependent on the forest for grazing.

8.8 Status of compliance of Forest Right act (FRA): A total of 1214 ha area of this division has been allocated under the Forest Rights Act. Status of FRA is shown in table 8.8.

Table 8.8: Statement showing the status of Forest Rights Committee (FRCs)

Sl. No	Name of FRC	Name of Range	Name of RF	No of claims	Claim on land area			Status/ Remark
					Home land (Ha)	Cultivated land (Ha)	Total area (Ha)	
1	GarbhangaUlubari	South Guwahati	Garbhanga	57	59	59	119	V
2	Amren Deka Pathar	-do-	-do-	44	67	64	131	V
3	PahamJila	-do-	-do-	39	48	41	89	V
4	Mehendri	Rani	Jorasal	88		49	49	V
5	Sessa	-do-	-do-	108	0.7	60	61	V
6	Sattargaon	-do-	Rani	50	26	32	58	V
7	Salli F.R.C	-do-	Kawasing	86	39	29	68	V
8	Jaypur	-do-	-do-	150	71	74	145	V
9	Kawasing	-do-	-do-	173	57	81	138	V
Sub total				**795**	**367.7**	**489**	**857**	
10	JalukPaham F.R.C	South Guwhati	Garbhanga	33	78	37	115	UV
11	Durapaham	-do-	-do-	40	147		147	UV
12	NumaliPathar	-do-	-do-	37	12	66	78	UV
13	Khansaigam MithaAmtol	Guwahati Range	Fatasil	128	16		16	UV
14	Mirza Ganesh para	Palasbari	Maliyata	49	1		1	UV
Sub total				**287**	**254**	**103**	**357**	
Grand total				**1082**	**621.7**	**592**	**1214**	

Ref: V=Verified & sent to SDLC, UV=Under verification

8.9 Other Rights and Concessions: Rights and Privileges granted to the villagers in some of the Reserved Forests of this division are elaborated in as follows:

i) Rights and Privileges over Garbhanga Reserved Forest:

i. The privileges of domestic consumption of firewood, bamboo, house pole, nungal, cane and thatch etc. are granted to villagers of (1) Kangthong village, (2)

Nangturivillage, (3) Mumpaham village, (4) Bhalukkhowa village Nepali Basti, (5) Jalukpaham, and (6) Dolopaham villages subject to control by the Forest Department.

ii. The villagers of the above mentioned villages are allowed to enjoy the privileges of free grazing of their cattle in the Reserved Forests; subject to the rules and control of the Forest Department. It is not possible to fix the exact number of cattle heads to be permitted to each family, but no professional grazing will be allowed.

iii. Public right of way over a portion of existing path leading from Gohaingurung village to the reserved forest to the Assam Trunk Road. 12ft cart road from Lokhra to Garbhanga and 7 numbers of 6ft path can be used by the local people.

ii) Matapahar Reserved Forest:

iv. The privileges of domestic consumption of firewood etc. have been granted to the villagers of (1) Helagog, (2) Benganabari, and (3) Nowgong village subject to control by the Forest Department and to the following limits as regards quantity and dimensions :-

a. Firewood head load - No limits
b. Firewood cart load - 10 cart load per year per house.
c. House post dia 15cm (undressed) - 12 nos.
d. Bamboo (any verity) - 100 nos. per year per family.
e. Cane - 5 bundles per year per family.

v. The villagers of the above mentioned villages are allowed to enjoy the privilege of free grazing of their cattle in the Reserved Forest (outside the forest plantation area) subject to the rules and control by the Forest Department. It is not possible to fix the exact number of head of cattle to be permitted to each family, but professional grazing will not be permitted free of cost in the Reserved Forest.

iii) Teteliguri Reserved Forest:

The privileges of domestic consumption of firewood, bamboo etc. have been granted to the village (1) Dakhinban, (2) Longkhong, (3) Gohaingaon, (4) Gandhinagar, (5) Teteliguri subject to control of the Forest Department

a. Firewood head load - No limit
b. Thatch head load - No limit
c. Bamboo (any verity) - 50 per year per family.

The villagers of the above mentioned villages are allowed to enjoy the privileges of free grazing of their cattle in the Reserved Forest (outside the forest plantation area) subject to rules and control imposed by the Forest Department. No professional grazing will be permitted in the Reserved Forest except on written permission from the forest department on payment of a fee to be determined by the D.F.O.

The villagers of the above mentioned villagers are allowed to use part of it for burial; where necessary.

iv) Marakdola Reserved Forests: The privilege of domestic consumption of firewood etc. is granted to the villagers of (1) Upertepechia (2) Gojaigaon (3) Sonaigaon (4) Marakdola (5) Sarutari (6) Amber (7) Medhikuchi, and (8) Phulung village subject to

the control by Forest Department and also subject to the following limits of quantity and dimensions:-

a. Firewood - Head load –No Limit,
b. Firewood - Cart load -10 Cart load per year per household,
c. House post (Dia 15 cm) undressed - 12 nos. every three years per household.
d. Bamboo - Any variety, 100 nos. per year per family,
e. Nangal - 3 nos. per year per household,
f. Cane - 5 bundles per year per household.

The villagers of the above mentioned villages are allowed to enjoy the privilege of free grazing of cattle in the Reserved Forests (outside the forest plantation area) subject to the rules and control of the Forest Department. It is not possible to fix the exact numbers of the cattle to be permitted to each family but no professional grazing be permitted free of cost in the Reserved Forest.

v) Maliata Reserved Forest: Rights of way are conceded to all springs in the reserve.

vi) Jalukbari Reserved Forest:

I. 140 bighas of land from inside Jalukbari RF contiguous to Lankeswar Dham temple land is allowed for the temple authority to exercise its rights in the interest of the management of the Lankeswar Dham temple without causing detriment to the Forest Reserve.
II. The temple authority is allowed to utilize the water sources from inside the RF for the benefit of the temple and pilgrims.

vii) Rani Reserved Forest: Rights of surrounding population – The privileges of the cutting grass and firewood within the reserve have been granted by the Chief Commissioner to the inhabitants of the nighbouring villages, subject to such rules as may be imposed from time to time to ensure the safety of this forest. Name of right holders - The villagers of (1) Satgaon, (2) Dhankhola (3) Bahupara (4) Kenhikuchi (5) Kacharipara (6) Rangapara (7) Norllong (8) Rajapara (9) Satargaon (10) Raibori (11) Gonakpara (12) Sazanpara (13) Mailata (14) Dogapam (15) Audijuli (16) Jubai (17) Patgaon (18) Raja (19) Panichanda (20) Ajhara (21) Chakardo (22) Deochotal (23) Maghuogaon (24) Daopara (25) Pamohi (26) Moinakhurung (27) Kallapara (28) Ghurapara (29) Nargaon, and (30) Allibari.

viii) Aprikola West Reserved Forest: The privileges of domestic consumption of firewood etc. to the villagers of (1) Topatoli (2) Madhupur (3) Dhomat (4) Fulling (5) Nartop (6) Luri (7) Markong (8) Pahigabti, and (9) Hatigola village; subject to the following limits as regards quantity and dimensions.

a. Firewood - Head load, No limit,
b. Firewood - Cart load, 10 Cart load per year per household,
c. House post (Dia 15 cm) undressed – 10 nos. every three years per household.
d. Bamboo - Any variety, 100 nos. per year per family,
e. Nangal - 3 nos. per year per household,
f. Cane - 5 bundles per year per household.

The villagers of the above mentioned villages are allowed to enjoy the privileges of free grazing of cattle in the Reserved Forests (outside the forest plantation area) subject to the rules and control of the Department. It is not possible to fix the exact numbers of head of

cattle to be permitted to each family, but no professional grazing be permitted free of cost in the Reserved Forest.

8.10 Dependence of local people on NTFPs: Forest villagers, JFMC beneficiaries and FRA Rights holders are dependent on NTFPs gathered from the forest. They have been legally empowered to collect NTFPs for their domestic needs. The fruits of Dillenia spp., Garcinia spp., Tubers, Medicinal Plants, and Herbs etc. are collected by the local people for consumption and use as medicines. To meet their domestic needs they mainly collect bamboo, cane and JhenguPatta. The legally enforced, Assam Forest Regulation Act, beyond the individual demands of the Right Holders, stipulates that the local selling and marketing shall be under proper transit pass or challan.The provisions of T.P/T.C. though required legally, have not yet been properly implemented due to their traditional practices. The Forest administration shall impose the mechanism for assessing the quantity domestically used and also the quantity marketed in the local market. During the constitution of the RFs, certain rights and concessions were allocated to the people living in and around the RFs.

8.11 Other aspects: All vacant Govt. land should be covered by forest in homestead, Tamples, Masques, Road dividers, Institutional land etc. with the help of Social Forestry Division and other NGOs. Agro forestry, Firm forestry are to be encouraged in fringe villages lessen the dependency of local people on RFs.

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CHAPTER 9

ADEQUACY OF POLICY, LEGAL AND INSTITUTIONAL FRAME WORK

9.1 Existing Policy and Legal Framework and their Compliance: All the legal frameworks are adhered to as per the norms, rules and laws.

There are several Acts, Rules and Regulations enacted by the Govt. of India and the State Government to deal with various issues for protection and management of Forests. These are-

a) Assam Forest Regulation 1891 (Amended Act 1995).
b) Wild Life (Protection) Act1972.
c) The Assam Wildlife Protection Rule 1997.
d) Indian Forest Act 1927.
e) Forest Conservation Act 1980.
f) The Biological Diversity Act-2002.
g) Assam Bio-diversity Rule-2010.
h) The Wood base Industries (Establishment and Regulation) Rules 2000.
i) The Cattle trespass Act 1871.
j) The Assam Forest (Removal and storage of produce) Regulation Act-2000.
k) The Assam (Control of Felling and Removal of trees from Non-forest Land) Rules 2002.
l) Schedule tribe and other traditional Forest Dwellers (Recognition of Forest Rights) Acts 2006
m) Schedule tribes & other traditional Forest Dwellers (Recognition of Forest Rights) Rules 2007.
n) The Assam Joint (Peoples Participation) Forestry management Rule-1998.
o) The Assam Minor Mineral Concession Rules-2013.

Besides the above Acts, Rules and Regulation, Indian Penal Code and Criminal Procedure Code are also applicable to support the above Acts/Rules depending applicability and jurisdiction. Compliance of all the above Acts, Rules, Regulations are satisfactory in as much as the provisions of such Acts/ Rules are being applied/ enforced towards sustainable management of forest. But enforcing of Assam Forest Regulation 1891 (Amended Act 1995) and Wild Life (Protection) Act1972 for punishment of offenders require much meticulous efforts. Capacity development and training of staffs and officers are becoming an urgent to deal with the legal issues which can, of course, give an positive impact in forest conservation.

9.2 Status of approved Working Plan and compliance: Since 1988 the division does not have any approved working plan.

9.3 Number of forest offences:

There are number of forest offence reports recorded, which have been sent to court for discretion and several of them are pending. The pending cases are registered in the beginning of the financial year in order to keep track of the records. The assessment of the forest

offences since 1982-83, under different Ranges, donot show any decline with many cases lined up for discretion. The following table shows forest offences

Table 9.3: Number of forest offences in Kamrup East Division.

Assessment Year	Types of Offence	Number	Cases taken to the court of law	Types of loss of Forest and revenue
2008-2009	Sand	44	—	No Loss of revenue
	Stone	31	—	—do—
	Earth	54	—	—do—
	Timber	18	—	—do—
	River Silt	13	—	—do—
	Firewood	1	—	—do—
2009-2010	Sand	36	—	No Loss of revenue
	Stone	28	—	—do—
	Earth	47	—	—do—
	Timber	31	—	—do—
	River Silt	12	—	—do—
	Firewood	2	—	—do—
	Lime Stone	1	—	No Loss of revenue
	Single	3	—	No Loss of revenue
2010-2011	Illegal Removal of Sand	33	—	No Loss of revenue
	Stone	32	—	—do—
	Earth	21	—	—do—
	Timber	19	—	—do—
	River Silt	6	—	—do—
	Firewood	1	—	—do—
2011-2012	Sand	60	—	No Loss of revenue
	Stone	21	—	—do—
	Earth	36	—	—do—
	Timber	13	—	—do—
	River Silt	9	—	—do—
	Firewood	1	—	No Loss of revenue
2012-2013	Sand	37	—	No Loss of revenue
	Stone	24	—	—do—
	Earth	37	—	—do—
	Timber	15	—	—do—
	River Silt	6	—	—do—
2014-2015	Sand	11	—	No Loss of revenue
	Stone	16	—	—do—
	Earth	12	—	—do—
	Timber	3	—	—do—
	Lime Stone	1	—	No Loss of revenue
	Single	3	—	No Loss of revenue
	Illegal Removal of Sand	67	—	No Loss of revenue
	Stone	46	—	—do—
	Earth	40	—	—do—

2015-2016	Timber	5	—	—do—
	River Silt	19	—	—do—
	Firewood	1	—	—do—
	Agar wood	2	—	—do—
	Charcoal	9	—	—do—
	Lime Stone	8	—	—do—
	Sand Gravel	2	—	—do—
2016-2017	Sand	177	—	No Loss of revenue
	Stone	83	—	—do—
	Earth	49	—	—do—
	Timber	40	—	—do—
	Firewood	6	—	No Loss of revenue
	Agar wood	1	1	Pending in court
	Charcoal	5	—	No Loss of revenue
2017-2018	Sand	170	—	No Loss of revenue
	Stone	94	—	—do—
	Earth	102	—	—do—
	Timber	69	3	Confiscation proceeding is under process
	River Silt	7	—	—do—
	Firewood	8	—	—do—
	Agar wood	2	2	Pending in court
	Charcoal	4	—	No Loss of revenue

9.4 Status of research and development: The State Forest Department, along with associated Silviculture Department, has carried out many studies in the division. There are many research works carried out in different aspects of biodiversity conservation, remote sensing and geospatial studies in the division. Sal regeneration study is attached vide Annexure XVa. 'A Study on Human-Elephant conflict in and around areas of Kamrup East Division and Guwahati Wildlife Division and potential solution' by Sri Mrigen Barua, AFS attached vide Annexure XVb.

9.5 Human Resource Capacity Building Efforts: The capacity building of the existing staff is carried out through a number of trainings, field visits and workshops. The effectiveness of these training programmes is also assessed. The capacity building programmes help to build an active task force. The details and the status of training conducted for capacity building of human resources for efficient utilization of the human resources in Kamrup East Division is shown in the table 9.5 below. During the tenure of thisworking plan the Forest Department will ensure that at least 2/3rd staff should be trained on various aspects of forest management.

Table 9.5: List of training and capacity building programs carried out in the division.

Category/ theme of training (indicate separately for trainers and trainees	Annual (No.)	Total number of trainees (No.)	Effectiveness of the training (activity relevant to the training) (%)
Human Rights and Peace and conflict	1	1	100%

management			
Work place creativity and stress management	1	1	100%
Project management	2	2	100%
Ethical Decision Making in Govt.	1	1	100%
DIP under PMKSY at NERC, NIRD & PR	1	1	100%
Contempoary Forest Management & way forward	1	1	100%
Accountant Financial Rules	1	1	100%
District irrigation Plans under PM Krishi Sanchai	1	1	100%

9.6 Forest Resource Accounting: Tangible benefits from forests are timber, NTFPs, fuelwood, fodder, livelihood, ecotourism, biodiversity, etc. The intangible benefits of forests are carbon sequestration, soil erosion control, water recycling, oxygen production, control of air pollution, animal habitat, etc. Duing the tenure of this working plan positive efforts will be made to quantify the tangible and intangible benefits. Benefits from these to the states economy are presently underestimated.

9.7 Budgetary allocation to the forestry Sector: The total budgetary allocation for both planned and non plan budget for 2015-16 is given in the following table 9.7.

Table 9.7. Budget allocated to the forestry sector in Kamrup East Division

Reporting year	Budgetary allocation	Total budget received (Rs. in lakhs)	Timely completion of the work	Efficiency in cash flow	Audited report and reporting
2015-2016	Plan – CSS(NBM)	6.25	Works timely completed	Efficient	Not yet audited
	Non-Plan	909.15			
	FDA	--			
	GIM	--			
	CAMPA	94.18			
	APFBC	91.81			
2016-2017	Plan – CSS(NBM)	Nil	-	-	
	Non-Plan	Nil		-	
	FDA	Nil	-	-	
	GIM	Nil	-	-	
	CAMPA	31.79	Works timely completed	Efficient	
	APFBC	Nil	-	-	-
2017-2018	Plan – CSS(NBM)	Nil	-		
	Plan -RDF	9.035	Works timely completed	Efficient	
	Non-Plan	Nil	-		
	FDA	Nil	-		
	GIM	Nil	-		
	CAMPA	84.64	Works timely	Efficient	

			completed		
	APFBC	Nil	-	-	-

9.8 Existence of monitoring, assessment and reporting mechanism: Both physical and financial monitoring are being done from time to time by C.C.F., C.F, D.F.O, and external agencies.

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. During the tenure of this working plan, efforts should be made to increase public awareness of the important forestry programmes, benefits provided by forests and sustanaible management of forests, along with distribution of published materials such as brochures, pamphlets, leaflets, posters etc.Forestry/environmental awareness and education programmesshould be conducted for students.Meetingsand workshops are to be held regularly inviting resource persons from outside. Powerpointpresentations and documentary filmsshould be exhibited during such workshops.

9.10 Adequate Man Power in Forest Division: The position of staff of the division as it stood on 30/11/2019 is furnished in table 9.10a.

Table 9.10a: The total number of posts and total amount spent during the financial year under Non-Plan

Sl.No.	Name of Post	No. of Post	Total amount (Rs) of the month(Nov/2019)	Total amount (Rs) for the year 2019-2020
1	DCF	1	81,508.00	9,50,783.00
2	ACF	5	4,39,860.00	50,22,720.00
3	FR	8	6,71,760.00	78,22,112.00
4	Dy.Ranger	7	4,85,184.00	56,82,432.00
5	H.Asstt	1	71,807.00	8,42,536.00
6	Acctt.	1	65,952.00	77,5,236.00
7	Sr.Asstt	4	2,07,724.00	24,37,616.00
8	Jr.Asstt	9	4,45,437.00	52,26,948.00
9	Drafts man	1	56,274.00	6,60,348.00
10	Forester-I	49	24,92,679.00	35,10,66,576.00
11	Forester-II	15	7,90,500.00	11,12,81,040.00
12	Forest Guard	93	41,74,770.00	58,80,24,864.00
13	Driver	8	4,16,056.00	48,82,048.00
14	Surveyor	2	49,206.00	7,72,176.00
15	Handyman	1	20,793.00	2,46,336.00
16	Chainman	1	20,793.00	2,46,336.00
17	Dak Runner	2	70,666.00	8,28,976.00
18	N/ Chowkider	2	72,546.00	8,51,344.00
19	I.B.Chowkidar	2	72,546.00	8,51,344.00
20	Gate Chowkidar	17	6,16,641.00	73,99,692.00
21	Shop chowkidar	2	72,546.00	8,51,344.00
22	Mali	2	72,546.00	8,51,344.00
23	Peon	5	1,81,365.00	21,28,360.00
	Total	**238**	**1,16,49,159.00**	**1,09,89,27,275.00**

Table 9.10b: Excess staff under Non-Plan Head of Kamrup East Division (2019-2020)

Name of Post	Sanctioned strength	Excess staff	Amount /month (Rs)	Total amount (Rs)
ACF	5	Nil	Nil	Nil
FR	8	Nil	Nil	Nil
Dy.Ranger	7	Nil	Nil	Nil
Forester Grade-I	49	Nil	Nil	Nil
Forester Grade-II	15	Nil	Nil	Nil
Forest Guard	93	Nil	Nil	Nil
U.D.Asstt	4	Nil	Nil	Nil

9.10.1 Labour Supply: Labours fromForest Villages, Taungya Villages and neighboring Revenue Villages are engaged, whenever required, for creation and maintenance of plantation works which include clearing the site, burning debris, stacking, hoeing in strips, making planting holes, planting, sowing seeds, weeding, cleaning and thinning etc. The creation of nursery is also labourdependant work - from seed collection, seed cleaning, seed treatment for preparing nursery beds, seed sowing nursery weeding, watering, shade making and so on. Their services are also utilized in protection- works like fire line cutting, controlled burning, etc. For felling, sectioning, debarking etc. skilled labour is engaged. Labourers are also required for other development works like road maintenance, building, maintenance, cultural operations. Forest villages were established inside the forests in earlier days to ensure labour supply. Forest villages are of two types:

(a) Residential Forest Villages.
(b) Non-residential Forest Villages.

The aim and object of establishing the forest village is defined in the forest manual. In addition to these two types of forest villages, there is another type known as Taungya Village. The adult members of these forest villages rendered 5 days free labour in a year. But now-a-days the forest villagers do not render any free labours for forestry works; paid labourers are engaged on daily wages.Under the jurisdiction of Kamrup East Division there is only one forest village i.e. Jaipur forest village in Jarasal RF under Rani Range. The daily labour wages prevalent in the past and at present under the Division are shown in Table 9.10.1 below.

Table 9.10.1: Daily labour wages prevalent in the past and at present under the Division

Sl. No.	Type of labour	Local rates during the year 2000 (`per day)	Local rates during the year 2013 (`per day)
1	Ordinary labour male and female	40/- – 50/-	200/- – 250/-
2.	Skilled labour	60/- – 80/-	250/- – 300/-
3.	Mason, Carpenters	100/- – 120/-	350/- – 400/-
4.	Wages of Homeguards engaged for protection & patrolling duty.	52/-	200/-

CHAPTER 10

FIVE YEAR PLAN

10.1Environment: Protection of the environment has to be a central part of any sustainable inclusive growth strategy. This aspect of development is especially important in the Eleventh Plan when consciousness of the dangers of environmental degradation has increased greatly. Population growth, urbanization and anthropogenic development employing energy-intensive technologies have resulted in injecting a heavy load of pollutants into the environment. More recently, the issue assumed special importance because of the accumulation of evidence of global warming and the associated climate change that it is likely to bring. An important feature of any environmental strategy is that environmental objectives require action in several areas, which typically lie in the purview of different ministries. The Ministry of Environment and Forests (MoEF) has the important role of monitoring the development process and its environmental impact in a perspective of sustainable development and to devise suitable regulatory structures to achieve the desired results. While this role is crucial, environmental objectives can only be achieved if environmental concerns are internalized in policy making in a large number of sectors. This would require sharing of Kamrup West Forest Division responsibility at all levels of government and across sectors with respect to monitoring of pollution, enforcement of regulations, and development of programmes for mitigation and abatement. Regulatory enforcement must also be combined with incentives, including market and fiscal mechanisms to encourage both industry and people in their day-to-day working to act in a manner responsive to environmental concerns, sustainable use of natural resources also requires community participation with a responsible role assigned to the communities for conservation.

10.2 Management of Forests under Five Year Plans: Forest is a dynamic living entity that is to be managed with a view to conserve the natural capital without any depletion, while catering the present needs of the society. As such, the forest planning becomes a multifaceted, consistent and well integrated affair, where due weightage has to be given to soil and moisture conservation along with satisfaction of the present and future demands of the society and that of the industries utilizing forest produces. The Planning Commission of India, which is approving plans for the most effective and balanced utilization of the Country's resources, for the development of the Country, gave due importance to planning in forestry sector too. Accordingly, special attention was given in the Five Year Plans to enhance the productivity of the Forests by adopting sound schemes, such as rehabilitating the depleted forests and creating valuable man-made forests to cater to the needs of the industrial sector. The successive Five Year Plans have aimed at accelerating the pace of Forestry Development and expansion of the forestry activities in the Country. Forests in the Division have benefitted from these schemes.

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 (1956-61) 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 (1961-66) 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 (1969-74) 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- 91. Mass afforestation and social forestry programme programmes were emphasised during the Sixth Five Year Plan (1980-85). 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 Eighth Plan (1992-97) 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 (2002-07) further emphasized on the importantrole 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 2002-03 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, 2002-07). 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.

10.2.1 Priority in checking biotic interference: Illegal loggings, encroachment, collection of fire wood and fodder, hunting are the factors responsible for biodiversity degradation. Regeneration plots, Plantations, are very much exposed to humans and cattle. Environmental conditions including edaphic condition (soil nutrients, moisture, fertility), climatic condition are otherwise very much favourable for regeneration and growth of species. If the forest could be protected from biotic interference (human and cattle) all species will show vigorous regeneration and growth. An example of Nameri wildlife sanctuary where soft releases of captive breeding Pigmy Hogs are done may be cited. The area which has been intensively protected with barrier including power fencing restricting entry of humans and cattle with a view to get the Pigmy Hogs accustomed with natural environment (soft release) is seen to have good forest growing up naturally with diverse floral composition followed by attraction of other wild animals. One more example of unwanted but spontaneous creation of forest could be seen. Micro forest like natural vegetation with natural growth of species could be seen in small plots of land when some people procure land in city and leave it with barriers/walls for some 2/3 years. These are not only examples but substantiate that if our forest could be protected from biotic interference, we can have good forests with diverse flora and fauna.

During the past decade lots of forest development activities including regeneration of forests were undertaken. But in comparison to the investment, result is not satisfactory. Lots of Plantation programmes were undertaken, but survival percentage of these plantations in average are 30-40%. This is a clear example of wastage of Money. These plantations are not encouragingly successful because of biotic interference than any other factors impacted these. Had these plantations were protected by erecting strategic fencing (strong barrier to resist human and cattle entry), these would have shown good result with vigorous growth with 80-90% survival. As such it is advised in this Working Plan that Plantations shall and must be protected from biotic interference. Strong strategic fencing, and wherever required, RCC

Walls shall be erected. This will not only protect the plantations but will protect the forest land from encroachment. Year-wise details of five year plans are appended in Volume-II.

In order to protect the natural environment of the forests and to regenerate and restore degraded ecosystems, sufficient funds are being provided to this division in every Five-Year Plan. These funds are used for development of forests infrastructure, training and capacity development of forest staff, regeneration in RFs, bamboo plantations, plantations of NTFPs, people's participatory plantations, plantation of economic species, etc.Year-wisefund allotted to this division during the current Five Year Plan are as under.

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

Development agencies	Year	Development programmes	Total funds allocated(Rs.)
Bamboo Mission (JFMC)	2011-2012	(a) Training	80,75,862.00
		(b) Bamboo Museum	
		(c) Water tube-wells	
		(d) Boundary wall etc.	
	2012-2013	(a) Training of farmers	45,76,000.00
		(b) Micro irrigation	
		(c) Bamboo plantation and maintenance	
	2013-2014	(a) Bamboo plantation and maintenance	61,69,000.00
	2015-2016	(a) Bamboo plantation and maintenance	6,25,000.00
	2016-2017	Nil	-
	2017-2018	Nil	-
NAP (JFMC)	2011-2012	(a) Creation of plantation and maintenance	52,30,000.00
	2012-2013	(a)Plantation and maintenance	12,42,000.00
	2013-2014	(a) Plantation and maintenance	8,85,000.00
	2014-2015	Nil	-
	2015-2016	Nil	-
	2016-2017	Nil	-
	2017-2018	Nil	-
CAMPA	2011-2012	(a) Creation & maintenance of nursery	7,39,485.00
	2012-2013	(a) Construction of Buildings	53,95,000.00
		(i) Gwahati Range = Forest Ranger's Quarter.	-
		(ii) South Guwahati Range = Dy. Ranger's Qtr.	-
		(iii) Sonapur Range=Forest Ranger's Qtr.	-
		(b) Maintenance of nursery.	1,36,800.00
	2014-2015	(a) Creation of plantation and maintenance	3,14,015.00
	2015-2016	(a) Plantation & Nursery maintenance	2,97,142.00
		(b) Plantation	71,65,455.00
		(c) Vana Mohutsava	3,00,000.00
		(d) Maintenance of plantation	60,372.00
	2016-2017	Nil	-
	2017-2018	Nil	-

CHAPTER 11
PAST SYSTEMS AND MANAGEMENT

11.1 General History of the Forest:

Copeland and Milroy, the pioneers in forestry in these areas had observed that there was considerable extent of thinning (Shifting Cultivation) in the hilly areas before constitution of Reserved Forests in the Division.Extracts of remarks, which are interesting and revealing, made by Milroy in his Working Plan, for these forests are described below :-

11.1a Most of the Duar (alluvial plain) land was settled with the Lower Assam Tea Company, which opened out the present Barduar Tea Estate. But several thousands of acres of valuable Sal forests were subsequently reliquished to avoid the necessity of paying land revenue on land that had little apparent value in those days. The relinquished area was added to the Barduar Reserve of which it forms the major part

11.1b The creation of Rubber and Teak plantations absorbed the energies of the forest staff till about 1885. The earthquake of 1897 considerably altered the external features of the Kulsi Range; forest roads up the east bank of the KulsiRiver from Kulsi to Rajapara and through the heart of the Barduar Reserve from Tiyamara to Rajapara were destroyed by the formation of the ChandubiBeel. A forest rest house at Ukiam collapsed in the earthquake and the KulsiRiver by changing its course obliterated the road to Ukiam.

11.1c A considerable population of Garos formerly thrived on 'Jhuming practice' in the hills, both in Kamrup and across the border in the Khasi hills, and a number of villages had to be broken up, when the Pantan Reserve was created.

11.1d TheGaros seem to have been particularly susceptible to 'Kala-Azar', an epidemic disease that was first noticed in Assam amongst the Garos on the north face of Garo hills in 1882 and the mortality was extremely heavy in all the villages of the Kamrup border.

11.1e The ravages 'Kala-Azar' permitted additions being made to the reserves, and this, combined with the formation of 'Beels', and much treacherous ground by earthquake, has turned what was formerly a thickly populated part of the country into a very sparsely inhabited tract, that is difficult to access.

11.1f On the other hand, the broad cultivated plain stretching from the north boundary of the Barduar and Kulsi Reserves towards the South Trunk road was a swamp containing very few paddy fields expect near Choygaon. There are still alive eye witnessess of the deaths of the last Wild buffalo in the plains where these are no longer a vestige of jungle. This past history is of interest in that it explains why signs of forest destruction are more commonly found in what are now desolate parts, and how areas that are easy of access in these days escaped exploitation before proper forest conservancy could be established.

11.1.2 Constitution of the Reserves: The first RF was constituted in 1872-73 i.e. 145 years ago. Further reservations are effective from 1882 onwards upto as late as 1990. The policy of reservation is still being pursued. The three PRFs viz. Hohora, Garowani and Apricola are in

the process of reservation. The names of the existing RFs and PRFs have been given in Chapter 2.

11.2 Past Systems of Management and Their Results:

11.2.1 Management prior to introduction of Working Plan: After the formation of the first Reserved Forest, demarcation of the areas was taken up, Jhuming was prohibited and fire protection was introduced for the first time in Sal forests. Prior to introduction of Working Plan, all the RFs under this plan had undergone unregulated fellings. Traders were allowed to cut trees under ordinary permit system. The choice of trees was entirely left to permit holders but trees were pre-marked by forest staff prior to felling. No girth limit and number of trees seem to have existed. As the demand for timber was very limited in those days, obviously the best stems from the easily accessible areas had been removed. Extensive sleeper operations used to be carried out by the department in forest areas declared reserved during the pre-independence period. This was stopped only after visit of the Inspector General of Forests to these forests in 1906, who issued an order prohibiting further felling until a Working Plan for these forests was formulated.

The forests that were declared Reserved after independence had undergone tremendous devastation by way of jhuming, removal of Sal Poles for Electrical Transmission (ET), Constructional timbers and firewood - huge demand of which existed till the advent of LPG for cooking. . Jhuming was quite prevalent prior to constitution of the first RF but was not intensive, as the tribal population living in and around these forests was limited. Jhumiers did not come back for jhuming in the same locality, let alone the same plot, once jhumed as there were plenty of forestlands available in adjoining hills. But with the increase in population and shrinkage in forest land, the jhuming cycle had shortened and jhuming was carried out after a span of 5-6 years in areas jhumed earlier.

11.2.2 Past systems of management and their results: There are very limited plain forests only in the two reserves viz. Jarasal and Kawasing and the area under plain forest is only 1,351 Ha (approx) out of the total reserve area of 43,205.20 ha of Kamrup East Division, hence the hill type forests have been taken up for elaborate discussion in the past system of management.

11.2.3 Introduction of Working Plans

11.2.3.1 Copeland's Plan: Consequent upon the aforesaid order of the Inspector General of Forests, the first Working Plan for the Sal Reserves of this division viz. Jarasal, Rani and Kawasing together with some other reserves was compiled by late D.P. Copeland for the period 1909-10 to 1918-19. His plan covered 62 sq. miles under Sal out of 162 sq. miles of the then total reserve area. He divided the reserve into compartments and each of them was to be worked over once during the 10 years plan period under improvement felling. He realised that the forest had been overworked in the past and hence prohibited removal of sound well grown mature tree likely to improve during the next 10 years, unless Silviculturtally necessary. He prescribed removal of trees over 6' in girth where their felling was necessary on Silvicultural grounds. Emphasis was laid on removal of malformed and decadent trees. For the first time light thinning of pole crops was introduced. Copeland hoped to attain a

more normal forest and natural regeneration. For the first time he prescribed climber cutting and other subsidiary operations after the main felling.

Although Copeland's Plan was sound but it failed because its prescription could not be carried out owing to lack of demand for the kind of trees that were marked, in sudden contrast with best of the forest that used to be extracted prior to introduction of his Plan.

Thinning improved the standing crop but small opening thus helped weeds forthwith to appear, further indulged by fire protection. These factors helped in formation of a low dense canopy beneath which no seedlings could survive under the soggy conditions induced during the monsoon. This resulted in giving-up of fire protection in 1914-15. He was a pioneer in introducing a systematic method of working in these forests.

11.2.3.2 Milroy's Plan: A.J.W. Milroy's Plan came into effect in 1919 and was in force for the next decade i.e. upto 1929. His plan covered 34 RFs which included Maliala and the aforesaid three reserves (mentioned above in Copeland's plan) of the present Kamrup East Division. Out of the three Working Circles he constituted viz. Working Circle "A", Working Circle "B" and Working Circle "C". Only Working Circle "C" included the hill type forests. Milroy though prescribed Selection System for these reserves, stipulating the girth limit of 4'6", but did not depend upon the Selection System as a method of regeneration. Instead he depended on "Taungya" for regeneration. But this did not produce good results as they were taken up in isolated pockets scattered over the whole Working Circle and the plants were spaced too far apart to form a pure crop. Purchaser being the selector for exploitation of trees, Silvicultural considerations took a backseat. Quantum of revenue received might have been satisfactory but at the same time much harm must have been done to the forests. Probably this was the best option he had under those conditions of paucity of trained staff.

11.2.3.3 Dr.Bor's Plan: The plan that came next was that of Dr. L. N. Bor and covered the period from 1930-31 to 1939-40. His plan included Garbhanga RF and the four RFs of present Kamrup East Division mentioned in the plans of late Copeland and Milroy mentioned above. The hill Sal forests were to be worked under selection system with a dia. limit of 18" in best sites and 12" in worst sites, on a 10 years cycle subject to silvicultural availability. Diameter limit for other species were also fixed and thinning in congested Sal patches was specifically mentioned. No sequence of felling was formulated. Three felling series were formed. Sal regeneration was not laid down. Climber cutting in Sal patches was prescribed. One Tenth of the total area of the hill working circle was worked annually since 1932. As Bor's prescriptions for plains forests did not give desired results, his prescriptions were given up in the middle of his plan period and a revised plan compiled by Late M.C. Jacob, IFS was introduced from 1938-39.

11.2.3.4 Jacob's plan: The revised Working Plan of M.C Jacob came into effect in 1938-39 and it was meant for a period of 10 Year i.e. upto 1947-48. It covered 5 RFs viz. Kawasing, Rani Jarasal, Mallata and Garbhanga of the present Kamrup East Division. The 5 RFs, of this division were worked under:-

(a) Sal long period conversion Working Circle comprised of accessible Hill Sal Forests

(b) Selection Working Circle comprised of remote hill forests

(c) Miscellaneous Working Circle comprised of overlapping areas containing mixed deciduous and evergreen forests on the lower hills.

In the "Sal long period Conversion Working Circle" the method of treatment was uniform system with aided natural regeneration. The conversion period as well as the rotation was fixed at 150 years with 5 (five) periodic block of 30 years period. PBV areas were chosen from compartments of the plains Sal forest and the areas of the rest of the periodic blocks were located in the hill Sal forest. Areas were specifically allotted for P.B. I, II & V, and areas under P.B III &IV were lumped together as P.B-Inter. The Working Circle was not sub divided into felling series.

In Sal Selection Working Circle the rotation was fixed at 150 years. The treatment adopted was removal of trees over a prescribed girth limit, subject to limitation of annual coupe areas and number of trees. A 15-year felling cycle was fixed. No sequence of area to be marked was laid down but the DFO was to take up 1/15th of the area to the working circle annually and half the number of Sal trees over 5feet girth limit were allowed to be felled in each year. Yield was thus regulated by area/number of trees. All Non-Sal trees above the prescribed girth limit were allowed to be marked subject to the condition that no large gaps were created. High thinning in congested pole crops was prescribed. The subsidiary silvicultural operations prescribed were cutting of bamboo over established Sal leaf burning of all areas, cutting of climbers in 10 years cycle and mandatory rising of 1acre plantation for every sixty tree removed.The Miscellaneous Working Circle comprised Non-Sal areas of the Sal conversion Working Circle. Jacob prescribed minimum girth limit for 7 (seven) species, for exploitation and raising of one-acre miscellaneous plantation for every 60 trees removed. In addition to this, he prescribed raising of 5 acres of miscellaneous plantation annually at Maliata, Lokhra, Mainakhurung and Sajjanpara.

The succeeding WPO LC Das estimated a deficit of 88,807 units (67, 14 4m3) approximately) from P.B. I areas of both long and short period Conversion Working Circles of Jacob's plan during the 17 year period. Hence the opinion expressed by the succeeding Working Plan Officers that P.B. I felling carried out during Jacob's plan wasnotupto the extent prescribed by him, is convincing. At the end of the 17 years of treatment under Jacob's plan, the succeeding WPO L.C. Das could not shift any area from P.B. I of the presentKamrup East Division to regeneration P.B. L.C. Das' estimate that another 1200 hectares in the rest of the P.B. I contained established regeneration, was found to be exaggerated on the basis of the stock mapping carried out during the field works of P.C. Das' Plan.

11.2.3.5 L.C. Das' Plan: Jacob' plan was revised by L.C. Das and the plan was in force from 1955-1956 for a period of 15 Years i.e. upto 1969-70. His plan was for 41 RFs, which included 5 RFs of the present Kamrup East Division mentioned in Jacob' plan and Khanapara;which was declared RF in 1953. The old compartments were sub-divided into smaller units and for the first time Das introduced the procedure of blocks comprising of several compartments with serial number for each compartment instead of existing procedure of compartments being designated by name only. The six reserves of the present Kamrup East Division were worked under -

- **Sal Conversion WC:** Comprised areas of Jacob's short and long period Working Circle as well as some areas of Sal Selection Working Circle.

- **Protection and Sal Improvement WC:** The balance areas of Jacob's Sal Selection Working Circle
- **The Firewood Sub WC:**Khanapara RF
- **Miscellaneous WC**: Overlapping areas of other Working Circles containing Non-Sal forests.
- **Bamboo WC**: Areas containing bamboo overlapping other Working Circles.

The method of treatment adopted under Das' plan is similar to the "Sal Conversion Working Circle" as that formulated by Jacob in his plan owing to continuation of same system of management i.e. uniform system. The rotation/conversion period (150 years), number of periodic blocks (5), period of each block (30 Years) etc. were same as those prescribed by Jacob for "Long Period Conversion Working Circle". Similarly, specific areas were allotted to P.B I, II & V and rest of the areas were clubbedtogether as P.B.Inter. Out of the conversion period of 150 years, it was affirmed that 38 years were to be considered as passed and that the period left for conversion of the working circle was 115 years.

Table11.1:Compartments under P.B. - I Treatments of both Jacob's and Das' Plans (Area in ha)

Compartment	Gross area(Ha)	Net Forest area(Ha)	Net Sal area allotted in Das' plan(Ha)	Area under established young Sal(Ha)	Area covered by Teak &Misc Plantation(Ha)
Sajjanpara - 3	316	316	153	23	20
Saropara - 2	112	73	86	34	---
Total	**428**	**389**	**239**	**57**	**20**

The position in respect of other compartments brought over by Das to P.B. I (from P.B. II, P.B.Inter& Selection Working Circles of Jacob) is indicated in table 11.2.

Table 11.2: The position in respect of other compartments brought over by Das to P.B. I (from P.B. II, P.B.Inter& Selection Working Circles of Jacob)

Compartment No.	Gross area(Ha)	Net Forest area(Ha)	Net Sal area allotted in Das' plan(Ha)	Area under established young Sal(Ha)	Area covered by Teak &other Plantation(Ha)
Harbhanga – 2	1241	1236	435	12	16
Uttar Jarasal – 3	143	124	120	8	1
Total	1384	1360	555	20	17

From the above, it can be safely stated that the pace of regeneration under the method of treatment adopted was discouraging.

11.2.3.6 Swargowari's Plan: After the expiry of P.C. Das' Plan in 1982-83 his Plan prescriptions were continued on ad-hoc basis till the revision of the Plan i.e. up to 2001-02. As such, the last plan enjoyed a span of 29 years. The P.C. Das Plan was revised by Sri A. Swargowari, IFS, Working Plan Officer, Lower Assam Circle and came into effect since 17/08/2002, but his Working Plan was not approved by the Government.During these years, the Forests have borne the brunt of political and social turmoil. This period witnessed the departmental operation of timber, which is believed to be the root cause of devastation of

these forests. During pendency of the last Plan, timbers were granted on permit to various individuals/institutions at a rate quite lower than the prevailing market price under order from the State Government.

In absence of records in the Division as well as in the field Offices, it has become difficult to ascertain the number of Sal and other trees marked and volume removed from Blocks and Compartments under different Working Circle, types of Silvicultural operations carried out in different areas, incidence of fire and extent of damage etc.

11.3 Special Works of improvement undertaken: Haphazard record keeping made it difficultto keep track of the development works undertaken during last good span of time.Detailed records regarding the works of improvement, except construction of buildings, undertaken in the division could not be traced out. The details of civil works undertaken (buildings constructed) by the division is furnished in table 11.3.1. Resource map of the division is shown in Fig 11.3

Table 11.3.1. Details of buildings constructed in thisDivision.

Sl. No.	Building	Description of the building	Year of construction
1	O/O the CF, Social Forestry, WAC	A Class - Assam Type	1999
2	Forest Guards Quarter	C Class - Assam Type	1989
3	Forest Guards Quarter	B Class - Assam Type	1980
4	O/o the C.F., N.A.C	A Class - Assam Typewith RCC Post	1983
5	IVth Grade Quarter (Double Barrack)	C Class - Assam type	1988
6	Forest Guards Quarter (Double Barrack)	B Class - Assam Type	1988
7	Range Office of Survey& Demarcation Range	A Class - Assam Type	1989

Statement showing details of buildings constructed during 2011 upto July 2016 under Kamrup East Division is given in table 11.3.2.

Table 11.3.2. Details of construction building during 2011-12 to 2015-16 upto July, 2016

Sl. No.	Range	Location	Scheme	Year of const.	Type of building	Plinth area m^2	Present status	Remarks
1	Sonapur Range	14th Mile	State Plan Scheme	2011-12	Forest Guard quarter	--	Utilized	Complete
2	South Guwahati Range	Lakhara RO	13th Finance Commission	2013-14	Barrack	--	Utilized	Complete
		Basistha	State Plan Scheme, Building	2013-14	Central Godown for storage of Red	2684	Utilized	Complete

					Sander at Basistha			
		-	CAMPA Fund	2013-14	Barrack	--	Utilized	Complete
3	Sonapur Range	Sonapur RO	13th Finance Commission	2013-14	Barrack	--	Utilized	Complete
		HQ Range	CAMPA Fund	2013-14	Construction of Fgd Quarter, HQ Sonapur	--	Utilized	Complete
4	Guwahati Range	Hengrabari Beat	CAMPA Fund	2013-14	Construction of RO's Quarter	--	Utilized	Complete
		Jorabat Beat	13th Finance Commission	2013-14	Construction of Dy.R., Fr-I Quarters	--	Utilized	Complete
5	South Guwahati Range	Headquarter	APFBC Scheme	2015-16	Range Office Qtr.	--	--	Complete
6	Rani Range	Garopara	APFBC Scheme	2015-16	Beat Office Qtr.	--	--	Complete

Summary and result of works such as fire protection, improvement in communication, interface activities, amenities to staff, etc. is given in table 11.3.3.

Table 11.3.3: Statement on results of different measures and activities undertaken

Sl.No.	Item	Measures taken	Remarks
1	Fire protection	Regular patrolling in vulnerable area, reporting	
2	Forest protection	-do-, framing of offence	Shortage of staff by 40%, over aged, unfit for forest protection
Development of infrastructure			
3	Construction and improvement of Office Buildings, Camps		Inadequate to protect a vast area with 20 nos of Reserve Forests and diverse wildlife
4	Construction and improvement of road and culverts		-Do-
5	Procurement of vehicles such as Truck, Bolero		-Do-
Amenities to staff			
6	Supply of drinking water for staff		
7	Construction of toilets		
Training of staff			
8	Training to Officers and Staff imparted		Inadequate, no exposure visit

Statement showing details of existing Roads upto July2016 under Kamrup East Divisionisshown in Annexure XVI.

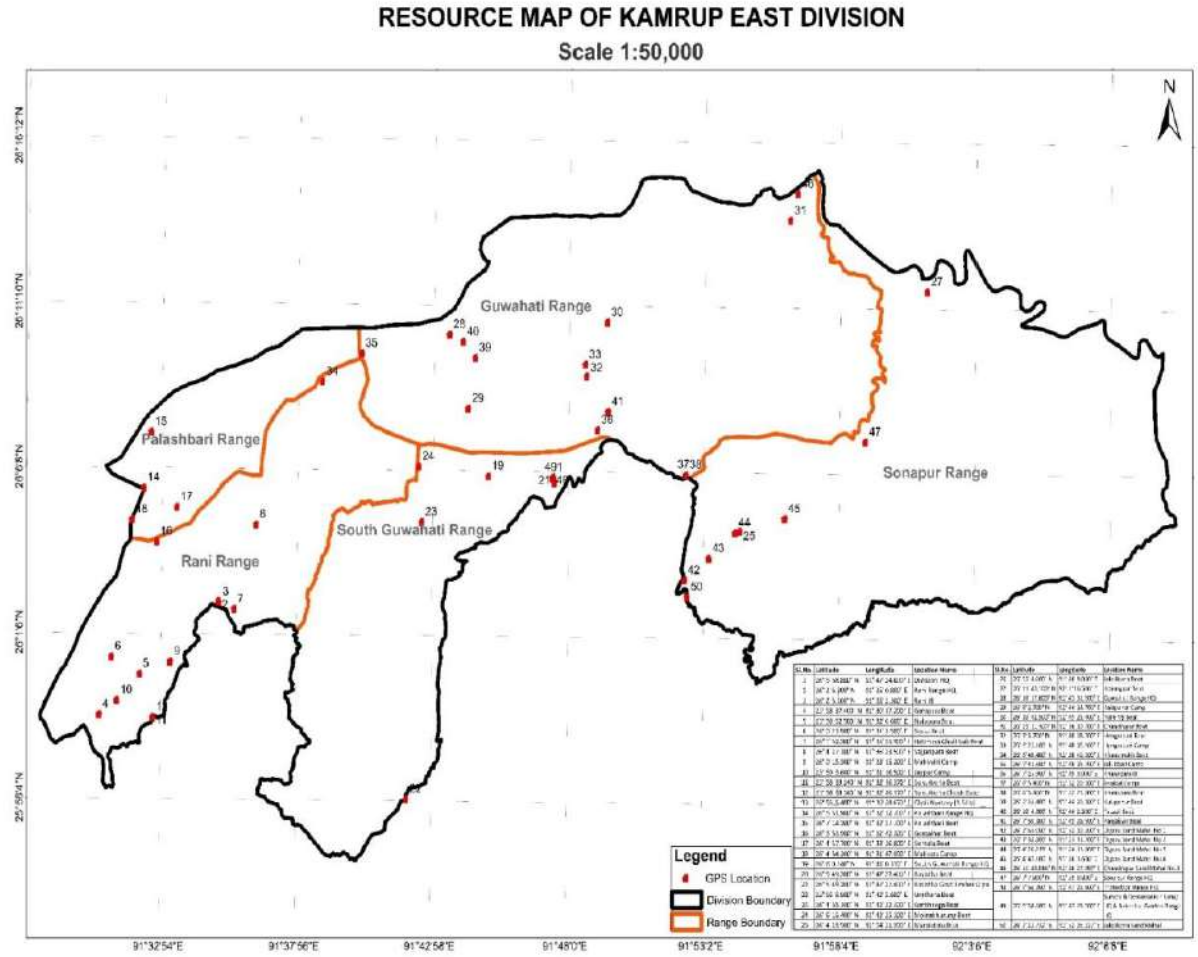

Fig 11.3: Resource map of Kamrup East division.

11.4 Past yield, revenue and expenditure: Since there is blanket ban on felling since 2005-2006 there has not been any felling in the forest.Revenue and expenditure of the last plan period is shown in table 11.4.

Table 11.4: Revenue and expenditure of the last plan period w.e.f.2008-2009 to 2017-2018

Year	Revenue (Rs)	Expenditures	
		Non-Plan Expenditure (Rs)	Plan Expenditure (Rs)
2008-2009	4,45,54,030.00	4,16,12,142	2,67,47,118
2009-2010	8,07,09,793.00	4,40,22,905	1,52,74,380
2010-2011	2,64,55,598.00	6,18,67,981	58,87,020
2011-2012	2,86,75,317.00	6,37,83,711	2,40,01,534
2012-2013	3,80,63,924.00	7,44,23,939	1,21,01,433
2013-2014	1,43,82,026.00	8,25,36,253	1,07,75,037
2014-2015	2,80,21,340.00	8,78,27,187	1,09,26,892
2015-2016	3,11,01,511.00	9,37,24,323	-
2016-2017	11,33,51,631.00	9,41,69,073	35,42,900
2017-2018	12,31,81,412.00	10,27,53,829	29,30,350

Volume of outturn recovered (from illegal felling), revenue thereof and expenditure incurred in sectioning, debarking to depot etc.

Table 11.4.1: Volume of outturn recovered in Kamrup East Division.

Year	Volume (cu.m.)	Government value (Rs.)
2008-2009	55.576	1225306
2009-2010	352.3361	1760254
2010-2011	588.2204	7275030
2011-2012	323.906	7099458
2012-2013	290.288	1683911
2013-2014	414.138	1893868
2014-2015	197.132	1021347
2015-2016	71.299	422491
2016-2017	382.499	132996
2017-2018	703.057	2960302

11.4.2 Timber Operation: The past timber operations from 1987-1988 to 1998-1999 has been shown in table 11.4.2.

Table 11.4.2: Table showing timber operation since 1987-1988 till 1998-1999.

1987-1988	**1988-1989**	**1989-1990**
Rs.1,09,064.76	-	-
1990-1991	**1991-1992**	**1992-1993**
Rs.97,974.65	Rs.1,26,011.75	Rs.1,40,925.30
1993-1994	**1994-1995**	**1995-1996**
Rs.1,00,130.00	Rs.2,08,146.00	Rs.2,07,270.00
1996-1997	**1997-1998**	**1998-1999**
Rs.2,88,161.00	Rs.13,43,351.13	Rs.5,86,369.48

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CHAPTER 12
STATISTICS OF GROWTH AND YIELD

12.1 Statistics of Growth: There is no working plan developed for the division since 1988, hence there are no current statistics available on growth and yield of important forest species of the Division. It is not feasible to collect the statistics of growth of Sal in the division, as there are no plots of different ages where definite age of the crop is known. Hence measurements carried out in Sal plantations of known age during the course of field work in the erstwhile South Kamrup Division by P. C. Das as well as from old records of sample-plot measurements of Silviculture and in plantations of this Division as well as of an adjacent Division have been relied upon and reproduced in table given below.

Table 12.1. Sample-plot measurements of the division

Location	Year of Creation	Age (yr)	Top height Range (m)	Mean (m)	Top height as per all India yield table quality range mean			Avg. dia. (cm)	Avg. Dia. (cm) of nearest age (yr) as pot yield table	Remark
					Quality (yr)	Range (m)	Mean (m)			
Sample plot 7 Amsoi	1937	21	13.4 to 25	21.0	Q. I 19	16.5 to 19.8	18	18.3	14.2 cm at 20yrs for Q. I	--
-Do-	1937	26	19.3 to 26.7	25.4	Q. I 24	18.3 to 21.8	20.1	22.4	17 cm at 25yrs for Q. I	--
Sample plot 8 Amsoi	1928	30	20.4 to 30.5	26.5	Q. I 24	20.1 to 24.1	22	25.7	19.8 cm at 30yrs for Q. I	--
-Do-	1928	40	21.9 to 31.5	26.7	Q. I 9	22.4 to 27.7	25.0	38	34.6 cm at 40yrs for Q. I	--
Barjuli 3A	1945	23	10.1 to 27	17.5	Q. II 24	14.6 to 18.2	16.4	15	14.5 cm at 25yrs for Q. II	--
Uttar Jarasal C 3	1947	23	11.5 to 18.5	15.0	Q. II 24	14.6 to 18.2	16.4	12.5	14.5 cm at 25yrs for Q. II	Congested
Belguri C1	1934	36	19.5 to 28.6	24	Q. I 24	18.3 to 21.8	20.0	20	28.4 cm at 35yrs for Q. I	Congested

In the course of compilation of the P.C. Das Plan of erstwhile South Kamrup Division, height and diameter measurements of a number of Sal trees in natural stands, in scattered groups over a number of compartments in alluvial plains type Sal, as well as Khasi Hills Sal type were taken to determine the quality of both types of Sal. The average quality of alluvial plains type Sal (Kamrup Sal) was found to be I/II and lower than II/II in Khasi Hills type Sal.

12.1.1 Statistics of Growth – Teak: The measurements of sample plots in the Teak plantations of the erstwhile South Kamrupdivision maintained by the Silviculturists are furnished in the table given in the following page.

From the above it is seen that whereas the height of Sample Plots No. 6 & 9 corresponding to quality-I, those of 5 & 8A conform to quality-II. The average quality of plantation Teak in this Division can, therefore safely be assumed to be quality - II.

12.1.2 Statistics of Yield - Sal:From the timber-marking registers of the different Ranges of the erstwhile South Kamrup Division, the figures of out-turn (Current commercial volume in the round) of Sal trees operated from different areas during a period of three years were collected and classified into 10 cm diameter class of trees. The volume figures (approximately) as obtained by plotting the average volume against the mid-diameter of the class are furnished in table 12.1.b.

Table 12.1.2: The volume figures w.r.t. the average volume against the mid-diameter of the class

No. of trees in the Diameter class for which record of outturn collected	Diameter class (DBH Over bark) (in cm)	Volume under - bark (cu.m.)
180	21 to 30	0.28
860	31 to 40	0.60
1430	41 to 50	1.0
1218	51 to 60	1.51
927	61 to 70	2.10
241	71 to 80	2.80
90	81 to 90	3.66
30	91 to 100	4.80
11	Over 100	5.95

12.1.3 Statistics of Yield - Teak: The record of out-turns of three clear felling coupes in the 1982 Teak Plantation at Kulsi during 1958-59 were out from the timber marking registers and the diameters and out-turns (commercial volume in the round) were classified into 10 cm diameter classes. The average volume for each coupe for a diameter for the class and a smooth curve was drawn. . The average volume was then read off from the curve against the mid diameter of the class and the results are furnished in the table below:

Table 12.1.3: The average volume with respect to the mid diameter of the class.

No. of trees in the Diameter class for which record of out-turn available	Diameter class (BH Over bark) (in cm)	Volume (Over bark) (cu.m.)
20	21 to 30	0.34
153	31 to 40	0.60
70	41 to 50	0.91
42	51 to 60	1.39
18	61 to 70	2.05
7	71 to 80	2.95

12.1. 4 The figures rather old and the commercial volume for a tree of each diameter class is likely to be more on the basis of current trend of utilisation and hence the data above would serve the purpose of a rough estimate only.

12.1.5 Teak Thinning: In the course of a survey of plantation in the erstwhile South Kamrup Division, small plots (0.4 ha each) for samplingwere laid out and thinned in the Teak Plantation of different ages. Complete conversion of trees felled during such thinning was carried out and the data on yield of thinning were collected. The figures given below are averages of figures from a few such sampling plots in the Teak plantations of Loharghat and Kulsi Range.

To have a general idea about the composition of the growing stock of the forests of Kamrup East Division, the results of inventory of the forests carried out were analysed. Inventory was carried out at the compartment level as mentioned under Chapter VI on grid based systematic stratified random sampling basis during 2015-2016; for the forests of the division. Inventoried forms from all the sample plots (630) laid out in the forests of Kamrup East forest division have been utilized for analysis. Major species namely *Shorearobusta*, *Schimawalichii*, *Tectona grandis*, *Careya arborea*, *Dilleniapentagyna*, *Vitex altissima*, *Toona ciliata*have been recorded and the rest of the species classified as "others".

Basal areas have been calculated species wise. Volume has been derived by applying the FSI formula. The volume per ha for the forest has been calculated by taking into account the net area for the assessment of growing stock after deducting areas diverted for non-forestry purposes. WPO assessed the availability of volume/yield tables for the main timber species, which have been prescribed for felling in various working circles for calculation of out-turn/yield. Due to non availability of such tables, non-destructive method for preparation of local volume may be adopted. Help of North East Space Application Center (NE-SPAC) has been taken.

12.2 Statistics of Forest Carbon Stock: Diameter class wise average carbon stock (tons) per tree is analysied based on the equations of FSI and shown in table 12.2. The total carbon stock in secondary moist bamboo brakes is 619.98 tons.

Table 12.2. Statement on forest carbon stock in Kamrup East Division.

Dia class (cm)	Number of trees	Average carbon (tons) per tree	Total carbon in dia class (tons)
10-20	1,41,105	0.178	25116.69
20-30	1,89,997	0.491	93288.53
30-40	1,59,485	1.065	169931.3
40-50	74,140	2.021	149836.9
50-60	17,270	2.906	50186.62
>60	9,614	11.894	114348.9
Total	**5,91,611**	**-**	**6,02,708.9**

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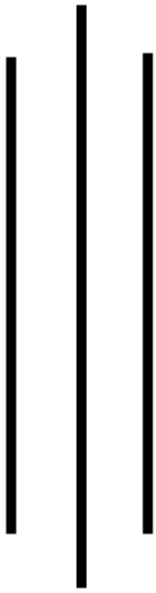
PART II



FUTURE MANAGEMENT

CHAPTER 1

BASIS OF PROPOSAL

The working plan of Kamrup East Division is a technical document prepared to manage the forests under Kamrup East Division on sustainable basis. The overall objective of the working plan is to Increase area under forest cover, enhance biodiversity, improve growing stocks and to Maintain the environmental stability in the areas under the division.
For plan preparation and implementation, it is necessary to examine the relevantpolicies, Laws, Rules, Court orders and various administrative orders issued by theGovernment of India and Assam, so that all the prescriptions are brought under the umbrella of the existing policy framework.

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 understory (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 outcompetes and becomes stand-dominating. The third stage, *understory reinitiation*, involves further disturbance and the creation of gaps; at this point stratification develops, with layers of canopy, midstory, and understory appearing. The final stage, known as *old-growth*, is the extension and completion of the understory reinititation; 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 $GtCO_2e$ 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 CO_2 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 fuelwood, 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 fuelwood to meet its domestic energy needs. For about 100 million of them, forests are main source for livelihood and cash income from fuelwood, 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(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 $GtCO_2e$ 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 CO_2 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 fuelwood, 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 fuelwood to meet its domestic energy needs. For about 100 million of them, forests are main source for livelihood and cash income from fuelwood, 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.

Method of treatment shall be -

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-

i) The entire forests will be protected fromharvesting.

ii) 20 meters wide strips on both sides of streams, watercourses and 40 meters from the river will be protected, no harvesting in these stripareas.

iii) Special habitat management for wildlife conservation will receive high priority. There are areas preferred by migrating, straying wildlife especially members of catfamily.

iv) Kamrup East Division has quite some riparian zones which need 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 forestareas.

v) Preference will be accorded to natural regeneration and promising coppice growth will receive suitable tending and soil working to stimulate growth anddevelopment.

vi) Artificial regeneration will be used as supplementary activity, at places, where natural regeneration is inadequate or is not likely tosucceed.

vii) 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.

viii) Local people will be actively involved in forest management, forest protection, plantations and development of natural resources in thevillage.
ix) Management of forests close to villages shall primarily be done through JFMcommittees.
x) Sustainable Non-Timber Forest Produce (NTFP) production will be given high priority in the forestmanagement.
xi) 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 livestockimprovement.
xii) Involving local people in managing forests and generating awareness in rural and tribal areas is considered indispensable for the forestconservation.
xiii) Reducing biotic pressure on forests, particularly, illicit felling, unsustainable grazing, fire and encroachment near villages will be considered on prioritybasis.
xiv) Forests capable of producing medium to large sized timber will be harvested under the Selection-Cum-Improvement managementsystem.
xv) Boundary demarcation will be carried out in time-bound manner for ensuring territorial integrity offorests.
xvi) Action will be taken to convert all the miscellaneous forests adjoining the Reserved Forests and large patches, away from villages into ReservedForests.

1.3 Constitution of Working Circles: The working circles proposed and approved in Preliminary Working Plan Report (PWPR) for KamrupEast Forest division are asfollows:

1) SalReengerationWorkingCircle
2) PlantationWorkingCircle
3) JointForestManagementWorking Circle
4) WildlifeManagementandBiodiversityConservation (Overlapping) WorkingCircle
5) ForestProduce[a) NTFP,b)Bamboo(Overlapping)]WorkingCircle.
6) ForestProtectionoverlappingWorkingCircle.

1.3.1 Sal Regeneration Working Circle: This Working Circle has been constituted to cover all the areas having pure Sal in the crests, ridges and spurs of the hills as well as in a very limited area of the plains. This Working Circle also includes some of those areas where Sal is found in considerable numbers mixed with other species. As the outcome of the past systems of management is very discouraging, the pace of regeneration of Sal is to be accelerated within a reasonable period. The appropriate silvicultural operations may be allowed to improve the health of growing stock.

1.3.2Plantation Working Circle: Identified areas covered by moist mixed deciduous forests and Sal have been brought under this Working Circle to rehabilitate and restock the depleted forest of poor value by raising plantations of ecologically more valuable species to meet the demand of fuelwood, timber and as carbon sequestration. The appropriate silvicultural operations may be allowed to improve the health of growing stock. Plantation working circle to cover existing plantations done by the department, blanks and under stocked areas not suitable for ANR (Assisted Natural Regeneration), clear felled areas, road side, river side, railside areas and lands under compensatory afforestation etc. which are suitable

forplantations will be identified and allocated to different years of plan period along withprescription of sustainable management. Apart from above, all encroached areas of different RFs of the division have been kept in this Working Circle. These encroached areas will be evicted and plantation of fast growing indigenous species will be taken up. Area under encroachment will be evicted gradually involving the local people and will be brought under plantation. All the compartments having natural regeneration are to be protected. Canopy manipulation has to be done to assistproper growth of the upcoming seedlings, where the crop density is high or crop iswell stocked. Protection measures like erection of fencing or digging of trenches, removal of invasive species like *Michenia*spp., *Lantana camara*, *Eupatorium* spp., wherever required, protecting there generations from biotic interferences.

1.3.3Joint Forest Management Working Circle: With the prime objective of protecting the forest and its biodiversity**,** involvement of village community living in fringe villages is to be ensured. The past experience has taught a lesson that unless and until the people residing near forest are taken into confidence and their regular requirements are not met up, there is very less possibility of achieving the desired results of bringing forest cover. This Working Circle has been constituted keeping in view of the dependency of local local people on forest and necessity to cater their domestic needs alongwith exploring employment opportunities for these people. The management of forests will be as per micro-plan prepared by the community through Participatory Rural Appraisal (PRA) 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 sharing of the usufructs as per "*The Assam Joint (Peoples' participation) Forestry Management Rules1998*."

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 encroached 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.

1.3.4 Wildlife Management and Biodiversity Conservation (overlapping) W.C. :

Kamrup East Division lies, Zoo-Geographically under traditional zone between Indian Sub Region and Indo-Chinese sub-region of the oriental region.Therefore the overall species diversity are on the higher side in the Reserve Forest areas. So far 30 species of mammals, 212 species of birds,29 species of reptiles,9 species of amphibians,and 383 species of plant were checklisted.The diversity of the area represent the genetic diversity, species diversity and eco-system diversity and the values of biological resources have been recognized in most human disciplines for religion to science. The biological resources of the forest areas of Kamrup East Division are beyond qualification because they provide the biotic raw materials for every type of economic endeavour. But the Reserve Forest areas were over exploited in form of encroachment, illegal felling, and unscientific illegal collection of fuelwood and fodder, jhum cultivation, conversion of forest land for agricultural purposes and development works.

Kamrup East Divisionis having three Bio-diversity Management committees at Anchalic Panchayat levelin the revenue areas of both Kamrop Metro and Kamrup District and about to create 30 (thirty) nos. of Bio-diversity ManagementCommittees (BMC). A capacity building

workshop of BMC members was arranged at Nalbari on 18.03.2014, with a view to implement the provisions of Assam Bio-diversity Rules, 2010. Preparation of People Bio-diversity Register (PBR) is in progress. Comments and vetting of Chief Wildlife Warden shall be obtained before finalizing the prescription for this Working Circle.

.**1.3.5 NTFP and Bamboo (overlapping) Working Circle:** The NTFP working circle shall comprise largely of fringe forest areas or such other areas, which according to WPOare, fit for extraction of a particular NTFP at a rate, prescribed by him, 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 the present and future generations. Therefore, the WPO will prescribe 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 management. 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. Apart from NTFPs, minor minerals are also collected under provisions of the Assam Minor Mineral Concession Rules, 2013 from Minor Mineral Units.

1.3.6 Forest Protection Working Circle: The main objective of this working circle is to provide protection to the forests and to facilitate them to restock by natural process and to provide rest to the forests, which had been under extensive biotic pressure. This working circle shall include complete forest area of the division. Such areas shall not be worked for timber or other NTFPs but 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 fringe forest areas/JFMC areas as well as 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. Some of the semi-evergreen and mixed deciduous formation located in Garbhanga and Rani RFs have been included under this working circle. Besides, certain areas, which have good regeneration but are under heavy biotic pressure have been included in this working circle. The appropriate silvicultural operations viz. climber cutting, weeding, gap filling, etc. may be allowed for the good health of growing stock.

1.4 Period of Working Plans and necessary for intermediate revision: The period of working plan will be for 10 years i.e. from 2021-2022 to 2030-2031. 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 RAPCCF (MoEF). 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.

1.4.1 Implementing Authority: The Divisional Forest Officer, Kamrup West Division is the principal implementing authority of the Working Plan. Range Officers of various Ranges under the Division, Beat officers assisted by all subordinate Officers and staffs are also equally responsible for implementation of the Working Plan in their respective Ranges and Beats.

1.4.2 Fund: Fund for implementation of the prescriptions as estimated and as required shall be allotted by the Government from the State Plan (SOPD) and Non-Plan head. Other fund like CAMPA, EAP(APFBC, JICA), World Bank aid or any other fund may also be utilized.

Compartment-wise area distributions in various working circle: Following is the area statement showing distribution of areas into various compartment.

Table: 1.3a Statement of areas distributed into compartments

Range	RF	Block	Compt	ComptArea (Ha)	Sal Reg WC	Plant WC	JFMC WC	NTFP & Bamboo WC	
								NTFP	Bamboo
Rani	Rani	Mainakhurung	RAN1	394.00		394		21	
	Rani	Mainakhurung	RAN2	491.00		488		15	
	Rani	Rani Block	RAN3	491.00		405		16	
	Rani	Sajanpara	RAN4	594.00		594		7	
	Rani	Sajanpara	RAN5	371.00		371		9	
	Rani	Sajanpara	RAN6	794.211	366	367		18	
	Rani	Mainakhurung	RAN7	405.322		-		33	
	Rani	Rani Block	RAN8	415.663					
	Rani	Rani Block	RAN9	338.00		333		20	
	Rani	Rani Block	RAN10	631.00				7	
	Kawasing	Kawasing	KAW1	115.977			115	8	
	Kawasing	Kawasing	KAW2	66.858	65			30	
	Kawasing	Kawasing	KAW3	345.197	345			35	
	Kawasing	Kawasing	KAW4	502.799	501			8	
	Jarasal	Joypur FV	FV	106.142			106	16	
	Jarasal	Uttar Jarasal	JAR1	63.680			63	30	
	Jarasal	Uttar Jarasal	JAR2	153.389		153		37	
	Jarasal	Uttar Jarasal	JAR3	180.539	180			30	
	Jarasal	Belguri Block	JAR4	349.007				25	
	Jarasal	Belguri Block	JAR5	287.995		283		7	
Palasbari	Maliyata	Maliyata	MAL1	342.413		342		15	
South Guwahati	Garbhanga	Lokhra	GAR1	183.00	179				
	Garbhanga	Lokhra	GAR2	349.218	349				
	Garbhanga	Lokhra	GAR3	331.520	-	328			
		Kantham	GAR4	526.817	484	-			
	Garbhanga	Satargaon	GAR5	814.562	-	814			21
		Lokhra	GAR6	854.063	-	849			9

		Lokhra	GAR7	849.277	-	836			64
		Satargaon	GAR8	1543.090	-	1543			46
		Garbhanga	GAR9	1809.290	-	1809			14
		Garbhanga	GAR10	958.968	953			29	10
		Garbhanga	GAR11	1178.460	1178			13	10
		Garbhanga	GAR12	1585.720	1577			13	10
	Garbhanga (Addn)	Umthana	GAR13	515.607				17	6
		Kantham	GAR14	823.496				20	10
		Paham	GAR15	957.065				11	5
		Paham	GAR16	337.056				5	18
		Pahami	GAR17	772.204				5	3
		Pahami	GAR18	642.107				2	64
		Pahami	GAR19	524.589				8	8
		Pahami	GAR20	285.826		283		2	64
		Pahami	GAR21	525.483		-		6	34
	Garbhanga	Lokhra	GAR22	483.908		-		2	64
	Garbhanga (Addn)	Umthana	GAR23	816.00		760		12	26
		Umthana	GAR24	759.776		740		30	64
Guwahati	Fatasil	Fatasil	FAT1	272.00			257	9	
	Fatasil	Fatasil	FAT2	449.145			449	16	
	Jalukbari	Jalukbari	JAL1	87.490		87		17	
	Gotanagar	Gotanagar	GOT1	164.00			161	20	
	South Kalapahar	South Kalapahar	SKA1	45.465			45	20	
	Hengrabari	Hengrabari	HEN1	665.00			632	26	
	SaraniaHill	Sarania Hill	SAH1	11.119			11	10	
Sonapur	Apricola West	Panikanti	APR1	447.081		374			33
		Jakoikona	APR2	868.00	249	-	568		15
		Jakoikona	APR3	347.130	347	-	--		
		Panikanti	APR4	367.592		340	-		12
		Jakoikona	APR5	334.310		334	-		15
		Panikanti	APR6	670.455		670	-		6
		Jakoikona	APR7	473.693		468	-		10
		Jakoikona	APR8	369.086		368	-		12
		Margaon	APR9	457.029		447	-		12
		Margaon	APR10	645.066		-	606		8
		Margaon	APR11	877.00		-	722		19
		Panikanti	APR12	467.770		-	327		22
	Marakdola	Marakdola	MAR1	714.225	695			6	
	Marakdola	Marakdola	MAR2	568.445				8	
	Marakdola	Marakdola	MAR3	695.362				38	
	Chamata	Chamata	CHA1	28.863		25		10	
	Teteliguri	Teteliguri	TET1	126.552		126		7	
	Matapahar	Matapahar	MOT1	279.187		279		7	
				34520.554	**7468**	**15211**	**4062**	**756**	**714**

CHAPTER 2

SAL REGENERATION WORKING CIRCLE

2.1 Name of the Working Circle: Sal Regeneration Working Circle.

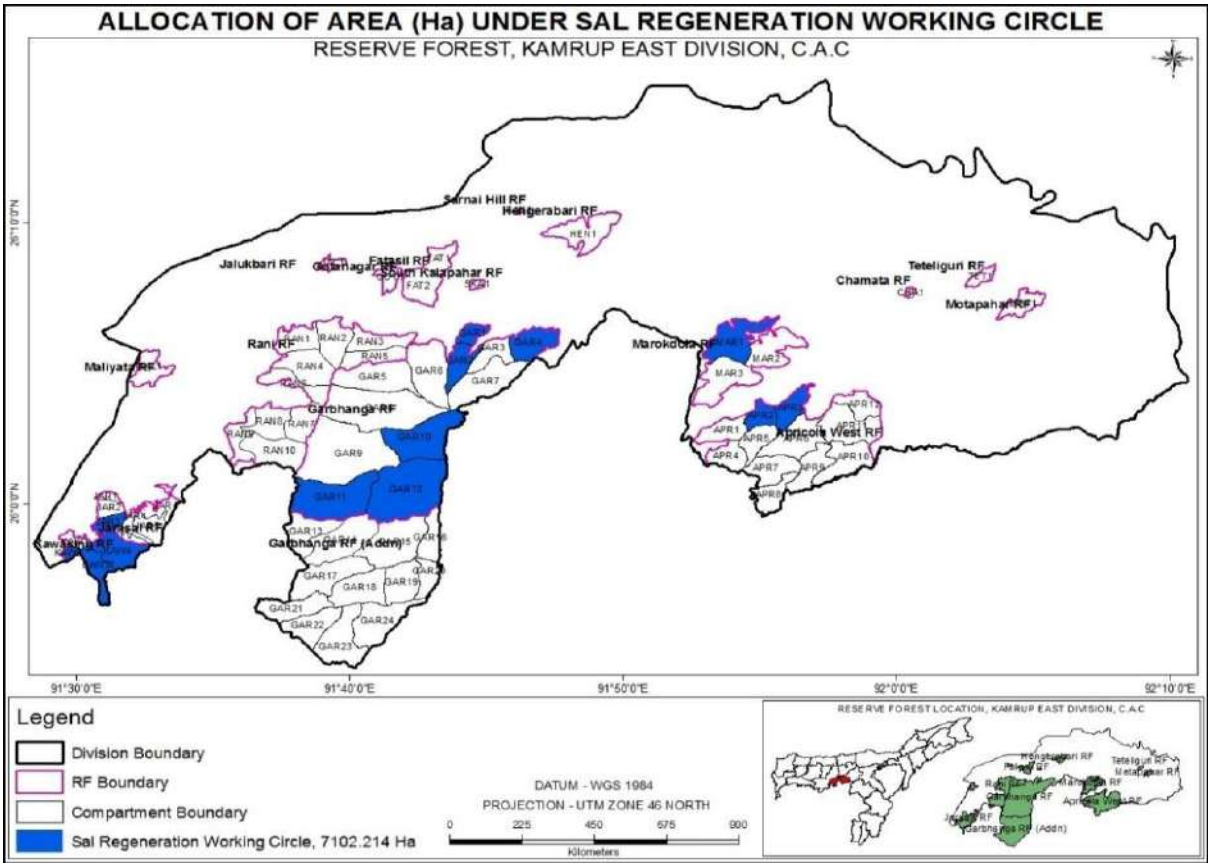


Figure 2.1: Map of Sal Regeneration Working Circle as per existing compartments

2.2 GeneralConstitutentsof the Working Circle: This Working Circle has been constituted to cover all the areas having pure Sal in the crests, ridges and spurs of the hills as well as in the very limited area of the plains. This Working Circle also includes some of those areas where Sal is found in considerable numbers; mixed with other species. As the outcome of the past systems of management is very discouraging, the pace of regeneration of Sal is to be accelerated within a reasonable period. The appropriate silvicultural operations may be allowed to improve the health of growing stock.This working circle comprises all commercially important and well stocked forests of Sal situated on almost the entire flat floor, the lower slopes of the Khasi hills. This working circle corresponds to the unmanaged Sal growing areas, Coppice areas and a few Sal Irregular Shelter wood patches. This working circle includes almost all the commercially important and better quality Kamrup Sal and Khasi Hill Sal forests of the division. The rotation cycle of Sal is around 150 years. The main object of creating this working circle is to conserve the Sal and its associates and to attain ecologically sound forest by block plantation, gap filing and assisting natural regeneration (ANR) of KamrupSal and Khasi Hill Sal and its associates in the Sal growing areas. This will lead to development of significant Sal carbon sink blocks. Further this will also help in maintaining the ecosystem services to Guwahati; the main city of the North East India.

2.3 General characteristics of vegetation

Sal is one of the most important timber yielding plants and also good source of aromatic resin and non- timber forest product. These forests are exposed to over-exploitation, deforestation, encroachment and alteration in land use and land cover and in return being replaced by secondary regenerated Sal forest. Altogether, 71 plant species were recorded from the selected Sal forest. Herbaceous layer of the forest was most species rich (30 species) layer followed by tree and shrub species. Leguminasae and Asteraceae were among the most dominant families in the forest while large number of families was monospecious. *Shorearobusta*has contributed about 90% of the total stand density (2559 individual per hectare) of the forest, while species like *Erythrina suberosa, Delonix regia* and *Pterospermumacerifolium*were represented by single stem. Similar to that of stand density, Sal have contributed to the maximum basal area of the forest. The girth class distribution confirmed a reverse J-shaped distribution, with higher density in lower girth classes and sharp decline thereafter. Total density of shrubs and herbs was recorded 2 individuals per M^2 and 63 individuals per M^2, respectively. Based on the dominance, *Shorearobusta*showed highest dominance followed by *Zizyphusrugosus*. Diversity index for tree, shrub and herb species was recorded 1.43, 2.30 and 3.28, respectively. Dominance index showed reverse trend to that of diversity index. About 84% of the plant species showed contagious distribution, however none of the species exhibited regular distribution. The forest is heterogenous in composition with high dominance of *Shorea*and is under regenerating stage. Therefore, for sustainability of the forest it requires effective conservation measures for Sal and its associate plant species.

Phytosociological analysis of trees, shrubs and herbs in Kamrup Sal forest stands are given in following tables (Table 2.3.a and Table 2.3.b).

Table 2.3.aPhytosociological analysis of trees, in KamrupSal forest stands

Name of Species	Family	Density/ha	Basal area (m2/ha)	IVI	A/F ratio
Shorearobusta	Dipterocarpaceae	2431	26.087	212.67	0.972
Zizyphus rugosa	Rhamnaceae	29	0.18	13.33	0.047
Schimawalichii	Theaceae	22	0.172	8.39	0.096
Stereospermumpersonatum	Bignoniaceae	13	0.135	7.94	0.059
Lagerstroemia speciosa	Lythraceae	8	0.08	7.51	0.033
Streblus aspera	Moraceae	5	0.119	5.24	0.05
Trewianudiflora	Euphorbiaceae	5	0.071	5.07	0.05
Tectona grandis	Verbenaceae	12	0.256	4.46	0.263
Alstoniacholaris	Apocynaceae	4	0.064	4.24	0.06
Dillenia indica	Dilleniaceae	3	0.053	3.4	0.075
Actinodaphneobovata	Lauraceae	3	0.015	3.26	0.075
Spondiasmangifera	Anacardiaceae	3	0.059	2.62	0.1
Talaumahodgsonii	Magnoliaceae	3	0.045	2.57	0.1
Bauhinia purpurea	Leguminosae	3	0.029	2.51	0.1
Bischofiajavanica	Euphorbiaceae	3	0.019	2.48	0.1
Syzygiumcumini	Myrtaceae	2	0.033	1.72	0.15
Mallotusphilippensis	Euphorbiaceae	2	0.026	1.7	0.15
Oroxylum indicum	Bignoniaceae	2	0.019	1.67	0.15
Calicarpa arborea	Verbenaceae	2	0.018	1.67	0.15

Sterculia villosa	Malvaceae	2	0.015	1.66	0.15
Cassia fistula	Leguminosae	2	0.015	1.66	0.15
Sapiumbaccatum	Euphorbiaceae	2	0.01	1.64	0.15
Delonix regia	Leguminosae	1	0.045	0.97	0.3
Erythrina variegata	Leguminosae	1	0.007	0.83	0.3
Pterospemumacerifolium	Malvaceae	1	0.005	0.82	0.3

Table 2.3.bPhytosociological analysis of shrubs and herbs in Kamrup Sal forest stands

Scientific Name	Family	Density/ ha	IVI	A/F Ratio
Shrub layer				
Chromolaena odorata	Asteraceae	5147	37.45	1.033
Cledodendroniscosum	Verbenaceae	4627	36.1	0.805
Urena lobata	Malvaceae	4160	33.44	0.776
Flemingiastrobilifera	Leguminosae	3573	29.21	0.836
Desmodiumlatifolium	Leguminosae	1453	16.92	0.531
Lantana camara	Verbenaceae	280	5.9	0.506
Solanum torvum	Solanaceae	333	5.63	0.762
Rauvolfiatetraphylla	Apocynaceae	373	5.3	1.114
Rauvolfia serpentina	Apocynaceae	347	5.18	1.035
Cassia sophera	Leguminosae	387	4.85	1.571
Cannabis sativa	Cannabaceae	480	4.25	4.388
Leea indica	Vitaceae	120	3.63	0.488
Abutilon indicum	Malvaceae	213	3.54	1.248
Sida cordifolia	Malvaceae	160	3.3	0.936
Caesariavereca	Flacourtiaceae	93	2.99	0.546
Leeacrispa	Vitaceae	53	2.3	0.488
Herbaceous layer				
Ageratum conyzoides	Asteraceae	52000	16.13	0.937
Xanthium strumarium	Asteraceae	32667	12.32	0.719
Commelinabenghalensis	Commelinaceae	39000	11.43	1.582
Borreria articularis	Rubiaceae	37333	11.17	1.514
Cyperus brevifolius	Cyperaceae	45333	10.92	3.604
Cynodondactylon	Poaceae	42667	9.37	6.922
Mikeniamacrantha	Asteracea	24667	8.42	1.362
Dryopteris spp.	Dryopteridaceae	24000	8.31	1.325
Centella asiatica	Apiaceae	24000	7.56	1.908
Spilanthespeniculata	Asteraceae	24000	7.56	1.908
Oplismenus spp.	Poaceae	22000	7.24	1.749
Melastomamalabathricum	Melastomataceae	18667	7.1	1.226
Chrysopogonaciculatus	Poaceae	28000	7.06	4.543
Borreria hispida	Rubiaceae	21333	6.76	2.094
Costusspeciosus	Costaceae	11333	6.32	0.626
Cleome viscosa	Capparidaceae	18667	5.96	2.319
Drymeria cordata	Caryophyllaceae	16000	5.92	1.57
Achyranthes aspera	Amaranthaceae	18000	5.86	2.236

Oxalis corniculata	Oxalidaceae	21667	4.93	10.766
Crotalaria spp.	Leguminosae	6333	4.77	0.503
Polygonum hydropiper	Polygonaceae	18667	4.45	9.275
Justicia simplex	Acanthaceae	15333	4.31	4.876
Pollia japonica	Commelinaceae	15333	4.31	4.876
Amorphophallus campanulatus	Araceae	5333	4.24	0.523
Leucas aspera	Lamiaceae	9667	4.17	1.568
Brunella vulgaris	Lamiaceae	9333	3.36	2.968
Polygonum chinense	Polygonaceae	12000	3.02	10.6
Crassocephalumcrepidiodes	Asteraceae	6000	2.46	2.981
Cyperus rotundas	Cyperaceae	5333	2.35	2.65
Scoparia dulcis	Scrophulariaceae	9333	2.23	18.55

2.4 Felling series, cutting sections: Felling Series is a forest area forming the whole or part of a Working Circle and delimited for forest management purposes so as to (1) distribute felling and regeneration to suit local conditions and (2) to maintain or create a suitable distribution of age classes. Yield is calculated separately for each Felling series (f.s) within a Working Circle, may be based on administrative requirements: to meet the needs of different markets, to ensure even and regular distribution of working among the staff, contractors, and laborers.This Working Plan has not prescribed any harvesting (felling). As such the nomenclature of "felling series", for management purpose in this Working Plan shall be known as "Working Series" (Plantation Series).

2.5 Blocks and Compartment allotment Areas: Blocks, compartment and the area to be covered in this working circle is provided in the table below (Table 2.5.a). Compartmentwise detail under the Sal regeneration working circle is shownbelow.

Table2.6:CompartmentsandArea(Ha)allocatedunderSalRegenerationWorkingCircle.

ReserveForest	Total RFarea(Ha)	area allocated to the WC	Compt.No.	Compartment Area (Ha) allocated to WC	Total area(Ha) Earmarked for Sal plantation
ApricolaWestRF	5253.13	596.21	APR2	249	59
			APR3	347	90
Garbhanga RF	18305.7	4720.24	GAR1	179	179
			GAR10	953	199
			GAR11	1178	115
			GAR12	1577	193
			GAR2	349	179
			GAR4	484	311
Jarasal RF	1134.75	179.53	JAR3	180	135
Kawasing RF	1026.83	910.85	KAW2	65	30
			KAW3	345	212
			KAW4	501	255
Marakdola RF	1978.03	695.36	MAR1	695	686
Rani RF	4,370	394.22	RAN6	366	304
TOTAL	32068.4	7496.41		**7468**	**2947**

2.6 Special objectives of Management

1. To obtain the object of normal forest by way of bringing the existing irregular growing stock under
intensive method of treatment augmenting the natural regeneration with Aided Natural Regeneration
to accelerate the rate of regeneration of Sal.
2. To conserve the existing growing stock in areas other than those earmarked for regeneration operations.
3. To replenish the depleting growing stock to its fullest capacity in forms of volume/hect.

2.6.1 Analysis of the crop

The plant species richness in the in the Division is recorded quite high (71 species in 1.2 ha). The present species richness is found higher as compared to those reported from Central Himalayas and Central India. Leguminosae was found to be the largest family among plant species and is represented by 8 species. Leguminosae is the prominent family for Indian deciduous forests. Among trees, both Leguminosae and Euphorbiaceae were found to be the dominant families with 4 species each followed by Moraceae, Verbenaceae and Bignoniaceae. In shrub layer, both Leguminosae and Malvaceae were recorded as most dominant families. In herbaceous community Asteraceae was the dominant groups while the co-dominant being the Poaceae. Asteraceae is the dominant family followed by Poaceae among the herbaceous communities. Total basal area is recorded 27.57m^2 per hectare. Presence of large number of individuals in the lower girth classes contributed the maximum basal area. The tree species *Shorearobusta*shared the maximum IVI (212.67) than the other plant species. The diversity index of trees is recorded 1.43 is within the range of earlier reported values. Further, diversity index for shrubs and herbs was recorded 2.30 and 3.28 respectively. The Simpson's dominance index ranges between 0.04 and 0.51. Higher fluctuation of Shannon index (H) value (1.43-3.27) indicates that this tropical moist deciduous Sal forests are also species diverse systems. The density girth distribution of tree species in the present study confirmed the reverse J-shaped distribution. Abundance/frequency ratio exhibited that most of the species have contiguous distribution, while only two species showed random distribution. Thus, it can be established that the forest is heterogenous in composition with high dominance of *Shorea*. Girth class distribution structure of the population also confirms that the forest is under regenerating stage. Girth class distribution decreases exponentially with increasing GBH are characteristic for species with continuous regeneration.

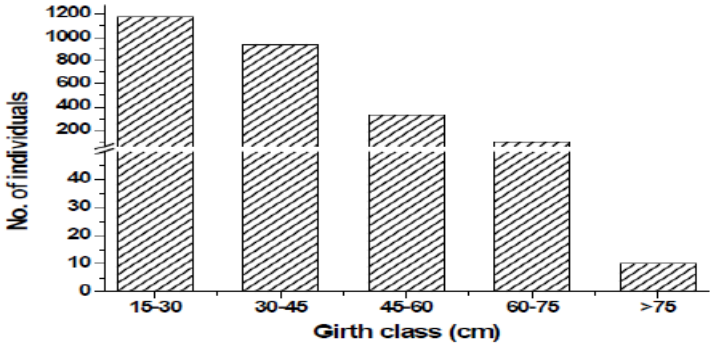


Figure: 2.6.1.a Girth class distribution of tree species

Figure: 2.6.1.b Density and basal area of *Shorea robusta* in different girth class (Ideal)

2.6.2 Silvicultural system: Due to poor growing stock in the Reserve Forests, no harvesting prescription is given except that the Forests shall be managed in order to restock by Artificial Regeneration and Aided Natural Regeneration.Only selection felling of dead and dying trees to give space to new generations may be undertaken with approval from PCCF &HoFF.

Coppice system is an even-aged silvicultural system for which the main regeneration method is vegetative sprouting of either suckers (from the existing root systems of cut trees) or shoots (from cut stumps). This system is limited to hardwood species management. Artificial regeneration shall also be undertaken for filling vacant patches and gaps. This system is prescribed with the aim to nurture the coppieses coming up after rampant illegal felling occurred during previous couple of decades. Though both the system are contradictory to each other, implementation of combination of these systems will create forest of heterogeneous nature bestowed with enriching biodiversity in as much as Irregular Shelterwood system deals withuneven-aged stands and Coppice system deals with even-aged forest.

2.6.3 Rotation period:A rotation period is simply the time between the establishment of a stand of trees and when that same stand is ready for a final cut. This period of years, often called the "optimum" rotation period, is especially important when foresters try to determine

the most advantageous harvest condition in an even-aged stand of trees. When a stand is either economically mature or reaching beyond natural maturity, the "rotation period" has been reached and a final harvest can be planned. In previous Working Plan it was aimed to attain 50″ (125 cm) dia of Sal at a rotation fixed at 120 years. As harvesting prescription is not given in this Working Plan, the Rotation period is not fixed. In subsequent Plan rotation is fixed at **100 years**.

2.6.4 Harvestable diameters: Shall remain same 50′ (125 cm) diaas in previous Working Plan subject to mid term deviation requiring felling/harvesting. But, as harvesting is not prescribed in this Plan, the harvestable diameter per se is not applicable for this Plan.

2.6.5 Reducing factors and reduced areas: Reducing factors shall be derived during course of Working Plan period with respect to quality and density for species.

2.6.6 Felling cycle: Since felling is not prescribedexcept thinning, felling cycle is not necessary to be constituted.

2.6.9 Table of felling: Not applicable, hence not prepared.

2.6.10 Method of executing the felling: Not prescribed.

2.7 Tending operations:

Tending operation or Cultural operations carried out for the benefits of forest crop at any stage of its life. It essentially covers operation on the crop itself and competing for vegetation and include weeding, cleaning, thinning, felling, pruning, climber cutting, girdling but exclude soil working, drainage, irrigation, and burning, etc.

For the establishment of the regeneration and subsequent development of the forest crop up to harvesting, several operations are carried out. These operations are carried out in the forest crop at different stages of growth in order to provide a healthy environment for their development.

Need for tending operations:

Two major needs:

To provide growing space for trees.

- The act of reducing the chance of attack by pathogen, insects and other diseases. The trees which are susceptible, injured, broken, weak, diseased, or infected by insects are removed.
- Looking for space in which trees extend their masses, lastly tending operations are essential for providing, the tree with more light water nutrients, etc.
- Tending operations result in the achievement of a form which confirms the human sense of liking.

2.7.1 Weeding:

Any unwanted plant that interferes or tends to interfere with the growth of the individuals of favoured species' is called a **weed**. **Weeding** is defined as 'a tending operation done in the seedling stage in the nursery or in a forest crop, that involves the removal or cutting back of all weeds.

2.7.2 Objectives of Weeding

- To protect the crops from suppression
- To reduce root competition for moisture and nutrients available in the soil
- To reduce transpirational water loss
- To improve light conditions

2.7.3 Methods of Weeding

Weeds may be controlled by the following methods:

- a) Mechanical Methods
- b) Biological Methods
- c) Chemical Methods

2.7.4 Weeding Important Points to Note

- The removal or cutting back of any sort of weed growth that is interfering with the growth of the crop is called weeding.
- Removal means uprooting the entire weed even Morus alba if not required.
- Cutting back is meant by cutting the upper portion but this does not control weeding.
- When plants are 3feet high or less, the stage is seedling. In the seedling stage usually, the side branches have yet to come out and light frequently falls upon open interplant spaces and then weeds become active, start competing and start sucking food, hence they are removed.
- Weeds usually come from indigenous spp, some are persistent for example *Imperita cylindrical* (drub) constantly refuses to leave the land because it is deep-rooted and even plough can hardly do harm to its one feet deep rhizome.
- Weeds mainly appear from seeds, others from coppice and still others form suckers.
- In natural forests, *Micheneaspp*creates a problem by appearing again and again.
- Weeding should be at early ages because seedlings have to suffer when the weeds surpass them in height.
- For Sal plantation, weeding is done twice in the first year.
- In addition, weeding continues with cleaning as well.

2.7.5 Cleaning:

Cleaning is carried out in a crop which has not crossed the sapling stage and is defined as the cutting made in order to face the best individuals from undesirable one of the same age which interfere or are likely to interfere with the growth of the desired individuals.

The greatest advantage offered by cleaning is the proper regulation of the composition of the crop, particularly in mixed crops.

2.7.6 Methods of Cleaning

Methods of cleaning may be mechanical, biological and chemical as described under weeding.

- Tending operations done in sapling crop particularly just before or with the first thinning are involving the removal or cutting back of all inferior growth, climbers, etc" including an excess of coppice shoots and sapling if interfering with better one.
- Sometimes cleaning and the first thing is done simultaneously or sometimes separate.
- Since the sapling branches shade up the ground then weaker type of seedlings may appear, they are undesired and removable.

2.7.7 Climber control:

- A plant that attaches itself to other plants or objects such as posts and walls as it grows is a Climber.

- This difficulty is faced in nurseries usually seedlings are twined by climbers. Afterwards, the internode increases in length. The climber pulls the head of the seedling. Since this host climber can't be extended, shoot of the seedling is broken.
- Sometimes it completely girdles the shoots and plants die of suffocation. The climber may ravel itself around the crown, so the victim is devoid of light and food.
- Their removal is necessary.

2.7.8 Pruning:

It is a kind of management of crops at younger and/or older stage in which branches live or dead are removed for further improvement of crops to produce knot-free timber. It is the removal of branches from the trees.

2.7.9 Objectives of Pruning

- To get clear, knot-free high-grade timber
- To meet the demand for fuelwood and fodder
- To get access for inspection and reduce the chance of fire hazard

2.7.10 Kinds of Pruning

On the basis of the kind of branches, pruning is classified into:

- **Dry pruning**, i.e., pruning of dead branches
- **Green pruning**, i.e., pruning of living branches

On the basis of the agency of pruning, it is classified into:

2.7.11 Natural pruning: The natural death and fall of branches of standing trees from such causes as deficiency of light, decay, snow and ice. It is also known as self-pruning. Teak, most Eucalyptus species and Kadam are good natural pruners.

2.7.12 Artificial pruning: The pruning done by forester without waiting for nature to do it in dense natural crops or where nature cannot do it due to artificially large spacing between stems in man-made plantations to reduce the cost of formation and rotation. It is a costly operation. So, artificial pruning is carried out considering the funds or outcomes.

2.8 Thinning

Thinning is considered as principal tending operation. The aim of thinning is to achieve appropriate stand density and enhance diameter growth. In Kamrup East Forest Division, the provision of thinning is in each compartment. The thinning is targeted for sapling, pole and young tree within the compartments. Proper method for thinning operation is lacking in the Division. If the nature of stand is uneven aged (old trees to young pole and saplings); the challenge is to apply appropriate method. In Kamrup East Division the size of stem (diameter distribution) is heterogeneous. Thinning shall be undertaken in compartments having uniform girth class or uniform age class. The spacing between the stems depends upon the number 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.

Silvicultural thinning supported by Mechanical thinning by using Laurie's Formula is prescribed in Sal Working Circle.

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 andmeasurement especially for identifying stems to be retained with the help of GIS.

Year wise thinning sequence is not prescribed to give DFO flexibility in the field. Though, broadly 'C' grade 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 $1/10^{th}$ of the total area of this WC will be taken. 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.

2.8.1 Principle of Thinning to be Followed: In order to carryout thinning, the field foresters should have 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.

2.8.2 Grades of Ordinary Thinning- In order to prescribe which classes of trees are to be removed in a particular thinning in a crop, it is necessary to differentiate various thinning grades. A thinning grade 'refers to relative extent to which a crop is opened up in thinning. Using the classes of trees to be removed, the following thinning grades are recognized in ordinary thinning:

I. **Light Thinning (A grade)-**This grade of thinning is limited to the removal of dead, dying, diseased and suppressed trees, i.e. classes V, IV, and III. It is of no practical use and is seldom carried out in field, except for comparative research on the effect of thinning on increment.

II. **Moderate Thinning (B grade)-** This grade of thinning is limited to the removal of dead, dying, diseased and suppressed, defective dominated, whip and occasional very defective dominant, i.e. classes V,IV, III, II(b), I(d) and an occasional I(c). Branchy advance growth,

which is neither practicable nor desirable to prune or lop, is also removed. This grade is also of little use in ordinary practice as it has very little influence on the growth of the remaining trees.

III. **Heavy Thinning (C grade)** in addition to the removal of all classes of trees of a grade, this grade consists of the removal of remaining dominated and such defective co- dominants as can be removed without making lasting gaps in the canopy, i.e. classes V, IV, III, II, I(b), I(c), and I(d). This is the grade which is ordinarily used for yield table computation. In the gaps created by the removal of the dominant trees some suppressed trees may be left as soil cover if their removal is of no economic or hygienic value.

IV. **Very Heavy Thinning (D grade)-** This grade consists of all tree classes to be removed in C grade as well as some of the good dominants, subject to the condition of not making any permanent gap in the canopy, i.e. classes V, IV, III, II, I, (b), I(c), I(d) and some I(a). The trees selected for retention are the trees with good boles and crowns, well and evenly distributed over the area, with space on all sides for proper development. In this grade also, some suppressed or dominated trees, whose removal is of no economic or hygienic value, are left as soil cover in the gap created by the removal of the dominant trees.

V. **Very Very Heavy Thinning (E grade)-** This is about the heaviest thinning that can be done in a crop without making permanent gaps in the canopy. In this grade more of the good dominants are removed as compared to D grade. Formerly this grade was applied chiefly for research purposes but it is now being used in divisional practice also for some species. Some suppressed and dominated trees are left as soil cover in the gaps of the removed dominant trees.

VI. Some times, it may be necessary to carryout thinning heavier then B, C or D grade but less heavier than C, D or E grade respectively and so intermediate grades are recognized. Viz., B/C, C/D and D/E. The thinning a prescribed in this working circle will be followed with the above standards

2.8.3 Tree Classification: Standard tree classification adopted in India Forestry for regular crop is as follows:

i. Dominant trees (class symbol-I; abb.-D): All trees which form the upper most leaf canopy and have their leading shoots free. These may be subdivided according to the position and relative freedom of their crown into:

a. Predominant Trees (abb.-D1): Comprising of all the tallest trees which

b. Co-dominant Trees (abb.-D2): Comprising of the rest of the dominants falling short of d1 and averaging about 5/6 of the average height of D1.

The dominants are further classified according to their vigour and soundness or otherwise into:

1. Trees with normal crown development and good stem form (Class symbol-**Ia**).
2. Trees with defective stems or crowns (Class symbol –**Ib**), e.g. (i) trees with crown space cramped by neighbouring trees; (ii) badly spaced old advance growth; (iii) trees with forked leader and similar defects.
3. Trees with very defective stems or crown, i.e. with same defects as in Ib to such an extent that they are of little or no present value or promise. (Class symbol-**Ic**).

4. Whips, i.e., trees with very thin bole and very constricted crown, incapable of existence without the support of the neighbouring trees. (Class symbol-**Id**).

ii. Dominated trees (Class symbol-II; abb.-d): Trees which do not form part of the upper most leaf canopy, but the leading shoots of which are not definitely over-topped by the neighboring trees. Their height is about ¾ that of the tallest trees. They are classified as: a. Trees with normal crown development and good stem form (class symbol-**IIa**)
b. Trees with defective crowns or stems (class symbol-**IIb**)
iii. Suppressed trees (Class symbol-III; abb.-S): Trees which reach only about ½ to 5/8 of the height of the best trees, with their leading shoots definitely over topped by their neighbours or at least shaded on all sides by them. A small tree of height typical of the suppressed tree standing with its leader free in a chance gap should not be classed as D or d.

iv. Dead and moribund trees (class symbol-IV; abb.-m): This class also includes bent over badly leaning trees usually of the whip type.

v. Diseased trees (Class symbol-V; abb.-k): Trees which are infected with parasites to such an extent that their growth is seriously affected or they are a danger to their neighbours. Abbreviation k is suggestive of canker. They are of:
a. Dominant (Class symbol-**ka**)
b. Dominated and Suppressed (class symbol-**kb**)

2.8.4 Definition of trees for salvage felling: Definition of dead, dry, dying, diseased and uprooted trees as given in chapter 4 of 'Maleta Committee' report is as under:
i. Dead Tree: A tree which is physiologically non functional is a dead tree.
ii. Dry Tree: A tree in which physiological activity has completely ended and which has dried completely from root to top of the crown.
iii.Diseased Tree: Trees which are infected with parasites to such an extent that their growth is seriously affected or they are a danger to their neighbors.
iv.Uprooted and Fallen Trees: A tree which cannot stand by its root system. It can be green or dry. Part of the tree broken and separated from the stem will also come under the definition of fallen tree.

2.8.5 Marking Rules for thinning (for light thinning): Very light to light thinning is prescribed.

(a) Mark all dead, top dead, wind fallen, diseased, mid broken, top broken and unsound Sal trees.
(b) Mark all mal formed or crocked Sal provided no large gaps are created.
(c) Mark all stems of inferior species interfering with Sal.
(d) In case of any doubt regarding removal or otherwise of a tree, decide in favour of retention.
(e) Only Congested patches of poles are to be thinned out. For guidance of thinning in congested patch following Laurie's Formula. The spacing and desirable number of trees per hectare by diameter (BH) for Sal forest are given in table 2.8.5.a. However, the number of trees to be retained may be increased considering local conditions, threats etc. as found fit by the DFO.

Table 2.8.5.a: The designed method for thinning

Diameter	Spacing	Minimum No of trees to be retained/hect after thinning	Considering local conditions May be increased upto
10 cm	3.15 m	1170	+ 90
15 cm	4.00 m	725	+ 80
20 cm	5.00 m	460	+ 70
25 cm	5.86 m	340	+ 60
30 cm	6.81 m	250	+ 50
35 cm	7.66 m	195	+ 40
40 cm	8.64 m	155	+ 30
45 cm	9.46 m	129	+ 20
50 cm	10.36 m	108	+ 10

2.8.6 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.

Table:2.7.b: Year-wise Silvicultural operations proposed in Sal Regeneration Working Circle

ReserveForest	Compt. No.	Compartment Area	Y1 Ha	Y2 Ha	Y3 Ha	Y4 Ha	Y5 Ha	Y6 Ha	Y7 Ha	Y8 Ha	Y9 Ha	Y10 Ha
ApricolaWestRF	APR2	249.00	-	28	27	27	27	28	28	28	28	28
	APR3	347.00	-	39	39	39	39	39	38	38	38	38
Garbhanga RF	GAR1	179.00	-	20	20	20	22	22	18	20	18	19
	GAR10	953.00	-	108	106	105	106	105	106	105	106	106
	GAR11	1178.00	-	131	131	131	131	131	131	131	130	131
	GAR12	1577.00	-	175	175	175	177	175	175	175	175	175
	GAR2	349.00	-	40	39	38	38	40	38	38	38	40
	GAR4	484.00	-	54	52	54	54	54	54	54	54	54
JarasalRF	JAR3	180.00	-	20	20	20	20	20	20	20	20	20
KawasingRF	KAW2	65.00	-	7	7	7	7	9	7	7	7	7
	KAW3	345.00	-	38	38	38	38	38	38	38	39	40
	KAW4	501.00	-	56	56	56	55	56	55	56	55	56
MarakdolaRF	MAR1	695.00	-	77	77	77	77	77	77	77	78	78
Rani RF	RAN6	366.00		41	41	41	41	41	41	40	40	40
TOTAL		**7468.00**	-	834	828	828	832	835	826	827	826	832

2.9 Regeneration:

*Shorearobusta*Gaertn.F. Family: Dipterocarpaceae, Local name: Sal

General: It is the predominant forest tree and the largest source of forest revenue in the state. Wood is very durable and is used for building bridges, for railway sleepers. Resistant to attack of white ants it is in great demand for construction works, mine props, piles, boat building, well construction; the wood is also used for furniture, tent poles and pegs, carriages, wheels etc. It is good firewood and makes very good charcoal. The leaves are made into plates which are in good demand in the market. The well-known ‘sal butter’ is extracted from the seeds; it is used as a lubricant, a substitute for butter in chocolates, and as cooking agent.

Description: A large gregarious tree. Bark brown, thick with deep longitudinal cracks. Leaves long, broad ovate. Flowers yellowish, on short stalks, calyx and petals softly grey tomentose outside, petals orange inside. Wood pale brown, darkening on exposure.

Distribution in the Division: Gregarious in the laterite tracts of entire Kamrup East Division, in the well drained land in the Terai and the lower hill forests. Sal requires well drained sandy loam soil with water retention capacity of 85%. Soil with pH value between 5.6 and 7.8 is best suited for Sal.**Seed:** Flowers appear from late February to April depending on locality and season. Seeds ripen from end May to early June. Weight of seed varies from 880 to 1060 seeds (with wings) per kg. Seeds should be collected from healthy plus trees or wellmaintained seed stand. Sal seed loosesviabilityrapidly. Seeds can be stored for 3 or 4 days, may be upto a week, but it is always advisable to sow as soon after collection as possible. Sound fresh seeds have high germination capacity. Germination capacity in the range 75 to 90 % has been observed.

2.9.1 Natural Regeneration:

The problem of the natural regeneration of the Sal is as old as the forestry operations in India. Practical experience and experimental evidence has been accumulated in wake of attempts at its solution. Regeneration, as a whole, is poor and there is sign of deficiency in most of the areas. Since Sal areas are prone to forest fire, sapling that come up in the areas gets burn down during sporadic small fires.

Beside this, there are signs of heavy biotic pressure in many areas and it is imperative to reduce it. Plantations done in the past have not produced the desired results. Fencing and dibbling of seeds just before the on-set of monsoon will help in regenerating the areas. The areas also need effective fire protection for at least three consecutive years. The three important factors which bear on natural regeneration of Sal are seeding, germination & establishment of seeding. According to Davis Sal natural regeneration progresses in two stages:

Stage I: From germination up to the large leaved whippy or small woody stage.

Stage II: From whippy or small woody stage to pole stage. The crux of the problem is to obtain ‘stage I’ i.e. germination to the sub whippy stage after which progress to ‘stage II’ i.e. whippy to established stages is comparatively rapid andsimple.

Method of regeneration: It is proposed that the entire Sal regeneration areas should be taken up for ANR work during the plan period. Depending on the existing natural regeneration &pole crops DFO may take up the entire compartment or part of it for ANR operations. DFO will prepare a site specific plan (SSP) for the areas undertaken for ANR operations and will undertake the whole chain of operations in a time bound manner to establish regeneration. Detail assessment of the site will be done (not below the rank of ACF) after a detailed environmental & ecological study prior to the preparation of SSP for an area proposed to be treated through ANR. The main objective of the SSP is to assess whether site enhancement treatments to improve floor conditions is sufficient to establish regeneration or gap planting is required along with effective protection from fire & biotic pressure. Full advantages will be taken of the existing regeneration in sub-whippy, whippy and woody stages by protecting

them from fire, grazing & frost. The following sequence of ANR operations for obtaining and establishing regeneration issuggested:

Top canopy: Proceeding of XI Silvicultural conference (1967) has recommended that opening of top canopy up to 0.5-0.6 density is conducive to seedling growth, subject to other factors. Hence, regeneration felling is to be done in areas keeping in mind that biotic interferences are extreme in areas adjacent to settlements.

Middle storey: In the middle storey light crowned species should be preferred. Low branching and dense foliaged species like mallottusmaybe thinned where absolutely necessary. Oxy, mallottus (a preferred species by elephant) and makrisal needs to be regnerated. Hence, it is prescribed that poles of teak & its species will be preferred for removal in place of middle storeySalassociates like Oxy, Makrisal, Jamun, Bahera, Aonla, etc. Regeneration of associate species of Sal will also be emphasized along with the regeneration ofSal.

2.9.2 Artificial Regeneration:

Propagation

The issue of natural regeneration of Sal has engaged the attention of foresters for a long time. Following various experiments it appears that all the attempts to obtain natural regeneration by manipulation of various site factors, have not been successful. Even such results as can be considered positive do not commensurate with the efforts and expenses involved. The common and easy practice has therefore been propagation through artificial regeneration.

Artificial regeneration

Sal is generally regenerated in clear felled coupes by direct sowing. Seeds are sown on cloudy days when the ground is moist, preferably after rain. Seeds are dibbled with wings sticking up in hoed up lines 30 cm wide. Prescription in Sal plantation is to sow eight lines of Sal alternated by eight lines of Sal associates. Each Sal line (30 cm wide) consists of 3 rows of seeds, the rows being 15 cm apart. Seeds are dibbled 8 cm apart in each row. Sowing of one row is completed first, then followed by sowing in the second and third rows in that order. Since germination capacity is not uniform over the seed time which lasts about 3 weeks, this method is adopted to ensure equal chance of regeneration throughout the area. The seeds are covered with a light layer of soil. Germination is completed within a week.

In Kamrup East Division, Sal lies in degraded condition over a large area. A major part of Sal area is managed and regenerated by the method of coppicing. The purpose of Sal coppice forest in Kamrup East division is to produce pole crop. Regeneration in Sal coppice forests is thus comparatively easier and less cost intensive. However, where Sal stumps do not have living root stock and thus fail to throw up coppice shoots, such areas are taken up for planting with Sal and its associates. The planting stock consists of nursery raised seedlings. Seeds are sown in polythene pots or hykopots immediately after collection. The pots are placed preferably on raised beds to facilitate air pruning and eliminate the phenomenon of root coiling. Seedlings established in polypots/hykopots can be planted during the same monsoon (provided the seedlings are tall and established), or preferably in the next year.

Soil working: The deleterious effect of organic matter, an improved moisture regime and exposure of mineral soil necessary for successful germination and post germination development make it imperative to adopt soil working in regeneration areas. Further, soil working around immature seedlings has to be resorted to where regeneration is stagnating. Thorough soil working preferably with a light chain type tractor before seed fall id to be done. If funds suffice, soil working along the contours, if not possible even slight wounding of the soil along the contour at random will generally be beneficial in arresting the fallen seeds from rolling down the hills and to survive the drought period.

Fencing: Effective fencing (physical or social) must be ensured before regeneration felling. Regeneration felling may be deferred if fencing could not be ensured & the deviation need not require sanction if informed to the higher authorities intime.

Shrub-cutting: Thorough and preferably complete weeding should be done in the rains. This operation is to be continued for the first 3 or 4 years and thereafter intensive shrub cutting in rains is expected to suffice.

Protection: Effective protection from fire & biotic pressure especially in the early stages of regeneration is must. Only wind fallen, storm damaged and diseased trees are likely to spread infection may be removed after being marked by an A.C.F. and 50% of the same verified by D.F.O. Fencing is a must to prevent human and cattle interference.

Fire Protection: Fire brakes, control burning or contract with local forest users to assist in the protection of the site from fire is the need for successful regeneration. The object of control burning is to remove excess leaf litter from the forest floor & to stimulate growth of stagnating whippy seedlings. For achieving this object, control burning should be carried out latest by the middle of February in patches carrying mainly whippy regeneration. The patches of sub-whippy regeneration should be protected as burning proves inimical to their survival. Patches of well grown woody regeneration should also be protected as otherwise it causes avoidable loss of growth.

Protection from Grazing: The area must be effectively protected from internal (Gujjar) & external (villages surrounding the forest) biotic pressure. The Gujjars should not be allowed grazing permits in the areas under ANR. Also, lopping of the Sal associates should not be allowed. People participation in minimizing external biotic pressure should be tried.

Protection from other biotic agents Injury/Damage

Sal crops, young and old, are liable to damage by drought. Obnoxious weeds such as *Mikenia, Eupatorium* and *Lantana* are serious threats to young seedlings of Sal. Sal is also very vulnerable to attack by climbers. A large number of borers of bark and wood, defoliators, sap suckers, fruit and seed eaters have been recorded. The most destructive is Sal heart wood borer, *Hoplocerambyxspinicornis.* Sal is also vulnerable to damage by a large number of fungi.

Gap Planting: Gap planting of Sal & its associates may be done as per CAMP Assam Norms. Since most of the Sal associates are good fodder species & hence browsable; gap planting requires special protection measures to make it successful.

Shrub Cutting: Intensive shrub cutting in rains is significantly superior both in respect of height and the number of unestablished seedling, hence is the most important operation, beneficial at all stages of development of Sal seedlings. Since complete eradication of weeds by pulling out by hands is still more beneficial, complete removal of shrubs in rains has also to be attempted where-ever feasible.

Burning: Burning is effective at two stages, firstly to obtain recruitment and secondly to stimulate the growth of stagnated seedlings. For obtaining good recruitment, a good burn prior to seed fall is very helpful. This may have to be repeated two years in succession but should not be done continuously and, in any case not unless a good seed year is expected. Control burning for stimulating the growth of seedlings in the small woody stage is required only in the laterstages.

Tending

In forests of this division, Sal plantations are seriously affected due to suppression by weeds and climbers. Sal requires intensive tending for establishment of seedlings. These operations involve weeding, cleaning, hoeing, shrub-climber cutting, fencing, and fire protection etc. at various stages. **Prescriptions:**

1. The area intended to be undertaken for regeneration must be fenced with permanent nature of fencing with chainlink fencing 2.0 meter high supported by concertina (rajor wire) coil and multy strand fencing. The posts being placed closely 2 meter apart with RCC 150mm 150mm prestressed or MS 75mm x5mm angle posts (Base should be of Concrete). While ercting such permanent type of fencing, it must be kept in mind that leaving buffer area in between human habitation and actual plantation area may cause encroachment in the buffer area. So, fencing should invariably be erected along Reserve boundary.

2. Seedling strips 1 (one) meter wide at 2 meter interval (edge to edge) should then be laid out in the aera irrespective of presence or absence of regeneration with proper lining and stacking with sticks and pegs. These seedling strips should preferably be laid in an east-west direction. This operation is to be completed by the end of March.

3. In the aereas in need of regeneration being induced, the central 70 cm of seedling strips should properly be hoed and raised seed beds (7-10) prepared during April providing bed surface with slight camber and no clods should be left. In Konkani soil, hoeing should be continued to the top of raised mounds and seed bed should be prepared in the form of Thali. This work should be completed latest by 1st week of May.

4. As soon as mature Sal seeds are available (within 25th of May), these should be dibbled in on the seed beds at spacing 5cm x 5cm. It should be ensured that only mature seeds are dibbled in and that takes place preferably within 48 hours of seed fall. This can be ensured by confirming collection of seeds from the floor of seed stands, where the floor can be swept every day and fresh fallen seeds can be collected.

5. In areas containing groups and patches of established Sal, the laying out of strips should be carried out in such a way as to accommodate all such groups and patches if necessary by widening the strips or by not following strictly straight alignment. Smaller patches or

individual Sal seedlings falling in the interval between the strips need not be bothered about. All the cut materials and felling debrises should be heaped in the intervening space between the two seedling strips and should be burnt.

6. 1st rain weeding (i.e., cutting of shrubs etc.) is to be carried out in whole of annual regeneration area during July.

7. 2nd rain weeding in August to be carried out in whole area with particular attention to removal of climbers like Michanea etc.

8. 3rd weeding is to be carried out in September, where alongwith shrubs and climber cutting, the singling out of thick patch of regeneration either of coppice or seed origin are to be done.

9. The plantation area is to be subjected to an early controlled burning at the outset of dry winter months. For this, firelines4 meter wide are to be cut along the boundaries of the plantation and in case of large plots, intermediate firelines 3 metrewide are to be cleared to sub divide the plots. Shrubs etc. occurring in seedling strips are to be placed along the middle of the intermediate space (two meter). Thatch and other growths occurring in the intermediate space are then to be pressed down. The cut and pressed materials are then to be burnt under control during the late evening or early morning by repeated torching. Care should be taken to ensure that no fire creeps into the seedlings strips and seedling patcthes. The control burning areas containing thatch should be done on the same evening or next morning of the day on which the materials are cut and pressed down. In areas having shrubby evergreen undergrowth, a day or two may be allowed to pass for drying up the debrises. All imflamable materials should also be burnt together with debrises. This operation must be completed by 15th November.

10. The fire links should be swept clean of all inflammable materials and burnt periodically during the remaider part of dry season.

11. The operations outlined under item no. 5,6,7,8 & 9 alongwith repairs/renewals of fencings are to be repeated duting the end year of the plantations onward till the Sal seedlings are established in the area. The time table to be followed is-

1st weeding = May/June
2nd weeding = July/August
3rs weeding = September
Pressing and Control burning = Late October to early November
During the 1st weeding in May/June, the vacancies are to be filled up by dibbling seeds or planting polypot raised Sal seedling. Every year, alongwith the planting works by dibbling, some polypots are to be dibbled with Sal seeds in nursery so that these polypot raised Sal seedlings can be used for beating up operation in the next year.
During the working and operations, the singling out coppice shoots are also to be done.

12. Thease operations are to be repeated in 3rd, 4th and 5th years too.

13. The fireline cutting and early burning firelines are to be done for 6th and 7th year plantations too.

14. During the 5th year of the plantation, the congested patch of Sal seedlings in the strips may be given a clearing.

15. The 1st thinning in the plantations would be due and should be carried out on 10th year of the plantations.

Table 2.9.1 Yearwise area to be taken up for plantation

Compt. No.	Area (Ha)	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
APR2	59.00	50	9	-	-	-	-	-	-	-	-
APR3	90.00	-	45	45	-	-	-	-	-	-	-
GAR1	179.00	-	-	-	50	50	50	29	-	-	-
GAR10	199.00	25	25	25	24	-	-	25	25	25	25
GAR11	115.00	-	-	10	15	15	15	15	15	15	15
GAR12	193.00	20	20	20	20	20	13	20	20	20	20
GAR2	179.00	20	20	20	20	20	20	-	19	20	20
GAR4	311.00	30	30	30	30	35	36	30	30	30	30
JAR3	135.00	15	15	15	15	15	15	15	10	10	10
KAW2	30.00	5	5	5	5	5	5	-	-	-	-
KAW3	212.00	30	22	20	20	20	20	20	20	20	20
KAW4	255.00	25	25	25	25	25	25	25	30	25	25
MAR1	686.00	70	70	70	70	70	70	71	65	65	65
RAN6	304.00	30	30	30	30	30	30	32	32	30	30
Total	**2947**	**320**	**316**	**315**	**324**	**305**	**299**	**282**	**266**	**260**	**260**

NB: The DFO, considering local condition, eg, vegetation stock, density, fund, feasibility etc. will be at liberty to deviate or to prioritize any area to maximum 25% in respect of area or location. There must be approval from PCCF &HoFF.

2.9.3 Coppice management option:

Simple coppice management is one of the most suitable forest management options to produce maximum biomass including fuelwood and fodder from Sal forest in short rotations. Simple coppice management option is not suitable for timber production. However, it can produce some wooden weaving materials and shuttering poles which can be used for house construction. Regeneration of the crop in coppice systems is based on coppicing. This management system produces maximum productivity from the harvested stumps. The simple coppice option has the shortest rotation. Coppices are either annually harvested or protected. The entire crop is harvested (clear felled) at the rotation age.

Coppice forest is a low forest and has come up in Kamrup East division as an outcome of rampant illegal felling. Though it is, in fact, an undesired forest, we have to protect the forest for the sake of environment and ecosystem restoration. These coppices shall be retained as shelterwood until regeneration from seeds are established.

Tending operation:

3-2-1 shoots per stool treatment (3-2-1 s/s): This treatment maintained three best shoots per stump for the first years. These were reduced to two shoots per stump in the second year and

further reduced to one shoot per stump in the third year. Generally, the canopy closed at four years and then it is clearfelled. In Kamrup East Division, after singling out, coppices shall be retained for next ten years.

2.10 Associated regulations and measures:

2.10.1 Fire protection: The main problem in Sal regeneration is repeated forest fire, which needs to be effectively protected by careful planning & execution at the field level. The forests being deciduous by nature leaf fall happens from March till May-June. It is during this period that the fire season is also at its peak. Control burning cannot be resorted to because fire season had already set in. At the same time, the accumulating leaf litter is too hazardous to be left like that in the forests. Hence, the whole working circle will be fire protected and protection will be done largely by departmental control burning. Control burning should be carried out latest by the middle of February. Due to non-felling and no cultural operations being done for a long time, many areas of the working circle is having dense crop with all sorts of diameter classes and ages. There is always hazard of major fire in these areas. Care should be taken to protect these areas from forest fire.

2.10.2 Grazing: Uncontrolled or excessive grazing has very serious adverse effects on the regeneration of Sal and other forest tree species. Trampling and browsing of regeneration is common and the soil is hardened to the detriment of germination of seeds. Erosion is accentuated and thorny unpalatable shrubs like *Carissa opaca* increase proportionately. Excessive grazing also arrests seral development of vegetation and sometimes leads to retrogression. Hence effective control on grazing is required

Areas where special cultural operations are prescribed in this working circle shall remain closed to grazing for the plan period. Areas undertaken for ANR should be fenced. The fencing must be cattle proof with the five strandbarded wire.

2.10.3 Felling beyond Prescription: Felling other than prescribed in the working circle shall be treated as deviation. In areas where the trees are to be felled due to natural calamities like 'hoplo attack' or Sal mortality (die back) etc and if the actual yield obtained or expected to be obtained from such trees comes out more than the yield prescribed in this working circle, the proposal for such deviation will be sent in advance to CCF Working Plan, so that the prior approval may be obtained from Government of India well in time.

2.10.4 Availability of Funds: The various silvicultural operations have been prescribed in this working circle. Marking, felling and silvicultural operations should be treated as combined activity. DFO, therefore, will ensure the availability of appropriate funds for completing all cultural operations followed by felling. If these things can not be ensured due to financial or other constraints, then felling may be differed & the deviation will not require sanction if informed in time to higher authorities.

2.10.5 Silviculture Plots: All operations including felling of green trees for various research activities e.g. establishment of experimental plots, preservation plots, sample plots and seed plots (S.P.A., S.S.P.A and C.S.O.) will be excluded from the prescription of this working circle and there will be no restriction in carrying out any research activity related to forestry.

However, all the results of the research activity will be shared with the DFO regularly, so that findings can be used to improve the condition of the forest.

2.10.6 Collection of Seed: Collection of Sal seed & seeds of its associates from whole of the working circle will not be allowed except for departmental works. In each compartment, some trees of the associates of Sal should be declared as 'Plus Trees'. The trees should be properly marked (with tin plates) and not be allowed for lopping. A group of such trees may be declared as 'Seed Stand' & marked. The number of trees for each species & the number of species in a compartment will be decided by the DFO.

2.10.7 Demonstration & Observation Plot: The main objective of this working circle is regeneration. Hence, demonstration and observation plots for ANR (Assisted Natural Regeneration) in each range needs to be established under the supervision of D.F.O. The size of these plots will be decided by the DFO; however, it should not be less than 10 ha. The data will be recorded in separate "Journal" for future reference.

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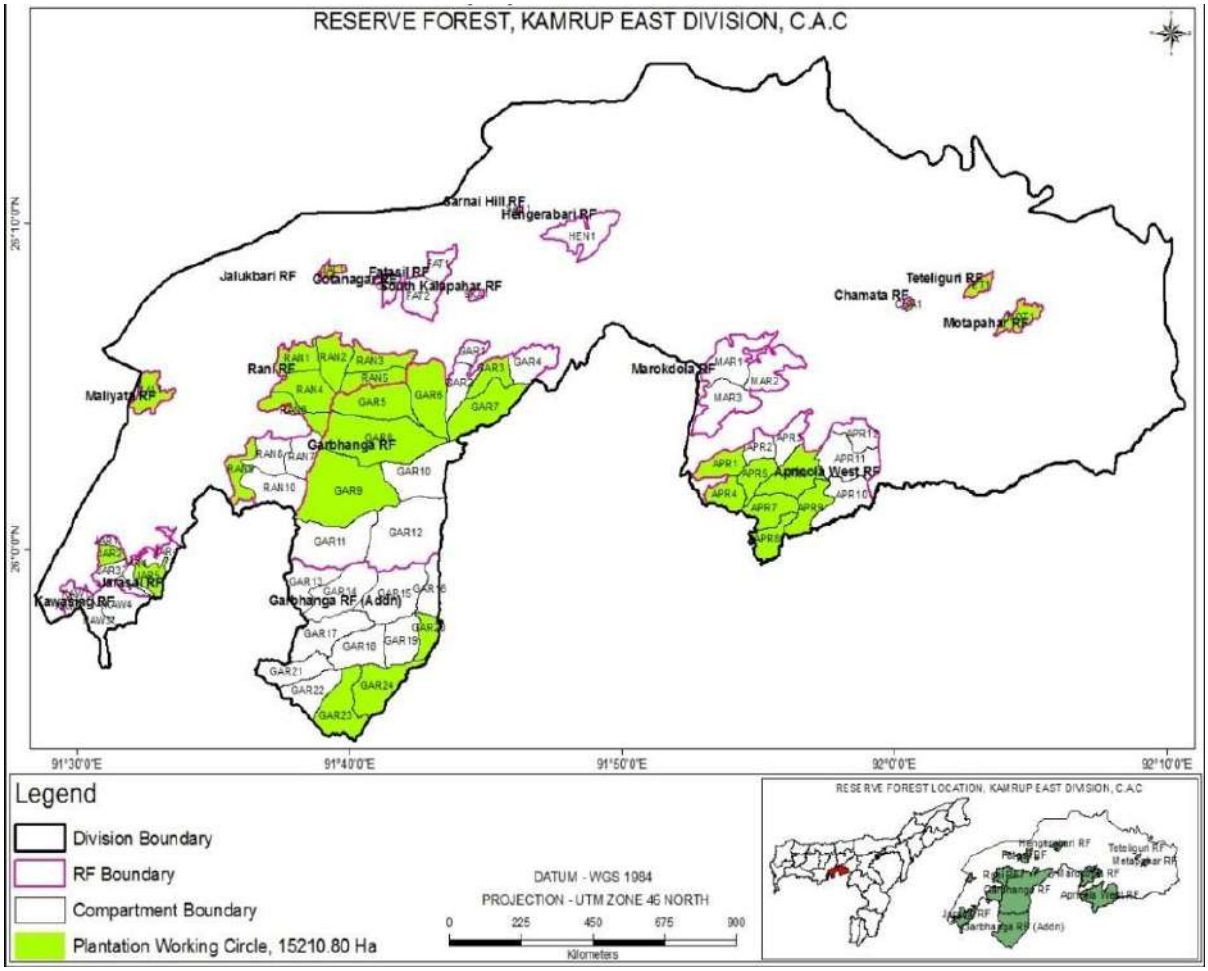
CHAPTER 3

PLANTATION WORKING CIRCLE

3.1 Name of Working Circle: Plantation Working Circle.

Figure3.1: Map showing existing compartment allotted to plantation working circle.



3.2 General Constitutents of the Working Circle: Mostly scrub and open forestareas under moist mixed deciduous forests, and identified areas under Kamrup Sal, Khasi Hill Sal and pioneer *Euphorbiaceae* scrub have been brought under this Working Circle. Selected areas under moderately dense forest and very high denseforest with gaps are also brought under this working circle. It is to rehabilitate andrestock the depleted forest with production forestry for meeting short term needs of fuelwood and fodder and long term needs of timber and as carbon sinks.

All wooded areas outside the Reserve Forest having been anihilated, the local people have startedcutting fire wood, house post for meeting theneeds of the nearby urban areas from the nearby Reserve Forests mostly illegally. The ReserveForest areas underthisworkingcircle is now under tremendous pressure from such seepages. The number of encroachers is also increasing. A number of encroachers usually clear the forest and gradually fell treesand render

woodedareas into blanks. A serious damage to the forests is also caused by erosion due tohill cutting and digging of soil to fill up the sprawling urban constructions, such areasaretransformedintodeath traps through suddenlandslidesduringtherainyseason.

3.3 General characteristics of vegetation: The forest in this division is rich indiversified flora The type 3C/c3 (b) and types 3C/c3 (2SI) is characteristicof the drier slopes and ridges of the hills with conspicuous absence of Sal in patchesand groups. In the R.F.s situated in the eastern part ofthe Division, this type is almost devoid of Sal.

Unabated and rampant illegal felling reduced forest stocks to a great extent. Regeneration of naturalspecies is low. 59% of the forest area examined comes under the mixed moistdeciduous forest. The principal species occupying the top canopy are MakoriSal,Ahoi, Paroli, Bhelu, Sida, Udal, Jamun, Gamari, Amari, Kuhir, Sam, Sopa, Siris,Amara, Poma, Koroi, Thotmala, Dimoru, Hilikha, and Seleng. Evergreen patchesmainly in the hill slopes along banks of perennial streams and in shady moist pocketsalong nalas, mostly situated in locations far away from habitations and not subjected to any kind of biotic interference in the shape of jhumming, grazing, fire etc. Secondary Moist Bamboo Brakes include large tracts of bamboo brakes occurringalong the Moist Mixed Deciduous Forests in the hilly area. They occur in greatprofusionindamplocationespeciallyalongtheperennial streamsandnalas.

3.4 Compartment under Plantation Working Circle: Compartment and the area to becovered in this working circle is provided in Table 3.4.

Table3.4: Proposed area (Ha) under plantation working circle

ReserveForest	Total RFarea (Ha)	Areaallocated	Compt.No.	Compt.area Allocated to WC	Area earmarked for Plantation
ApricolaWestRF	5253.13	3000.9	APR8	368	329
			APR1	374	348
			APR4	340	349
			APR5	334	322
			APR6	670	626
			APR7	468	431
			APR9	447	329
ChamataRF	24.86	24.86	CHA1	25	15
Garbhanga RF	18305.699	7961.03	GAR20	283	277
			GAR23	760	610
			GAR24	740	610
			GAR3	328	320
			GAR5	814	770
			GAR6	849	806
			GAR7	836	776
			GAR8	1543	1465
			GAR9	1809	1542
JarasalRF	1134.752	523.87	JAL1	87	41
			JAR2	153	95
			JAR5	283	250
Maliata RF	342.413	342.41	MAL1	342	321
MotapaharRF	279.187	279.187	MOT1	279	148

RaniRF	4406.62	2952.89	RAN1	394	354
			RAN2	488	437
			RAN3	405	365
			RAN4	594	495
			RAN5	371	318
			RAN6	367	305
			RAN9	333	258
TeteliguriRF	125.552	125.552	TET1	126	119
TOTAL	**29872.21**	**15210.804**		**15211**	**13431**

3.5 Objectives of the Working Circle: The broad objective of this working circle is toimprovethe stocksof the forest of this division through plantation to make fuel-wood, timber carbon blocks and fill the gaps in areas where earlier plantation hasn't survived. Specificobjectivesareto:

i) Raise plantations in open forests areas with native species and increase,
ii) Assist natural regeneration in moderately dense canopy cover areas,
iii) Meet short term fuel wood and fodder need sand long term timber needs,
iv) Generate revenue by developing blocks of carbon sinks,
v) Maintain city forests to maintain flow of ecosystem services, and
vi) Initiate future tree improvement research in the division for raising quality planting material.

3.6 Activities proposed to be undertaken are-

1. Plantation and regeneration works = **13431.00** hectares
2. Maintenance of plantation = **13431.00** hectares x 5 years

3.7 Strategy: Block plantations in the scrubs, AR plantations in the open forests and ANR gap filling of moderately dense and very dense forest areas. In blocks, highdensity fast growing species for fuelwood and furnituresand slow growing species forlongtermtimberandcarbonsequestrationwillbeplanted.

Very fast to moderately fast-growing species recommended are kadam, khokan, poma, gamari, semul, toona, koroi, champa, ajar, lali, etc. and species mainly kamrupsal, khasisal, sam, seleng, jamu, dhuna, bola, outenga, *Terminalia*, etc. willbe raised for meeting the long term needs of timber and for sequestration of carbon. Species like kanchan, nooni, kathal, sam, etcwill be raised for meeting the fodderneeds.

Patches and gaps in the areas under dense forest will be covered through assisted natural regeneration. Plantation of only native specieswill be carried out in the division. A total ecosystem conservation concept will be adopted. Watershed approach will be adopted. Planting will be done from the ridges toards the floodplains. An effective naturalization plan will 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 such as Sopa's, Poma, Ajar, *Terminalia*'s fruits pecies, and etc. Rather than planting exotic species. Further, introduction of exotic species in the area will be strictly restricted and plantation of both, slow and fast-growing native species of herbs, shrubs, and trees shall bepromoted. Involvement of local communities especially youth, women from the forestand fringe villages in plantation and regeneration activities will be encouraged toensure that local

population's participation in maintaining the forest and avoid anyillegal activities which can cause further forest degradation. The efforts therefore willbe to impose restrictions on local populations through participation in purview of legaland 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: The treatment proposed is focused to promote production forests, without any environmental and ecosystem degradation. Mixedspecies will be planted at high density in blocks on the scrub areas. However, scrubswith remnant or standing Sal associates will be converted into high density Salblocks. Similarly, areas under open forest will be covered through gap plantation.Assisted regeneration will be carried out to fill any vacant space in areas undermoderately dense forest and dense forest. Proper silvicultural operations will becarried out and thinning regimes for planted saplings will be adopted. Mature treeswill be kept as mother trees and to facilitate improvement of the micro-climate for thatspeciesforthegrowingsaplings.

3.9 Rotation and conversion period: The growth conditions being almost similar, both species can have the similar rotation (*Table3.9*).Changes in environmental conditions quickly outdate yield tables, so the growth data especially the increment isto be reworked for the division. Annual increment will be recorded during the plan period, analysed and new volume table is to be prepared.

Table 3.9: Preferred rotation of different plantation species in the Kamrup East Division.

Species	Preferred rotation in years		
	Short	Medium	Long
Teak	20	50	80
Outenga	15	20	25
Azar	15	20	25
Bogipoma	15	20	25
Titachopa	15	20	25
Kadam	10	10	12
Simalu	10	15	18
Jiapoma	15	20	25
Terminalia	25	30	40
Lali	20	25	30

The purpose of this working circle is to increase the forest cover under KamrupEastDivision with an aim to increase revenue and also to enhance carbon sequestration. Plantations will only be properly tended and protected until their harvest. During this plan period, plantations are to be selectively thinned after five years and nine years of plantation to the required density. The results are to be assessed in future yearsand fresh look has to be taken regarding rotation age accordingly. During recent past due to blanket ban thinning was not carried out. The value of endemic plants from the perspective of their capability to sequester carbon has been increasingly unabated. Therefore, plantations deserve much attention than what they have received so far.

3.6.4 Regeneration

Natural regeneration is the process by which juvenile plants and coppice that have established naturally replace plants which have died or have been killed. Over time, following a disturbance, the growth of natural regeneration will reestablish canopy trees. Natural regeneration shall be encouraged in places where it is growing naturally without biotic interference.

- For protection and development of natural regeneration of important species (both seed and coppice origin as well as for management of malformed rooted stock/shoots, tending of NR and rooted stock have to be done properly and in proper time. Plantation Register will be maintained on the lines of AR areas.
- All seedlings and saplings of seed origin of valuable species, more than 60 cm in height as well as healthy coppice shoots would be identified in the first year, which will be nursed as future crop. Specing operations, if requird, would be carried out to leave nearly 400 saplings per hectare at an average of 5.00 mt spacing spacing out operation may be in favour of ecologically valuable species and species rarely found in the area.
- Tending of natural regeneration and coppice shoot management, Cut-back operation (CBO) and artificial regeneration may be carried out in the next year of main felling.
- All treatment type areas will be shown distinctively on the map, including the area suitable for planting, areas having adequate promising natural regeneration and rooted stock and areas prone to soil erosion. For this purpose, grid maps (100m x 100m) with GPS reading should be used.
- As per requirement of site, weeding, soil working should be done after inspection by Zonal CCF/ APCCF. Model estimate for tending of NR to be approved by Zonal CCF/ APCCF.
- The areas poor in natural regeneration should be artificially regenerated by Teak, Miscellaneous species and Bamboo as per actual site condition.
- Involvement of JFMCs, giving benefit to JFMCs from cutback, stump dressing etc. should be considered as per Government guidelines.
- The natural regeneration should be assisted and encouraged by soil working and mulching around them, wherever needed.

Tending of Natural Regeneration

- **First year operation i.e, subsequent to main felling year:** Weeds in one meter diameter saplings of valuable species should be cleared during the first week of July/August. Uprooted weeds, grasses and leaf litter should be mixed in the upper layer of soil as the organic mulch and facilitate loosening and aeration of the soil by worms and insects. One soil working should be carried out in October/ November.
- **Second year operation:** The soil working should be repeated in the following year in the month of October in the seedlings of seed origin. However, one scrap weeding of one meter diameter should be carried out in the first week of August/October around the shoots of seedlings of coppice origin within the rootstock management area.
- **Third year operations:** Singling of coppice shoots, management of damaged and malformed saplings, climber cutting and shrub clearance should be repeated as third year operations.

- **Root stock and Coppice management:** In the areas where there is no sufficient seedlings of seed origin (at least 400 healthy and established saplings) are found, the existing root stock should be managed to increase the density and productivity of the crop. Preference should be given to encourage the ecologically valuable species. Tending of root stock (ecologically valuable species) in the B-1 type may be carried out as follows:

● **Singling of Coppice Shoots:** One healthy and promising coppice shoot shall be retained with the stump and the rest are to be removed. However, coppice shoots interfering with promising saplings of seed origin would be removed. Such coppice shoots should also be close enough to the ground so that it would no topple after gaining volume and weight and would be able to develop root system of its own subsequently.

● Coppice management of damaged malformed saplings: The saplings and poles of upto 45 cm gbh having one-third of the stem damaged and malformed should be coppiced by cutting flush to the ground. Such coppicing, however, should not expose the ground causing erosion and leading to soil loss. Poles having at least 2.50 meter of clean bole would not be treated as malformed.

- All such sites selected for tending of natural regeneration and root stock and coppice management should be geo-referenced on digital map of the division by taking GPS reading of at least four corners of the said site, which may be compared later with the satellite imagery of the division for any change of vegetation cover.
- A proper record, in the form of NR Register, should be maintained at Range level as well as division level regarding all activities of Regeneration. Records such as Register, number of seedling identified, cleaned saplings, maps, GPS reading, operations, photographs etc. should be maintained on regular basis.
- All entries should be made in the relevant *Coupe Control Forms and Compartment History Forms.* In case of Artificial Regeneration, proper Plantation registers should be maintained at Range level as well as division levels.
- In case of any deviation from the prescriptions of approved Working Plans, proposal should be submitted and got approved by competent authority in time.

Aided Natural Regeneration

ANR is most applicable in areas with remain-ing trees or patches of natural forest within a wider degraded landscape, as these trees provide propagation material or attract dispersal agents (birds, bats, mammals, etc).

Artificial Regeneration

Artificial regeneration is accomplished by the planting of seedlings (the most common method) or by the direct planting of seeds. Direct seeding is reserved for remote or inaccessible areas where seedling planting is not cost-effective. The most common method is to plant nursery raised saplings in the selected areas. In this division Artificial regeneration shall be undertaken.

Block plantation will be carried out in scrubs, gap filling in open forest area and in moderately dense area natural regeneration or assisted natural regeneration shall be promoted. The regeneration 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 , 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.

Involvement of local communities especially youths, women from the forest and fringe villages shall be ensured in plantation and regeneration activities. 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. For this purposes capacity building programs may be taken up. 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.

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 Kamrup East Division, the provision of thinning is in each compartment of plantation W.C. The thinning is targeted for sapling, pole and young tree within the compartments. Proper method for thinning operation is lacking in the Division. If the nature of stand is uneven aged (old trees to young pole and saplings); the challenge is to apply appropriate method. In Kamrup East Division the size of stem (diameter distribution) is heterogeneous. Thinning shall be undertaken in compartments having uniform girth class or uniform age class. The spacing between the stems depends upon the number 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.

Silvicultural thinning supported by Mechanical thinning by using Laurie's Formula is prescribed in Sal Working Circle.

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. 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 carryout thinning, the field foresters should have 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.

3.10.2 Grades of Ordinary Thinning- In order to prescribe which classes of trees are to be removed in a particular thinning in a crop, it is necessary to differentiate various thinning grades. A thinning grade 'refers to relative extent to which a crop is opened up in thinning. Using the classes of trees to be removed, the following thinning grades are recognized in ordinary thinning:

I. **Light Thinning (A grade)-**This grade of thinning is limited to the removal of dead, dying, diseased and suppressed trees, i.e. classes V, IV, and III. It is of no practical use and is seldom carried out in field, except for comparative research on the effect of thinning on increment.

II. **Moderate Thinning (B grade)-** This grade of thinning is limited to the removal of dead, dying, diseased and suppressed, defective dominated, whip and occasional very defective dominant, i.e. classes V,IV, III, II(b), I(d) and an occasional I(c). Branchy advance growth, which is neither practicable nor desirable to prune or lop, is also removed. This grade is also of little use in ordinary practice as it has very little influence on the growth of the remaining trees.

III. **Heavy Thinning (C grade)** in addition to the removal of all classes of trees of a grade, this grade consists of the removal of remaining dominated and such defective co- dominants as can be removed without making lasting gaps in the canopy, i.e. classes V, IV, III, II, I(b), I(c), and I(d). This is the grade which is ordinarily used for yield table computation. In the gaps created by the removal of the dominant trees some suppressed trees may be left as soil cover if their removal is of no economic or hygienic value.

IV. **Very Heavy Thinning (D grade)-** This grade consists of all tree classes to be removed in C grade as well as some of the good dominants, subject to the condition of not making any permanent gap in the canopy, i.e. classes V, IV, III, II, I, (b), I(c), I(d) and some I(a). The trees selected for retention are the trees with good boles and crowns, well and evenly distributed over the area, with space on all sides for proper development. In this grade also, some suppressed or dominated trees, whose removal is of no economic or hygienic value, are left as soil cover in the gap created by the removal of the dominant trees.

V. **Very Very Heavy Thinning (E grade)-** This is about the heaviest thinning that can be done in a crop without making permanent gaps in the canopy. In this grade more of the good dominants are removed as compared to D grade. Formerly this grade was applied chiefly for research purposes but it is now being used in divisional practice also for some species. Some suppressed and dominated trees are left as soil cover in the gaps of the removed dominant trees.

VI. Some times, it may be necessary to carryout thinning heavier then B, C or D grade but less heavier than C, D or E grade respectively and so intermediate grades are recognized. Viz., B/C, C/D and D/E. The thinning a prescribed in this working circle will be followed with the above standards

3.10.3 Tree Classification: Standard tree classification adopted in India Forestry for regular crop is as follows:

i. Dominant trees (class symbol-I; abb.-D): All trees which form the upper most leaf canopy and have their leading shoots free. These may be subdivided according to the position and relative freedom of their crown into:

a. Predominant Trees (abb.-D1): Comprising of all the tallest trees which

b. Co-dominant Trees (abb.-D2): Comprising of the rest of the dominants falling short of d1 and averaging about 5/6 of the average height of D1.

The dominants are further classified according to their vigour and soundness or otherwise into:

1. Trees with normal crown development and good stem form (Class symbol-**Ia**).
2. Trees with defective stems or crowns (Class symbol –**Ib**), e.g. (i) trees with crown space cramped by neighbouring trees; (ii) badly spaced old advance growth; (iii) trees with forked leader and similar defects.
3. Trees with very defective stems or crown, i.e. with same defects as in Ib to such an extent that they are of little or no present value or promise. (Class symbol-**Ic**).
4. Whips, i.e., trees with very thin bole and very constricted crown, incapable of existence without the support of the neighbouring trees. (Class symbol-**Id**).

ii. Dominated trees (Class symbol-II; abb.-d): Trees which do not form part of the upper most leaf canopy, but the leading shoots of which are not definitely over-topped by the neighboring trees. Their height is about ¾ that of the tallest trees. They are classified as: a. Trees with normal crown development and good stem form (class symbol-**IIa**)

b. Trees with defective crowns or stems (class symbol-**IIb**)

iii. Suppressed trees (Class symbol-III; abb.-S): Trees which reach only about ½ to 5/8 of the height of the best trees, with their leading shoots definitely over topped by their neighbours or at least shaded on all sides by them. A small tree of height typical of the suppressed tree standing with its leader free in a chance gap should not be classed as D or d.

iv. Dead and moribund trees (class symbol-IV; abb.-m): This class also includes bent over badly leaning trees usually of the whip type.

v. Diseased trees (Class symbol-V; abb.-k): Trees which are infected with parasites to such an extent that their growth is seriously affected or they are a danger to their neighbours. Abbreviation k is suggestive of canker. They are of:

a. Dominant (Class symbol-**ka**)

b. Dominated and Suppressed (class symbol-**kb**)

3.10.4 Definition of trees for salvage felling: Definition of dead, dry, dying, diseased and uprooted trees as given in chapter 4 of 'Maleta Committee' report is as under:

i. Dead Tree: A tree which is physiologically non functional is a dead tree.

ii. Dry Tree: A tree in which physiological activity has completely ended and which has dried completely from root to top of the crown.

iii. Diseased Tree: Trees which are infected with parasites to such an extent that their growth is seriously affected or they are a danger to their neighbors.

iv. Uprooted and Fallen Trees: A tree which cannot stand by its root system. It can be green or dry. Part of the tree broken and separated from the stem will also come under the definition of fallen tree.

3.10.5 Marking Rules for thinning:

i. Mark all dead, top dead, wind fallen, diseased, mid broken, top broken and unsound Sal trees.
ii. Mark all mal formed or crocked Sal provided no large gaps are created.
iii. Mark all stems of inferior species interfering with Sal.
iv. In case of any doubt regarding removal or otherwise of a tree, decide in favour of retention.
v. Only Congested patches of poles are to be thinned out. For guidance of thinning in congested patch following 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 andmeasurement especially for identifying stems to be retained with the help of GIS.

vi. The spacing and desirable number of trees per hectare by diameter (BH) are given in table below.However, the number of trees to be retained may be increased considering local conditions, threats etc. as found fit by the DFO.

Table 2.10.5a: The designed method for thinning

Diameter	Spacing	Minimum No of trees to be retained/hect	Considering local conditions May be increased upto
10 cm	3.15 m	1170	+ 90
15 cm	4.00 m	725	+ 80
20 cm	5.00 m	460	+ 70
25 cm	5.86 m	340	+ 60
30 cm	6.81 m	250	+ 50
35 cm	7.66 m	195	+ 40
40 cm	8.64 m	155	+ 30
45 cm	9.46 m	129	+ 20
50 cm	10.36 m	108	+ 10

3.10.6 Thinning schedule: Although there were thinning schedule for this species mentioned in the earlier working plans due to the anthropogenic factors there has been changes in the resources like land, associates, nutrient, soil compaction and also there are changes in

rainfall, temperature. Additionally, there has been a change in the perception on the forest, now there has been a recognized perception that forest sequesters carbon, therefore to accommodate these, it is advisable to rework the thinning schedule during this working plan period especially for the signature species.

3.10.7 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: As there is no harvesting, no annual yield is calculated under this working circle during the plan period. However, dead, dying and wind fallen trees will be only operated on prior approval of the PCCF &HoFF after personal inspection of Circle Conservator and recommendation judiciously as per the silvicultural procedures.

3.11.3 Sequence of regeneration: Allotment of area in different felling series of the Reserved Forests for sequence of annual regeneration is presented in Table3.11.3.

Table 3.11.3: Sequence of regeneration

ReserveForest	Compt.No.	Area allotted	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
ApricolaWestRF	APR8	329.00	33	33	33	33	33	33	32	33	33	33
	APR1	348.00	35	35	35	35	35	34	34	35	35	35
	APR4	349.00	35	35	35	35	35	34	35	35	35	35
	APR5	322.00	33	33	33	33	33	33	33	33	33	25
	APR6	626.00	65	65	65	65	65	65	60	60	58	58
	APR7	431.00	43	43	43	43	43	43	44	43	43	43
	APR9	329.00	33	33	33	33	33	33	32	33	33	33
ChamataRF	CHA1	15.00	15	-	-	-	-	-	-	-	-	-
Garbhanga RF	GAR20	277.00	30	30	30	30	30	30	25	25	25	22
	GAR23	610.00	60	60	60	60	60	60	63	63	62	62
	GAR24	610.00	60	63	63	62	62	60	60	60	60	60
	GAR3	320.00	32	32	32	32	32	32	32	32	32	32
	GAR5	770.00	77	77	77	77	77	77	77	77	77	77
	GAR6	806.00	80	80	80	80	81	81	81	81	81	81

	GAR7	776.00	80	80	80	75	75	73	73	80	80	80
	GAR8	1465.00	145	145	145	145	145	148	148	148	148	148
	GAR9	1542.00	155	155	155	155	155	155	155	152	152	153
JarasalRF	JAL1	41.00	-	20	21	-	-	-	-	-	-	-
	JAR2	95.00	-	-	-	45	50	-	-	-	-	-
	JAR5	250.00	25	25	25	25	25	25	25	25	25	25
Maliata RF	MAL1	321.00	33	32	32	32	32	32	32	32	32	32
MotapaharRF	MOT1	148.00	15	15	15	15	15	15	15	15	14	14
RaniRF	RAN1	354.00	35	35	35	35	35	35	36	36	36	36
	RAN2	437.00	45	45	45	45	45	45	45	40	41	41
	RAN3	365.00	35	35	35	35	42	43	35	35	35	35
	RAN4	495.00	50	50	50	50	50	50	50	50	50	45
	RAN5	318.00	32	32	32	32	32	32	32	32	32	30
	RAN6	305.00	35	30	30	30	30	30	30	30	30	30
	RAN9	258.00	30	30	25	25	25	25	25	25	25	23
TeteliguriRF	TET1	119.00	15	15	15	15	15	15	15	14	-	-
TOTAL		**13431.00**	1361	1363	1359	1377	1390	1338	1324	1324	1307	1288

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. There must be approval from PCCF &HoFF on recommendation of the Circle Conservator.

3.12 Prescriptions: The following prescriptions are recommended for ther Working Circle

a) Identification of good seed bearers and collect information on seed year.
b) Select mother trees, collecting the geo-cordinates and marking those.
c) Before a heavy seedfall, 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.
d) Transplantation of naturally regenerated seedlings which are 45 centimeters to 55 centimeters, and 6 to 8 months old.
e) 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.
f) All areas that are having gaps are to be planted with native tree species.
g) Planting schedule to be followed is presented in Table 3.10.7b.

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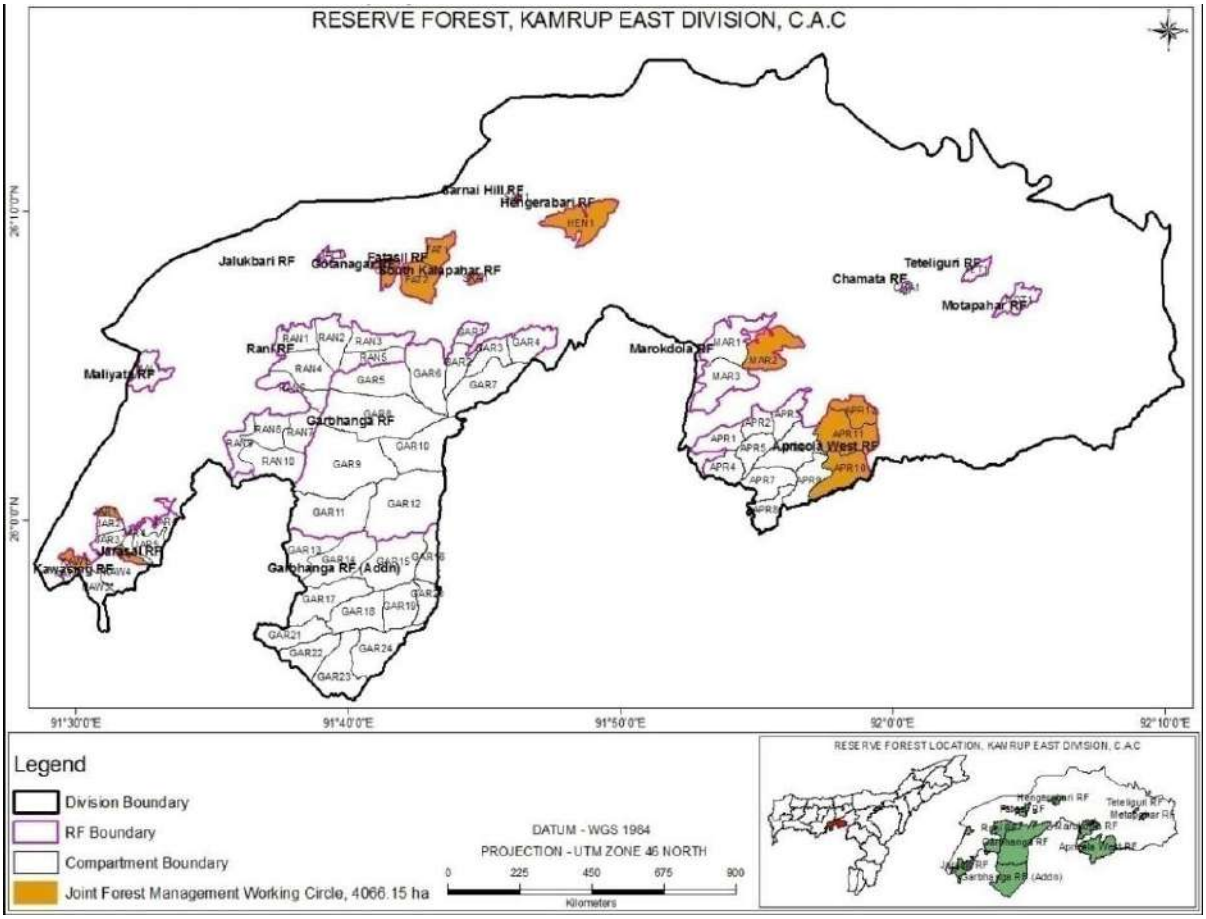
CHAPTER 4

JOINT FOREST MANAGEMENT WORKING CIRCLE

4.1 Name of the Working Circle: Joint Forest Management Working Circle.

Fig 4.1: Map showing allocation of compartments under JFMC Working circle.



4.2 General Constituents of the Working Circle: The compartments of fringe villages, agricultural fields, and anthropogenic disturbances will be covered under this working circle. Selected scrub areas, open forest, moderately dense forest willalso be covered under this working circle. Integration of active participation of thelocal population is necessary for conservation, maintenance and improvement offorest in the Kamrup East Division. The National Forest Policy, 1988 accordingly provided for creating a mass of people who suffer the most as a result of forest degradation. Encroached areas will be evicted and plantation of fast-growing indigenous species will be taken up. It is proposed to initiate eviction of encroachment in the first two years of the current working plan period and will bebrought under JFMC plantation. There are 31 JFMC constituted under Kamrup East Division. (The List of JFMC enclosed inVolume-II).

The NationalForest Policy, 1988 emphasized that domestic requirements of the tribal and other poor people living within and near the forest for fuel wood, fodder, NTFP and construction timber should be the first charge on forest produce and the holders of customary

rights and concession in forest areas should be motivated toidentify themselves with the protection and development of forest from which they derive benefits. In pursuance to the National Forest Policy the Ministry of Environment and Forests decided to ask the State Governments. To adopt the JFMsystem for the protection and rehabilitation of degraded forest. The Govt. Resolution No.SIF-1091/199/F-11, dated March16, 1992. JFM approach was adopted for degraded forest areas of this state and now new guidelines have been issued videG.R.No.MSC/2000/C.NO. 143/F-2, dated 25.4.2003.

Generally, the scarcity of forest products such as fuel wood, fodder etc. as a result ofdegradation of forests on which the local communities depend, forces the people tothink of steps for the protection and improvement of degraded forests.Peopleareusually reluctant to participate in JFM where sufficient forest areas are still availableto meet their requirements, so the identified areas have deteriorated forests. On thepart of Forest Department, the problems in protecting forest without the help of local people made the Forest Department staff realize the need of JFM. The JFM program succeeds where the initiative comes from the people's side and it usuallyfails where it is forced from Forest Department side as a govt. driven and targetoriented program. Villagers themselves are required to voluntarily participate in theprogram. JFMC is to be formed in each village. Each JFMC constitutes a ManagingCommittee consisting of members elected from general body and ex-officio membersrepresenting concern Govt. Department at village level and with local Forester as the member secretary. The managing committee is responsible to implement the decision of general body withregard to the execution ofJFM works in partnershipwith Forest Department Memorandum of Understanding (MOU) is signed between Forest Department and managing committee clearly specifies the duties and responsibilities of both parties. Entitlement of JFMC members to the share in forest produce is subject to the fulfilment of conditions of MOU.

4.3 Objectives of the Working Circle: The broad objective of this working circle is to protect forest and biodiversity alongwith 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.

4.4 Blocks, compartments and JFM area: Compartment and areas of JFMC is given in table 4.4.a

Table 4.4.a. Compartment wise forest area earmarked for JFMC Working Circles

RF	Total RF area (Ha)	Area allocated (Ha)	Compt.	Compartment area allocated to WC	Workable area (Ha)per compartment
FatasilRF	706.7	706.7	FAT1	257	175
			FAT2	449	285
Gotanagar RF	161.05	161.05	GOT1	161	117
Hengrabari RF	631.55	631.5	HEN1	632	419
Jarasal RF	1120.56	63	JAR1	63	41
Khawasing RF	984	221.15	KAW1	115	51
			FV	106	5
SaraniaHill RF	11.13	11.1	SAH1	11	9
SouthKalapahar	45.46	45.4	SKA1	45	17
ApricolaWest RF	5165.60	2223	APR2	568	243
			APR10	606	543
			APR11	722	696
			APR12	327	325
TOTAL	**13233.97**	**4062.15**		**4062**	**2926**

4.5 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.

4.6 JFMCs in Kamrup East Division:

4.6.1 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 can not 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. Details of JFMCs (Name and area projected) are given in table 8.1.a in Chapter-8, Details of empowerment of JFMCs are in Table 8.2.a, Summary of welfare activities are in Table. 8.2.b, details of labour welfare measures taken under forest village development scheme for the year 2007-08 are in Table.8.3.a, allotment of fund for development activities of Kamrup East FDA for the year 2009-10 are in Table.8.3.b,

Table 4.6: JFMCs in Kamrup East Division

Sl No	Name of JFMC	Name of Rani	Area initially allotted Ha	Area allotted in current WP
1	Kotabari JFMC	Guwahati	35	50.00
2	Panjabari JFMC	Guwahati	35	50.00
3	Garbhanga JFMC	South Guwahati	20	200.00
4	Pahamjilla JFMC	South Guwahati	20	250.00
5	Lokhra JFMC	South Guwahati	20	250.00
6	Basistha Mandir JFMC	South Guwahati	20	100.00
7	Indira Nagar JFMC	South Guwahati	20	100.00
8	Garopara JFMC	Rani	20	100.00
9	Suttergaon JFMC	Rani	20	100.00
10	Joypur JFMC	Rani	20	100.00
11	Sessa JFMC	Rani	20	100.00
12	ChallyTanganpara JFMC	Rani	20	100.00
13	Topatoli JFMC	Sonapur	20	126.00
14	Noonmati JFMC	Sonapur	20	100.00
15	Bamfor Koch Yuva JFMC	Sonapur	20	100.00
16	Borkhel JFMC	Sonapur	20	100.00
17	Bongalbari JFMC	Sonapur	20	100.00
18	East Apricola JFMC	Sonapur	20	100.00
19	Bogibori and Harara JFMC	Sonapur	20	100.00
20	Dikshok JFMC	Sonapur	20	100.00
21	North Durung JFMC	Sonapur	20	100.00
22	Bordurung JFMC	Sonapur	20	100.00

23	Kilirbong JFMC	Palashbari	20	100.00
24	Sontola JFMC	Palashbari	20	100.00
25	Pirpara JFMC	Palashbari	20	100.00
26	Gossaihat JFMC	Palashbari	20	100.00
Total				**2926.00**

4.6.2 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.

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

4.6.4 Status of JFM: In KamrupEast Forest division the JFM was started in 2006-07 The details of JFMCs areappended in Volume-II.

4.6.5 Details of villages under JFM in Kamrup East Forest Division: Number of JFM committees in division is 32**.** 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 hardly utilise this area 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 managementRule-1998" shall be followed. At present out of 32 committees constituted in the division, forest area of 2926.00hect is 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.

4.6.6 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 inconsonance with the prescriptions given

for that area under this working plan. Any deviation from the plan requires permission of the competent authority.

4.6.7 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.

4.7 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. DFO, Kamrup East Division shall prepare Microplans for the area to be assigned to concerned JFM Committee as provided in the The Assam Joint (Peoples Participation) Forestry managementRule-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.

4.7.1 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.

4.7.2 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.

4.7.3 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.

4.7.4 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 byJFMC
c) Share in proportion to the period of management in high forests managed byJFMC
d) 50% of net revenues to be reinvested in forestry works - a step towards sustainability of

JFMCs.

4.7.5 Proposed activities under JFMC workingcircle:

1. Raising of grafted fruit plants in forest areas, nearby fringevillages.
2. Raising of fast growing timber yielding species such as Azar, Titasopa, Kadam, Bandordima, Hatipoliya, etc. endemic to thedivision.
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 KamrupEastdivision along the catchment of those *suti's*(river course) flowing from the Khasi and Jaintia hills. DFO should conduct field investigations and initiate watershed development projects. Looking at the sociocultural 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 theirhomesteads.
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).

4.7.6 Additional Prescriptions under JFMC workingcircle:

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 funders 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 at leastquarterly.

iii) NTFPs to be collected and sustainably harvested from forest fringe areas under the JFMC and shall be sold by the concernedJFMC.

iv) Continuous efforts should be made to create and sustain the JFMC movement by creating required awareness among the people and the staff through trainingprogrammes.

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 becultivated.

vi) JFMC areas to practice minimum tillage, organicformulations.

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 increaseproductivity.

ix) Establishment of biogas plant as an entry point activity based on themicroplans.

x) JFMC plantation assistance will be released as per the standard government norms,

funder norms based on the survival of theplants.

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 followedstrictly.

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 landresources.

xiv) JFMC members may be consulted in choosing the species to be planted, keeping due regard to the biodiversity of the area and silviculturalsuitability.

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 thisprocess.

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 otherdepartments.

xvii) Soil and land development works may be undertaken in forest areas. Water harvesting structures may be constructed for soil and water conservation andfisheries.

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 otherareas.

xix) Whereas, demand of planting trees on private land is increasing, the JFMC members may be allowed Social Forestry benefits on their individualland.

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 planningdevices.

xxii) The JFMC members should have a meeting place. A community hall may be constructed for use of the JFMCmembers.

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 ConservationAct.

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 superceded the Working Plan of that area to thatextent.

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 theirjurisdiction.

xxvi) No new human settlement in any part of the Reserve 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) Act1980.

Table 4.7.5.a: Compartment wise plantation target in JFMC Working Circle:

Reserve Forest	Compt.	Area earmarked for plantation (Ha)	Physical target over a period of ten years									
			Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
FatasilRF	FAT1	175.00	18	18	18	18	18	17	17	17	17	17
	FAT2	285.00	30	30	30	30	30	25	25	25	30	30
Gotanagar RF	GOT1	117.00	12	12	12	12	12	12	12	12	11	10
Hengrabari RF	HEN1	419.00	42	42	42	42	42	42	42	42	42	41
Jarasal RF	JAR1	41.00	10	10	10	11	-	-	-	-	-	-
Khawasing RF	KAW1	51.00	-	-	10	10	10	11	10	-	-	-
	FV	5.00	5	-	-	-	-	-	-	-	-	-
SaraniaHill RF	SAH1	9.00	5	4	-	-	-	-	-	-	-	-
SouthKalapahar	SKA1	17.00	5	5	5	2	-	-	-	-	-	-
ApricolaWest RF	APR2	243.00	25	25	25	25	25	25	25	25	22	21
	APR10	543.00	55	55	55	55	55	55	55	55	53	50
	APR11	696.00	70	70	70	70	70	70	69	69	69	69
	APR12	325.00	30	30	30	30	30	35	35	35	35	35
TOTAL		2926.00	307	301	307	305	292	292	290	280	279	273

Annual targets of JFMC (Overlapping) Working Circle for the Plan period:

Prescribed activity	Physical target over a period of ten years									
	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Plantation with nursery and entry point activity: Plantation = 2926hect	307	301	307	305	292	292	290	280	279	273
Maintenance 22750 hect	-	608	915	1220	1512	1804	1787	1766	1738	1706
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.	4	4	4	4	4	4	4	4	4	4
b) 40 awareness programme.	4	4	4	4	4	4	4	4	4	4
Ecotourism development	5	5	5	5	5	5	5	5	5	5

CHAPTER - 5

WILDLIFE MANAGEMENT AND BIODIVERSITY CONSERVATION (OVERLAPPING) WORKING CIRCLE

5.1 Name of the Working Circle: Wildlife Management and Biodiverisity Conservation (overlapping) workingcircle. This Working Circle includes whole of 469.26 sq. km. of Forest land of the division.

5.2 General Constituents of the Working Circle: The National Forest policy 1988 aims at conserving the natural heritage of the country preserving the remaining natural forests with the vast variety of flora and fauna, which represent the remarkable biological diversity and genetic resources of the country. Only 4% out of nation's total geographical area is covered under protected area (PA) network. These PAs are not contiguous to eact other nor having linkage resulting confinement of wildlife in small areas breaking the continuity of genetic mixing. There is a need to maintain the linkage of the PAs. Reserve Forests can play a significant role to give abode to the wildlife. Forest Management should take special care to the needs of wildlife conservation and forest Management Plans should include prescriptions for this purpose. It is essential to provide 'Corridors` linking of the protected areas in order to maintain genetic continuity of wildlife.

This will be an overlapping Working Circle to cover specific areas ecompassing all the Reserve Forests of the division. These areas are favoured by Asiatic Elephants and there are reported cases of man animal conflict, accidental deaths.

5.2.1: Blocks and Compartment allotment Areas: This Working Circle includes whole of 469.26 sq. km. of Forest land of the division.

5.3 Objectives of the Working Circle: The aim under this proposed overlapping working circle is to ensure wildlife habitat conservation and improvement, 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.

5.3.1 Wildlife management Objective: 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 esuring ideal habitat management having abundant food, water and shelter.
(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 and to uplift socio-economic condition of the local people.
(6) To generate scope of employment avenues by promoting eco-tourism. To identify and promote ecotourism spots.
(6) To Formulating strategies for reduction of man animal conflict.
(7) To reduce biotic interference affecting the growth of wildlife and regulate cattle grazing.
(8) Rescue and rehabilitation of injured and stranded wild animal.
(9) Ensuring that no any non forest activity including development of roads, railways are executed inside Reserve Forests and create habitat fragmentation.
(10) To initiate researches on the faunal diversity and theirhabitat.
(11) Generate adequate publicity measures for conservation ofwildlife.

5.3.2 Biodiversity conservation: The specific objectives towards biodiversity conservation within the Working Circle are-

1. To restock the degraded biodiversity of the forests of this division by checking antropogenic activities in the RFs.
2. To ensure that 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, are not disturbed 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.
3. To map herbs, shrubs and climbers, and to make inventories of various NTFPs and Medicinal Aromatic Plants.
4. 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.
5. 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.
6. 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.
7. To take up collaborative projects with local and international Educational Institutes, Academic bodies, Research and other Organizations, agencies.

5.4 General Condition of Flora andFauna:

5.4.1 Flora: The forest landscape is a pristine woodland forests dominated by 'Khasi hill' and Kamrup type of Sal Forest' alongwith other valuable timber forest dominated by species such as *Micheliabaillonii, Gmelma arborea, Lagerstroemia parviflora, Shorearobusta*, besides a rich gene pool of many important wildlife species. However, the detail classification of plant composition and forest patterns were not thoroughly evaluated. The

forest vegetation may be classified as moist mixed deciduous forest. It is composed of large trees that occupy top canopy and it includes *Schimawallichi, Bombax ceiba, Lagerstroemia parviflora, Chukrasietubularis,Albizia lebbek, Stereospermumpersonatum, Albizia procera, Terminalia chebula, Sterculiavillosa, Gmelma arborea* etc. Medium sized trees species that forms middle storey and includes *Bauhinia acuminata, Holarrhaenaantidysenterica, Phyllanthus embetica, Syzygiumcumini, Garcinia peduncalata* etc. In some areas, the middle storey is occupied by bamboos called *Dendrocalamushamiltonii, Bambusa pallida, Bambusabaccoa, Bambusatulda* and other species that occur in great profusion in damp locations especially along perennial streams and nalas. In the lower slopes, *Coffea bengalensis, ClerodendrumserratumPhlogocanthusthrysiformis*etc occurs under loose canopies. Ground cover is predominated by different species such as *Chromolaena odorata, Phyllanthus fratemus, Justicia simplex, Paederiafoetida, Costusspeciosa, Sida cordifolia, Desmodium spp*., different types of grass and sedges such as *Panicum* sp., *Carex* sp., *Cyperus* spp., *Oplismemsburmanii, Eragrostris lamella*. Climbers are frequently found and most commonly species are *Clematis cadmia, Smilax macrophylla, Thunbergiagrandiflora, Argyreia speciosa, Myriopleronexternum, Combretum decandrum, Cissampelospareira, Dioscoreaalata* etc. They together form the canopy and subcanopy layers of the forest respectively. Below the subcanopy was a layer composed of young individuals of canopy and sub canopy trees and small trees. Moreover, different types of ferns such as *Asplenium sp, Blecnumsp, Adiantum phillipensis, Palhinhaeacemua, Pteris sp., LygodiumJlexuosum, Helminostachyszeylanica, Pyrrosiartuda, Drymnaglossumhelerophyllum, Asplenium sp., Dryneriaquercifolia* etc. are also found to occur. In regard to epiphytes, different orchids such as *Bulbophylhimcareyanum, Rhyncostylis sp*. etc., are found to occur in different host plants.

5.4.2 Fauna: During the winter, beels and other wetlands show a variety of habitat, such as, deep open water area (hydrophase), marshy lands, mud flat, emergent vegetation, water hyacinth patches, wet-grassland patches, paddy field area, dry grassland areas, and scattered forest areas, etc. support manifold habitats for migratory waterfowls, residential waterfowls and terrestrial avifauna The scattered forest present within the beel area supports a large variety of lizard species. Moreover, variety of habitats in Reserved Forests supports specific overlapping communities. These communities are linked by feeding relationships forming a very complex energy transformation system and food web. Important wild mammals found in this reserved forest are Hoolock Gibbon (*Bunopithecus hoolock*), Capped Langur (*Trachypithecuspileatus*), Assamese Macaque (*Macaca assamensis*), Rhesus Macaque (*Macaca mulata*), Leopard (*Panthera pardus*), Barking Deer (*Muntiacusmuntjak*), Indian Mangoose (*Herpestesjavanicus*), Wild Boar (*Sus scrofa*) etc.

Thefresh water Dolphins (*Platanista gangetica)*or South Asian River Dolphins (*The IUCN Red List of Threatened Species* 2019) are primarily found in the rivers of Ganga and Brahmaputra in India. It is often called as ‘Sihu’ or ‘Hihu’ in the local dialect. It can mainly be seen in the South Asia namely the Indian Subcontinent Region. These rare Dolphins have survived through the ages in India, Bangladesh, Nepal and Pakistan. Recognized by the Government of India as the National Aquatic Animals, these species are considered to have a whole number of mere 2500 around the world (of which less than 300 remain in the Brahmaputra River). The river Brahmaputra which is on the northern boundary of Kamrup East Division is the prime abode of River Dolphin. While the number of these mammals is

rapidly decreasing elsewhere, the still unpolluted water of the river Brahmaputra remains as the home of the largest number of these Gangetic Dolphins. And most sadly that is also into a threat of a rapid decrease.

There is urgent need to conserve the population of River Dolphin. Working Plan of Kamrup East Division brings River Dolphin conservation initiatives into its ambit. Presently, more than one NGOs in collaboration of certain agencies are working for Dolphin conservation. All necessary support will be provided to such initiatives-

a) To carry out standardised methods for monitoring dolphin status, habitat preferences and population movements in rivers using visual/sonar surveys, mapping of habitat and fish populations and interviewing locals for information.
b) To investigate the significance of different threats responsible for dolphin death, using post-mortems, interviews, and initiating efforts to reduce/prevent the prioritized threats in association with concerned stakeholders.
c) To thoroughly measure the effects of water-borne pollutants on dolphins, the Brahmaputra River ecosystem and riverside communities through water quality monitoring.
d) To strengthen and build local capacity to protect identified dolphin hotspots.

5.4.3 Invasion: In the Reserved Forests, large tracts of natural forest are being converted to open forest due to the anthropogenic activities, there is likelihood of invasion of exotic plants from the surrounding areas. These exotics out-compete die native indigenous species in terms of nutrient, space and different resources. As a result, different exotic species such as *Lantana camara, Chromolaena odorata, Mikenia scandens*, different grasses etc. establish in the open pockets thereby extracting large pool of nutrients, removes native plant species and brings about instability of ecosystem in long run.

5.6 Legal position: The areas under this Working Circle are within Reserve Forests legal status of which is "Reserve Forest" constituted under Assam Forest Regulation 1891. The Kamrup East Division is spread over a geographical area of 1,254 sq. km.with a forest area of 469.26sq. km comprising of 16 Nos. of R.Fs and 3 (tree) PRF. All legal matters are dealt with the following Regulations/ Acts/Rules applicable-

- Assam Forest Regulation 1891 (Amendment) Act'1995
- Wildlife life (Protection) Act'1972
- National Forest Policy, 1988
- Indian Forest Act, 1927
- The Wildlife (Protection) Assam Rules, 1980
- Assam Forest Policy, 2004 under IFA, 1927
- Indian Biodiversity Act, 2002

5.6 Strategies: For wildlife management the key focus is to ensure existence and maintenance of corridors and maintenance of habitat in the division. This is to be ensured through spatial mapping of corridors areas and assisting regeneration of elephant preferred species. A total ecosystem conservation concept will be adopted for conservation of the wildlife habitat in these reserve forests. 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 and women shall be encouraged and will be sensitized in forest and wildlife protection issues. Identification of problems and taking appropriate measures, participatory planning and sharing of responsibility and benefits need to be promoted. It is not to be forgotten that involvement of local population only can check illegal activities from further degradation of flora and fauna.

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.

5.7 Wildlife management prescriptions: Measures for protection in this working circle is elaborated below under proposed wildlife management prescriptions, and proposed biodiversity conservationmeasures.The main issues are conflicts with human, habitat destruction by illegal felling and encroachment, grazing, and livestockdisease.

5.7.1 Control of illegal felling: The forest staff shall keep vigil all the time through patrolling, information sharing through network development with the help of local people. Illegal felling must be stopped for wildlife habitat repairing. Timber smugglers engage local poor people to cut trees and the poor people in return of a little emoluments/wages cut a valuable tree. Government has to come up with major policies to give more benefits in the form of employment or any other incentive to these poor people to restrain them from cutting the trees. There are a number of rural development schemes some of which donot percolate to the bottom line and remain inaccessible from the reach of such poor people. Forest Department may play a pivotal role liaisoning between the development departments and the poor people.

Persons arrested for illegal felling should be booked as per provision of WLPA1972 in addition to AFR1891 for destroying of Wildlife habitat.

All other prescription given in Forest Protection Working Circle are to be followed.

5.7.2 Eviction of Encroachment: Identifying the encroachments, evictions are to be done with a standard procedure of eviction. No new villages or new dwellers should be permitted to come out in future in close proximity of the wildlife habitats.

5.7.3 Control of Grazing: The grazing has no much impact in the Division. However, domestic cattle sometimes stray out to the forests of the division. All domestic cattle need to be immunized from time to time. Initiation in this regard should be taken by facilitating vaccination camps in collaboration of Veterinary Department for cattle of the fringevillagers.

5.7.4 Habitat improvement: Due to anthropogenic pressure, the wild life habitat has been degraded. 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:

5.7.4.1Creation of water holes: Water availability, or the scarcity of it, is one of the major factors that decide the health of wildlife habitat. During water scarce seasons, probability of wildlife increases near water holes or near villages and thereby increases their susceptibility to poaching and conflict. So it is proposed to create water holes, density shall be commensurate with the density of wild animals found in thearea. Special emphasis should be given to improve and maintain the characteristic waterbodies. Water bodies, small and large should be developed and maintained for migratory birds and other bird species.

5.7.4.2 Fruit and fodder plantations: Plantation of elephants favourite fruit plants like *Dilenia*spp.,*Syzygium*spp., *Guajava* spp., *Artocarpus* spp., *Mangifera* spp., *Tamarindus* spp., *Emblica*spp. *Eugenia* spp., etc. in wildlife area; plantation of fodder species like *Musa spp. Bambusa*spp. *Bauhinia* spp., *Andropogon* spp., *Buchananias*pp., *Cassia* spp., *Croton* spp., *Dioscorea*spp., *Eragrostis*spp., *Eugenia* spp., *Ficus* spp., *Lagerstroemia* spp., *Saccharum* spp. Is prescribed.

5.7.4.3 Development of Nesting Sites: 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. Two dead trees per hectare is to be left out for wildlifehabitat.

5.7.5 Managing Man Animal Conflict: In Kamrup East Division conflict of humans are observed with Elephants. Man-elephant conflict has become one of the most challenging problems in modern wildlife management. With continuous loss of habitat qualitatively as well as quantitatively, elephants are forced to extend their range and raid crops to meet their energy requirements. During such forays of elephants into villages or agricultural lands and human forays into forests, confrontation is inevitable.

5.7.5.1 Causes of man-elephant conflict:

Besides the usual causes like habitat destruction, encroachment, increased activities in forest by humans, etc., one more reason is observed to be a cause of increased man-elephant conflict. It is observed that maximum people make country liquor in their homes for commercial purposes. Elephants are also fond of this liquor. When they get the smell of the liquor they tear down a house in search of the liquor

5.7.5.2 Unscientific methods to scare away elephants: This is one of important cause due to which human are killed. It was usually seen that when an elephant herd comes to raid an agricultural field, people try different ways to scare away the elephants. Some fire crackers, while others throw stones or shouts at them from different places. The elephant-herd breaks due to so much noise and in the process some men comes in front of the elephant and gets killed.

5.7.5.3 Control measures

Measures for controlling man-elephant conflict has been divided into two categories, viz. the short-term measures and the long-term measures.

5.7.5.4 Short term measures:

Short-term measures aimed at providing immediate relief to the people such as:

1. Driving away elephants physically.

2. Use of trained elephants (koonkie) to chase away wild elephants.
3. Use of barriers (Elephant – proof trench and watch towers).

5.7.5.5 Long term measures: Long term measures aim at removing the factors responsible for the elephant depredation and at creating ideal living conditions for elephants within the forests, viz, habitat development works, eco-development works, establish elephant corridors, promote conservation education and public awareness.
Following measures were recommended: -

Vegetative Barrier: In this type of barrier, thorny plants or other plants which acts as repellent to elephants such as lemon trees, red chilly and citronella grass can be sown around the boundary of the protected area. Elephants, to some extent, avoid the way where this type of vegetation is grown.

Trenches: Trenches may be dug in around the boundaries of the area to be protected from elephant depredation. (Trench specification-Top width = 2.50 mt; Bottom width = 1.50 mt; Depth = 2.50 mt.). The dugout earth is to be used as mound towards the inner-side of the protected area.

Power fencing: Battery operated Power fencing are used to prevent elephant movement into human habitation. But there is a negative side of this, which is experienced from other Division. After the battery and energiger got defected, some hostile and unscrupulous person connected direct 230-250 V power to the fencing wires which caused casualty of number of elephants in several instances. This is why the Power fencing should be avoided except in very important premises.

4. Reforestation: The habitat of the elephants should be restored. This can be achieved by plantation of natural fodder species and bamboos in the forest. If sufficient amount of fodder, bamboos and other plant species are available in the forest, elephants will seldom come down to raid crops.

5. Change of Crop Pattern: People in area are mainly dependent on the paddy, which the elephants are also accustomed to. A change in the pattern of cultivation of the crop may be tried viz. the vacant area between the forest and the agricultural land, which are full of edible grass, are to be removed and planted with red chilly, lemon trees, citronella grass or other plants with thorns and spikes.

5.7.5.6 Other Measures:

Anti Depredation Squads: Anti Depredation Squads may be formed during the month of September every year. Frequent meeting may be held with the Anti Depredation Squads. Minutes of meetings may be recorded.

a. Annual ADS meeting should be convened at DFO Office as annual feature without fail.
b. The meeting of District Level Task Force for Wild Elephant Antidepredation Committee notified by Government shall be convened before onset of elephant depredation season.
c. ADS register should be maintained at Range and Division level as well.

d. Forest Staff on Antidepredation duty shall carry an Elephant Duty Register with them whenever they visit villages for such duty. Village headmen or any villager or ADS member may sign such Elephant Duty Register. Such Elephant Duty Register is record of forest staff discharging duty in Revenue areas. Such Register may be diligently maintained and issued by Concerned Range Officer.

e. ADS meetings shall be recorded in register. All phone numbers of ADS members may be circulated among DFO, ACF, RO and BO. The phone nos of DFO, ACF and RO should be compulsorily shared with ADS members.
f. The RO/BO and ADS members shall be close connection with local Police Station/ OP, Veterinary Doctor and Revenue Official of the Rank of Circle Officer.
g. Similar meeting should be convened at DC Office Kamrup.
h. Crackers and Torch Lights shall be procured in advance, in credit if necessary before the onset of Elephant depredation season. Such Crackers and Torch lights may be distributed liberally among the ADS members and Staff.
i. Two(2) Kunki Elephant may be hired for mitigating man animal conflict.

5.7.5.7 Citizen Engagement for Awareness in Dealing Man Animal Conlfict:

The spectrum of citizen engagement includes Inform, Consult, Involve, Collaborate, and Empower. The potential benefits of citizen engagement are making legitimate decisions, making Better Policy, overcoming polarization, reducing conflict, looking for common ground, building competent, responsible citizens and including minorities.

AID in Citizen Engagement Plan:

- To develop some good audio-visual Modules on Wildlife and Man Animal Conflict for interaction with community.
- To develop some Documentaries on good practices/examples to be shown to the community.
- To develop some One-Act Plays or short Plays on critical issues and make arrangements for performances with the help of Civil Society Groups or Schools.
- To engage school/college students to take out processions to convey important messages on important Wildlife Week, Forestry Day, International Elephant Day , etc.
- Make use of Van Mahotsava and Wildlife Week Celebrations or cultural occasions to convey messages.
- Organise Household visits through volunteers/school college students/civil society groups to create awareness.
- Make arrangements for sending bulk messages on critical issues.
- Create a Website or Interactive Portal to transfer knowledge and get feedback from the community.
- Institutionalise a system of analysis of the feedback from the community and factoring it in the departmental plans.

5.7.5.8 General care to be taken:

1) Vaccination of cattle near the fringe villages needs to done regularly and awareness camp & animal health camps need to be conducted with the help of Veterinary doctors regularly.

1) JFMCs need to be activated & awareness to be given on protection to wildlife.
2) Provision of funds to public for construction of solar electric fencing around their agricultural fields will help to reduce the human-animal conflict.
3) For timely release of remuneration for human injury, crop damage & ex-gratia payments to victims of animal depredation, the Range Officers are required to inspect, verify the casualty areas &conduct spot enquiry & submit reports to the higher authority for quick release of the claims, which will reduce the vengeance killing of animals by the affected villagers.
4) Construction of watch towers & posting of staff on 24 hours duty during most vulnerable periods.
5) Care should be taken to prevent livestock grazing, fodder extraction, timber extraction, NTFP collection & establishment of new roads (or) pathways, encroachments/dwelling huts/ new clearing of lands for cultivation which may lead to shrinkage habitat.
6) A detailed elephant track/movement map covering the entire elephant movement area within the Kamrup East Division & specifically covering the conflict boundary areas where elephant proof trenches/solar electric fencing is required to control the elephant from moving rampantly into the human habitational areas.

5.8: Biodiversity Conservation:

"Biodiversity is the variation among living organisms from different sources including terrestrial, marine and desert ecosystems, and the ecological complexes of which they are a part." Biodiversity describes the richness and variety of life on earth. It is the most complex and important feature of our planet. Without biodiversity, life would not sustain. The term biodiversity was coined in 1985. It is important in natural as well as artificial ecosystems. It deals with nature's variety, the biosphere. It refers to variabilities among plants, animals and microorganism species. Biodiversity includes the number of different organisms and their relative frequencies in an ecosystem. It also reflects the organization of organisms at different levels.

Biodiversity holds ecological and economic significance. It provides us with nourishment, housing, fuel, clothing and several other resources. It also extracts monetary benefits through tourism. Therefore, it is very important to have a good knowledge of biodiversity for a sustainable livelihood. There are the following three different types of biodiversity:

- Genetic Biodiversity
- Species Biodiversity
- Ecological Biodiversity

5.8.1: Species diversity: Species diversity refers to the variety of different types of species found in a particular area. It is the biodiversity at the most basic level. It includes all the species ranging from plants to different microorganisms. No two individuals of the same species are exactly similar. For example, humans show a lot of diversity among themselves.

5.8.2: Genetic diversity: It refers to the variations among the genetic resources of the organisms. Every individual of a particular species differs from each other in their genetic constitution. That is why every human looks different from each other. Similarly, there are different varieties in the same species of rice, wheat, maize, barley, etc.

5.8.3: Ecological diversity: An ecosystem is a collection of living and non-living organisms and their interaction with each other. Ecological biodiversity refers to the variations in the plant and animal species living together and connected by food chains and food webs. It is the diversity observed among the different ecosystems in a region. Diversity in different ecosystems like deserts, rainforests, mangroves, etc., include ecological diversity.

5.8.4: Importance of Biodiversity: Biodiversity and its maintenance are very important for sustaining life on earth. A few of the reasons explaining the importance of biodiversity are:

5.8.5: Ecological Stability: Every species has a specific role in an ecosystem. They capture and store energy and also produce and decompose organic matter. The ecosystem supports the services without which humans cannot survive. A diverse ecosystem is more productive and can withstand environmental stress.

5.8.6: Economic Importance: Biodiversity is a reservoir of resources for the manufacture of food, cosmetic products and pharmaceuticals. Crops livestock, fishery, and forests are a rich source of food. Wild plants such as Cinchona and Foxglove plant are used for medicinal purposes. Wood, fibres, perfumes, lubricants, rubber, resins, poison and cork are all derived from different plant species. The national parks and sanctuaries are a source of tourism. They are a source of beauty and joy for many people. Biodiversity provides people with basic ecosystem goods and services. it provides goods such as food, fibre and medicine, and services such as air and water purification, climate regulation, erosion control and nutrient cycling. Biodiversity also plays an important role in economic sectors that drive development, including agriculture, forestry, fisheries and tourism. More than three billion people rely on marine and coastal biodiversity, and 1.6 billion people rely on forests and non-timber forest products (e.g. the fruits from trees) for their livelihoods. Many people depend directly on the availability of usable land, water, plants and animals to support their families. In fact, ecosystems are the base of all economies.

5.8.7: Ethical Importance: All the species have a right to exist. Humans should not cause their voluntary extinction. Biodiversity preserves different cultures and spiritual heritage. Therefore, it is very important to conserve biodiversity.

5.8.8: Different methods of conserving biodiversity:

Biodiversity can be conserved in the following ways:

- In-situ conservation: This method helps in the conservation of biodiversity within the natural habitat of the animals and plants by creating protected areas such as national parks and wildlife sanctuaries.
- Ex-situ conservation: This method refers to the conservation of biodiversity in the areas outside their natural habitat such as zoos and botanical gardens.

The 2010 WWF living Planet Report estimates that we'll need the equivalent of two planets by 2030 to support human populations if we continue with our current consumption patterns!

5.8.9: Sustainable Development: Sustainable human development is about living on earth without taking more than can be naturally replaced. it is about good health, good living

conditions and long-term wealth creation for everybody. all these things must occur within the carrying capacity of the planet. to understand sustainable development, think about its three pillars: "economic wealth", "social equity" and "environmental health"; or in other words "profit", "people" and "planet". all three are linked to each other. in other words, any development has to be not only economically sound but also beneficial to social equity and environmental health. see the box: "defining sustainable development" to read the various definitions of sustainable development.

There are many ways to define sustainable development. "Improving the quality of human life while living within the carrying capacity of supporting ecosystems." The World conservation union (IUCN), united nations environment Programme (UNEP) and World Wide fund for nature/World Wildlife fund (WWF).

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs." united nations in "our common future, the Brundtland report"

"Taking from the Earth only what it can provide indefinitely, thus leaving future generations no less than we have access to ourselves." friends of the earth Scotland

"Sustainable development involves the simultaneous pursuit of economic prosperity, environmental quality and social equity. Companies aiming for sustainability need to perform not against a single, financial bottom line but against the triple bottom line." World Business council on sustainable development

5.8.10: Strategies for biodiversity conservation:

- Biodiversity use and conservation education.
- Integrated health care.
- Agroforestry.
- Afforestation.
- Cottage industry.
- Community's involvement in Biodiversity Conservation.
- Traditional agro-ecosystems and biodiversity conservation.

1. **Biodiversity use and conservation education:**

- People should be aware about the direct and indirect benefits from the forest and their change in attitude is needed.
- Initiation of educational programs that comprises teaching of conservation topics and its extension to adult literacy and schools will bring beneficial change in people's attitude.

2. **Integrated health care:**

- Documentation of traditionally used plants, and selection of plants that are safe, effective and easily available or cultivated is to be done which plants may be integrated into modern health care system.

- Fansworth under a joint UNICEF/WHO study investigation for health needs of developing world concluded that the combination of traditional with modern system health care is truly effective and affordable for low income groups.

3. Agroforestry:

- It combines growing trees along with agriculture or livestock or both on the same piece of land side by side.
- International Center for Research in Agroforestry (ICRAF) defines agroforestry as collective name for land-use systems and practices where woody perennials are deliberately integrated with other crops or animals on the same land management unit.

- Agroforestry shall be usually practiced with the intention of developing a more sustainable form of land use that can improve farm productivity and welfare of the rural community. In current view, agroforestry provides ways to eliminate deforestation and land depletion and thus reduce poverty. The increasing integration of trees and crops into land-use system can be viewed as a passage towards forming an ecological niche that are occupied by several organisms, making the system ecologically stable, and biologically diverse.
- Emphasis on cultivation of indigenous and multipurpose forest trees with medicinal herbs shall be given for the development of agroforestry.

4. Afforestation:

- Multipurpose tree including legumes are marvelous, multipurpose resources that can protect and stabilize the soil, save water, symbiotically fix atmospheric nitrogen, produce valuable wood and fodder, and certain proteins and lipids for diet.
- In the most degraded areas where trees are difficult to grow, attention should be given to the shrubs which are highly palatable to cattle.

5. Cottage industry:

- Plants resources such as bamboos, fiber plants, rattans, leave which are used to develop cottage industries. Some of the important forest resources used for cottage industries are Bamboos (*Dendrocalamusstrictus, D. hamiltonii)*,Lokhta*(Daphne papyracea and D. bholua),* Munj grass (*Saccharum bengalense),* Sabai grass (*Eulaliopsisbinata).*
- Trainings should be organized in order to improve traditional skills of the villagers involved in the occupation.
- High market values provide incentives to exploit the resources and often indiscriminately that their population have depleted drastically in wild. Thus, market for these goods must be developed carefully to ensure that the harvest rate does not exceed the regeneration rate.

6. Communities involvement in Biodiversity Conservation:

- Collection of fuel-wood for household cooking and fodder for animals undertaking mostly by women and children should be allowed with regulation.
- Promotion of the community-based resource management systems of indigenous people will help in accomplishing the conservation of indigenous knowledge for biodiversity conservation.

7. Traditional agro-ecosystem and biodiversity conservation:

- Recent patterns of agricultural development are depleting soils, genetic diversity, species diversity both in managed fields and surrounding habitats. Further, due to introduction of imported seed of crops, fertilizers and pesticides, traditional agro-ecosystems are under threat. A decline in the crop yield has been gradually noticed in lack of sufficient chemicals which the country imports. To maintain the diversity and productivity of traditional genetic resources of agriculture, the government should promote and encourage the farmers to maintain traditional agro-ecosytems.

- Highly diverse plant species shall be maintained in the village area.

8. Keystone species and conservation:

An important category of plants that tend to be overlooked in consideration of genetic conservation are ‘keystone’ or ‘indicator’ or ‘target’ species. These are species whose presence is important in maintaining the organization and diversity of an area and whose absence would significantly decline biodiversity of an area. Selection of indicator species to monitor the ecological viability of the region need to be identified, as their removal could either rise or reduce species diversity and affect optimum ecological balance in a region.

5.9 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 foresthas 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.

Table: 5.9a: Year-wise activities to be undertaken in Wildlife Management and Biodiverisity Conservation overlapping workingcircle

Activities	**Y1**	**Y2**	**Y3**	**Y4**	**Y5**	**Y6**	**Y7**	**Y8**	**Y9**	**Y10**
Habitat enrichment: Regeneration of various fruit, fodder species = 1218.00hect.	125	125	125	125	125	125	125	125	118	100
Maintenance of Water hole= 10 nos	10	10	10	10	10	10	10	10	10	10
Formation of Anti depredation Squad and equip with logistics	5	5	5	5	5	5	5	5	5	5
Purchase of vehicle	-	5	5	5	-	-	-	-	-	-
Engagement of Kunki Elephant	2	2	2	2	2	2	2	2	2	2
Construction of watch tower	-	2	3	5	-	-	-	-	-	-
Digging of Elephant proof trenches (KM)	-	10	10	10	10	10	-	-	-	-
Erection of elephant (battery/solar) fence(KM)	-	10	10	10	10	10	-	-	-	-
Awareness campaign	8	8	8	8	8	8	8	8	8	8

Table 5.4.7.2: Area earmarked for fruit and fodder plantation:

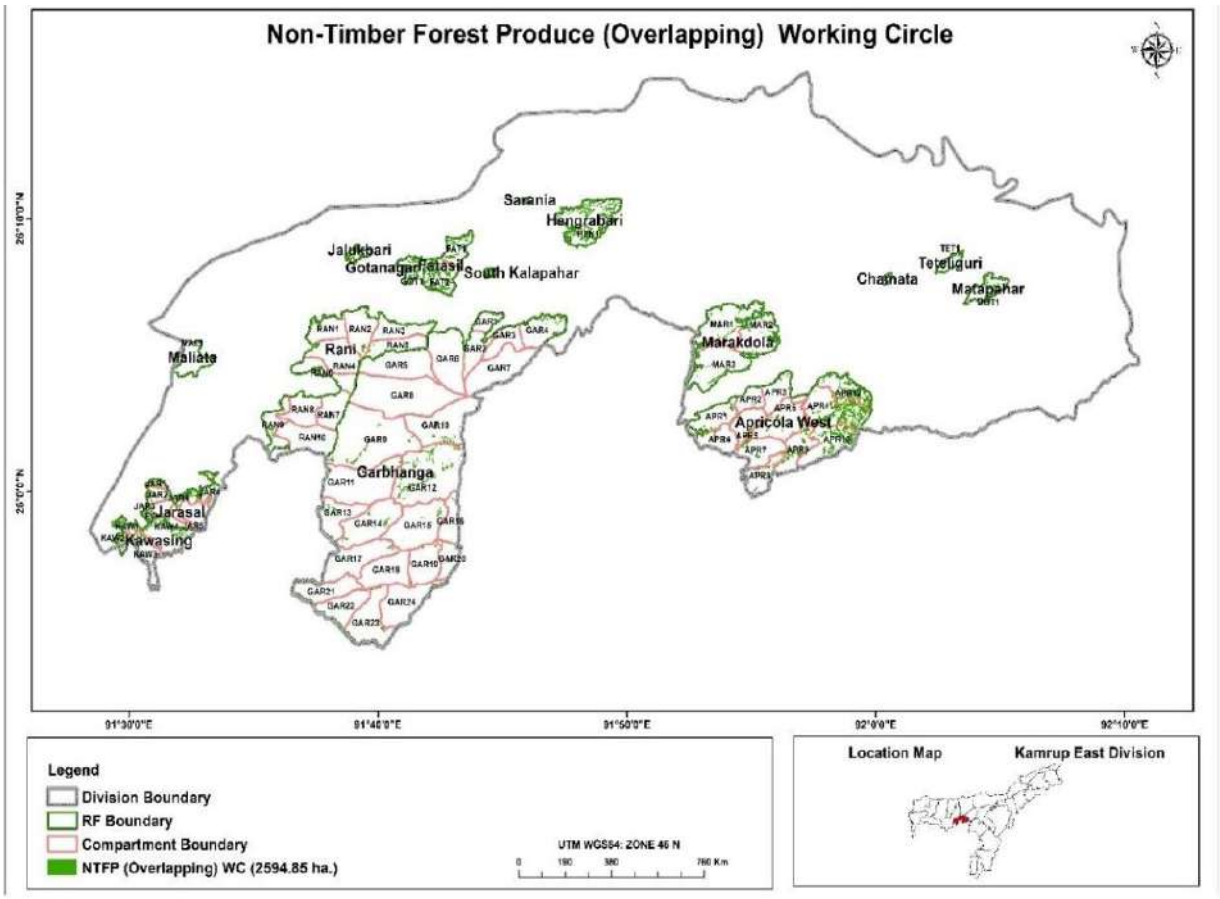
ReserveForest	Total RF area (Ha)	RFarea Allocated (Ha)	Compt.	Workable area underWC(Ha)
FatasilRF	706.79	706.79	FAT1	25.00
			FAT2	23.00
Garbhanga RF	18305.7		GAR22	46.00
			GAR23	39.00
			GAR24	40.00
			GAR21	30.00
			GAR18	20.00
			GAR19	10.00
			GAR20	10.00
			GAR17	50.00
			GAR15	30.00
			GAR14	30.00
			GAR16	30.00
			GAR11	50.00
			GAR12	50.00
			GAR9	50.00
			GAR10	20.00
			GAR8	50.00
			GAR5	20.00
			GAR7	50.00
			GAR2	50.00
			GAR6	20.00
			GAR3	20.00
			GAR4	50.00
			GAR1	50.00
			GAR13	50.00
JalukbariRF	88.61	88.61	JAL1	30.00
RaniRF	4406.62	4406.62	RAN9	40.00
			RAN8	10.00
			RAN10	10.00
			RAN1	10.00
			RAN4	20.00
			RAN5	20.00
			RAN3	25.00
			RAN2	20.00
			RAN6	50.00
			RAN7	50.00
South Kalapahar	45.96	45.46	SKA1	20.00
Total				**1218.00**

CHAPTER - 6

NON-TIMBER FOREST PRODUCES AND BAMBOO (Overlapping) WORKING CIRCLE

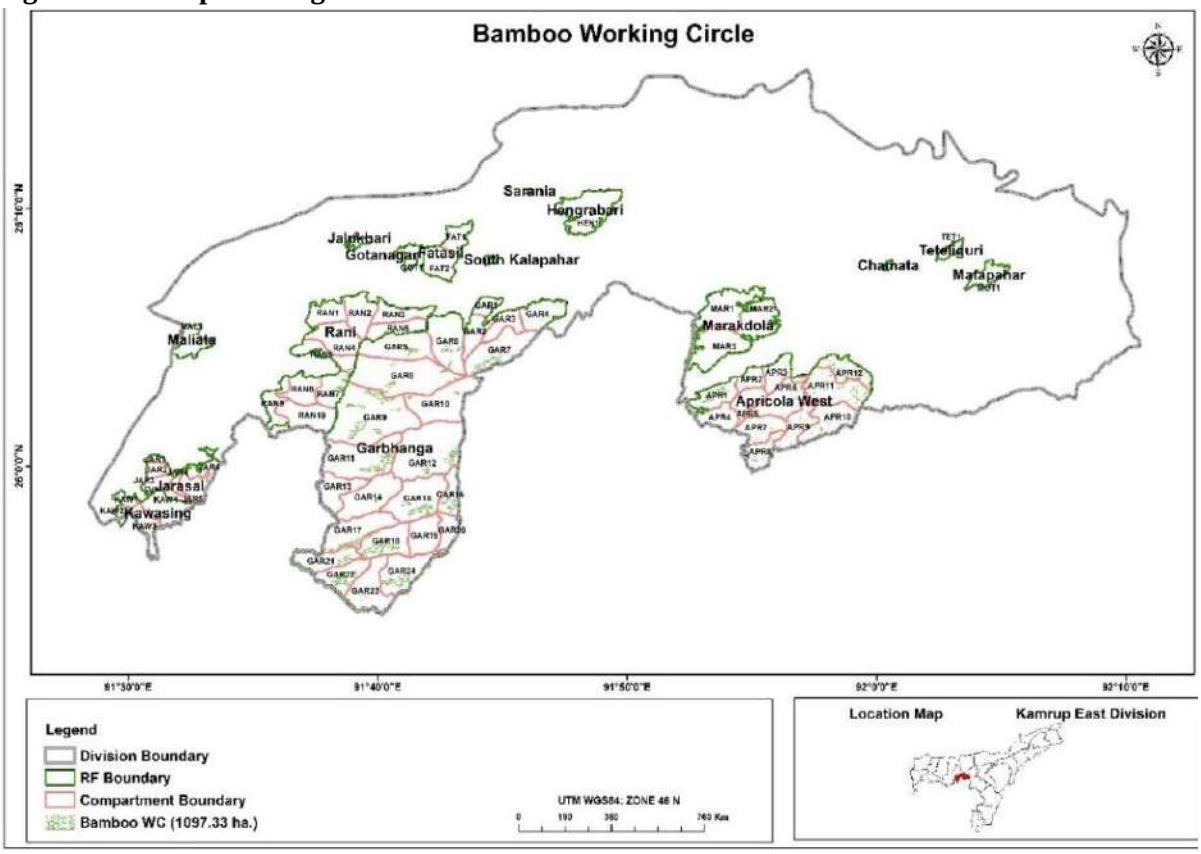
6.1 Name of the Working Circle: Non-Timber Forest Produce and Bamboo (overlapping) Working Circle. There are two components of the Working Circle- Non Timber Forest Produce and Bamboo.

Figure6.1a: Map showing NTFP W.C.



6.2 General Constitutents of the Working Circle: The NTFP and bamboo working circle shall comprise largely of fringe forest areas or such other areas, which are fit for extractionof a particular NTFP at a prescribed rate, that does not lead to a long-term decline of the biological diversity so as to maintain its potential to meet the needs and aspirations of present and future generations. It will be overlapping. Closure of anarea for the collection / extraction of particular NTFP for a specified period (closedarea); restricting or banning the collection or extraction of any forest produceforcertain 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 onJFMC areas, fringe forest areas, community forest areas with the help of community after imparting proper training to them regarding time of harvesting, grading andstorage for sustainable management and value addition etc. The bamboo working circle shall comprise of areas under moist bamboo brakes.

Figure 6.1b: Map showing Bamboo W.C



6.3 Special objectives of Management:

(i) Economic objective: To enhance the productivity of Non timber forest produces with a view to cater the need of rural people of fringe villages and schedule tribes living inside reserve forests. Culture of the NTFPs by the forest department engaging such people will help them economically.

(ii) Social objective: To engage village communities in culture and development of NTFPs will ensure employment to them uplifting socio-economic condition of such people.

(iii) Biodiversity & Ecological objective: Culture and development of NTFPs will create forest of heterogeneous nature with diversed species to maintain Forest Eco-system. The increased growth of biomass will help in carbon sequestration.

6.3.1 Other objectives of NTFP Working Circle are-

i) Sustained use of forests through sustainable collection, harvesting of NTFP adopting sound silviculturalprinciples.

ii) To involve the local communities living in and around the forest areas, in the management ofresources.

iii) 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.

iv) To increase the extent of minor forest produce plantations.

v) To increase the yield of NTFPs by encouraging regeneration and supplementing with artificial regeneration by intensivecultivation.

vi) 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

researchorganisations.

vii) Initiate research on medicinalplants.

viii) To promote Bamboo Plantation in the natural bamboo areas for meeting domestic need of local people and fodder for Elephant population

ix) To promote afforestation of open and degraded patches of forests.

6.4 General characteristics of vegetation: The forest in this division is rich indiversified flora The type 3C/c3 (b) and types 3C/c3 (2SI) is characteristicof the drier slopes and ridges of the hills with conspicuous absence of Sal in patchesand groups. In the R.F.s situated in the eastern part ofthe Division, this type is almost devoid of Sal.

In the past, these forests were exploited tomeet the timber demand. It led to decrease in forest stocks. Regeneration of naturalspecies is low. 59% of the forest area examined comes under the mixed moistdeciduous forest. The principal species occupying the top canopy are MakoriSal,Ahoi, Paroli, Bhelu, Sida, Udal, Jamun, Gamari, Amari, Kuhir, Sam, Sopa, Siris,Amara, Poma, Koroi, Thotmala, Dimoru, Hilikha, and Seleng. Evergreen patchesmainly in the hill slopes along banks of perennial streams and in shady moist pocketsalong nalas, mostly situated in locations far away from habitations and not subjected to any kind of biotic interference in the shape of jhumming, grazing, fireetc. Secondary Moist Bamboo Brakes include large tracts of bamboo brakes occurringalong the Moist Mixed Deciduous Forests in the hilly area. They occur in great profusion in damp location especially along the perennial streams and nalas.

6.5 Blocks and Compartment Allotment of Areas:A total of 1470 hect. is allocated to non timber forest prdouce working circle out of which 756.00 hect is allotted to NTFP plantation and 714.00 hect is allotted for bamboo WC.

Table 6.5 Area (Ha) details under the working circleRF

RF	Compt.	Area for NTFP	Area for Bamboo		RF	Compt.	Area for NTFP	Area for Bamboo
ApricolaWest	APR1		25.00		Garbhanga	GAR5		21.00
	APR2		5.00			GAR6		9.00
	APR3		19.00			GAR9		14.00
	APR4		12.00			APR8		5.00
	APR5		15.00		ApricolaWest	APR9		7.00
	APR6		33.00			APR10		8.00
	APR7		39.00			APR11		19.00
	APR8		22.00			APR12		25.00
	APR9		78.00			APR1		33.00
	APR10		20.00			APR3		2.00
	APR11		26.00			APR6		6.00
	APR12		64.00			APR7		2.00
Chamata	CHA1	10.00				GOT1	20.00	
Fatasil	FAT1	9.00			Gotanagar	HEN1	26.00	
	FAT2	16.00			Hengrabari	JAL1	7.00	
Garbhanga	GAR1	12.00			Jalukbari	FV	16.00	
	GAR10	29.00			Jarasal	JAR1	30.00	
	GAR11	13.00				JAR2	37.00	
	GAR12	13.00				JAR3	30.00	

	GAR13	17.00			JAR4	25.00	
	GAR14	20.00			JAR5	7.00	
	GAR15	11.00			KAW1	8.00	
	GAR16	5.00		Kawasing	KAW2	30.00	
	GAR17	5.00			KAW3	35.00	
	GAR18	2.00			KAW4	8.00	
	GAR19	8.00			MAL1	15.00	
	GAR2	2.00		Maliata	MAR1	6.00	
	GAR20	6.00		Marakdola	MAR2	8.00	
	GAR22	2.00			MAR3	38.00	
	GAR23	12.00			MOT1	7.00	
	GAR4	30.00		Matapahar	SAH1	1.00	
	GAR5	11.00		Sarania	SKA1	20.00	
	GAR10		17.00	SouthKalapahar	TET1	7.00	
	GAR11		10.00	Teteliguri	RAN1	21.00	
	GAR12		6.00	Rani	RAN2	15.00	
	GAR14		7.00		RAN3	16.00	
	GAR15		6.00		RAN4	7.00	
	GAR16		3.00		RAN5	9.00	
	GAR17		5.00		RAN6	3.00	
	GAR18		18.00		RAN9	20.00	
	GAR6		3.00		RAN6	18.00	
	GAR22		64.0		RAN7	33.00	
	GAR23		2.00		**SubTotal**	**756.00**	**714.00**
	GAR24		64.00		**Total**		**1470.00**

6.6 Non Timber Forest Produce found in the Division: List of NTFPs found in the division is given in table 6.6.a.

Table 6.6.a: Naturally occurringNTFPs

Botanical Name	Local Name	Medicinal Use
Agerartumconyzoide	Gendhela bon	Bruised leaves are applied to cuts and wounds as antiseptic.
Alangiumchinese	Sika morolia	Leaf, stem bark Decoction of leaves &stem bark is said to cure malaria
Alocasia indica (Roxb.)	Man kachu	Rhizome is given in abdominal pain.
Alocasia macrorriza	Borkochu	Boiled tender leaf is said to prevent tonsillitis.
Alpinia nigra	Tora	Rhizome paste is used in bronchitis.
Alstoniascholaris	Chatiana	Latex is applied on scabies and some skin diseases. Decoction of stem bark is given in chronic diarrhoea, dysentery and malaria fever
Alternanthera sessilis	Mati – kanduri	Shoot Boiled and given in dysentery.
Amaranthus spinosus	Hati-khutura	Root juice is given in diarrhoea.
Amaranthus tricolor	Bishalyakarani	Leaf paste is applied to cuts for quick healing.
Amorphophaluspaeoniifolius	Ol-kochu	Tender shoots are used as vegetables, which Boiled corm is used in the

		treatment of piles
Baccaurearamiflora	Leteku	Decoction of bark is useful in constipation. Powdered dry bark is applied on infected umbilicus of newly born baby.
Bixa orellana / Mallotusphillipinansis	Jorotgoch	Juice of the bark is prescribed for dysentery and kidney trouble.
Cassia alata	Khorpat	Applied on scabies and ringworm.
Cassia occidentalis	Medeluwa	Leaf decoction is applied on ringworm
Zingiberaceae	Bortora	Rhizome paste is used as remedy for sore.
Chromolina odorata	Bagh dhoka	Leaf paste is applied as antiseptic to cuts and wounds.
Cissus quadriangularis	Harjura lota	Stem paste is applied on wounds and bone fracture for quick healing.
Clerodendron colebrookianum	Nephaphu	Decoction of tender leaf is given to cure hypertension
Clerodendronviscosum	Dhopattita	Leaves are said to cure malaria.
Cordia dichotoma	Bowal	Paste of bark and leaf is applied to swelling and inflammation. Powdered dry seeds are applied on skin eruptions
Costusspeciosus	Jam lakhuti	Rhizome paste is given in jaundice
Curcuma aromatica	Bon-halodhi, keturi,	Rhizome paste is applied to sprains.
Cypeerusrotundus	Keya-bon Nut grass	The extract of boiled and pounded tuber is given in stomach discomfort.
Dillenia indica	Ou-tenga, Elephant apple	Decoction is given in dysentery, flatulence and constipation.
Erecthitesvalerianaefolia	Bon kopah	Leaf paste is applied to cuts and wounds for quick healing.
Eryngium foetidum	Man dhania	Leaf juice is given in flatulence and stomach trouble
Ficus racemosa	Mau dimoru	Boiled fruits are given in diabetes.
Flacourtiajangomas	Poniol, Indian plum,	Decoction of stem bark and leaves are useful in diarrhoea.
Garcinia cowa	Kuji-thekera	Fruit Infusion of dry pericarp is given in diarrhoea, dysentery and flatulence.
Garcinia lancifolia	Rupahithekera	Same as above
Garcinia pedunculata	Borthekera	Same as above
Gmelina arborea	Gomari	Leaf decoction is given in indigestion and flatulence.
Hedyotiscorymbosa	Bon-jaluk	Tender shoot Decoction is given in body ache and peptic ulcer.
Hibiscus sabdarifolia	Tengamora	Tender shoot Decoction is prescribed in diarrhoea or dysentery.
Homalomena	Aromatic Gondhi-kochu	Rhizome paste is given in stomach ailments.
Ichnocarpus frutescens	Dudhkuri lota	Black creeper Root juice is used in fever and diabetes
Justiiciaadhatoda	Boga-bahok Root ,leaf	Powder of dry roots is applied on ulcers. Warmed juice is used as message on lower abdomen after childbirth for uterus contraction.

Lasia spinosa	Chengmora	Boiled rhizome is prescribed for irregular menstruation and juice of the same is given in leucorrhoea.It also controls cholesterol deposition.
Linderniapusilla (Willd.)	Gakhiroti-bon	Whole plant Decoction is given to women after childbirth to promote milk
Litseasalicifolia	Dighloti	Leaf decoction is given in dysentery
Melia azedarach	Ghora neem	Bark, leaf Paste of bark and infusion of leaves are applied in skin diseases.
Mikania micrantha	Japanilota	Leaf juice is given in stomach pain and dysentery. Leaf paste is applied to cuts and wounds to stop bleeding
Mimosa pudica	Lajuki lota	Leaf Root paste is given in jaundice. Taking root juice with milk is said to increase the sexual vigour. Leaf paste is applied in skin disease
Murrayakoenigii	Narasingha	Leaf Leaf decoction is given in dyspepsia and dysentery
Oroxylum indicum	Bhat-ghila	Stem bark Decoction is given in sour mouth and tongue
Paederia scandens	Bhedailota	Tender leaf and shoot Decoction is given in dysentery, diarrhea, abdominal pains and flatulence.
Phlogacanthus thyrsiformis	Rongabahok, titaphul	Flower Eaten as vegetable is useful in rheumatism, anemia and cough
Sapindusmukorossi	Moni-chal, ritha	Gargle in tonsillitis and pharyngitis. Seed decoction is also applied on scabies.
Sida acuta	Sonborial	Decoction is given in stomach Snake'stongue Root pain.
Solanum indicum Indian nightshade	Titabhekuri	Fruit Eaten in curries or roasted useful as blood purifier.
Spondius pinnata	Amora Hog plum	Wild mango Stem bark, leaf, fruit Decoction is given in blood dysentery. Leaf juice is dropped in the ear in otalgia
Streblus asper	Saura	Toothbrushtree. Used as toothbrushto cure toothache.
Talaumahodgsonii	Borhomothuri	Stipule with bud Chewed with betel nut and betel leaf is said to strengthen gums and teeth.
Vitex negundo	Pochotia	Chinese chaste tree Leaf Paste is appliedon scabies and decoction is given inpneumonia

6.6.1 Some other commonly found NTFPs are:

1. Amlakhi (Fruits of Emblicaofficinalis)
2. Dhuna (Exudation of Canariumresiniferum)
3. Jamuk (Fruits of Syzygiumjamboos).
4. Arjun (Terminaliaarjuna)
5. Hilikha (Terminaliachebula)
6. Bhomora (Terminaliabalerica)

7. Bhatghila (Oroxylumindicum)
8. Sarpagandha(Rauwolfiaserpentine)
9. Satmul (Asparagusracemosa
10. Curcuma aromatica(Ban-haldi),
11. Emblica officinalis(bel),
12. Eugeniajambolana(Loha-jam),
13. Holarrhinaantidysentrica(Dudhkuri)
14. Hydnocarpuskurzii(Chalmugra),
15. Litsea cubeba(Mejankuri),
16. Phlogocanthusthyrsiflorus(Titaphul),
17. Piper longum(pipoli),
18. Saraca indica(Asoka),
19. Wedeliacalandulacea(Mahabhringraj,
20. Zinziber officinalis (Ada)
21. Pods of Sterculiaalata)
22. Cinogynedichotoma(Patidoi)
23. Lahambark
24. Adhatodavasica (BahakTita)
25. Honey

Medicinal plants: *Bhedailata, Dhekia, Kochu, Kathalu, Manimuni, Jamlakhuti.*

Orchids: *Rhyncostylis retusa, Aerides odoratum, Aerides multiflora, Papilonthe teres (Bhatouphool), Dendrobium fibricatum, D. Aphylum, Cymbidium aloipholium*

6.6.1.1 Collection of Forest Products and Period/Season:

People collect different types of products for different purposes, e.g., food products like edible vegetable, fruits and fish. For construction and domestic use products like Bamboo, thatch, cane, broomstick*(phuljharu)* etc are collected. Some of these products are collected throughout the year while some are during certain period.

6.6.1.2 Edible Forest Vegetable:

Traditionally forest dwellers are habituated in collecting varieties of wild edible vegetables from forest to meet household food requirements throughout the year. Edible fruits of all kinds, leaves, roots, tubers, constitute the items of food. There are households who depend up to 100 percent on forest vegetable. There is no such restriction from the Forest Department on collection of the forest vegetables. Most of the household hardly can afford to cultivate in the own land because of expenses, low productivity, insufficient land. Both male and female members are involved in collecting forest vegetable, but during summer season mostly female members collect the edible vegetables for the household.

6.6.1.3 Household Building, Fencing and Handicraft Material:

Produces generally collected by the forest villager are Bamboo, Thatch, palm leaves *(Japipat*&Tokopat), Cane and Broomstick. These products are collected during a particular season i.e. from November to February. Mostly male members of the households are involved in collection of these products. Entire day spent for the collection of these products

as they have to cover 10 to 15 km for collection. Knife, sickles *(Daus)* are use for cutting and carried by bamboo made *bhar.*

6.6.1.4 Stakeholders.

Primary and secondary stakeholders are:-

i) Local people for their dailyneeds,
ii) Local healthpractitioners,
iii) Cottageindustries,
iv) Petty sellers,
v) Dhobi or washer man.

6.6.1.5 Constraints:

i) Absence of fixed price for NTFP,
ii) Absence of marketingfacilities,
iii) No standard procedure for collection or harvesting,
iv) Involvement ofmiddlemen,
v) Ring formation at the time of tender cum auctionsale,
vi) Lack of processingunits,
vii) Ignorance of people about the availability of localresources.

6.6.2 Strategy

With the coming of the Scheduled Tribes and Other Traditional Forest Dwellers Recognition of Forest Rights) Act, 2006 and the distribution of Community rights, generally covering the right to collect NTFP in forest areas,it is important that items of NTFP that are being collected are listed and prescribed for collection.

All the listed NTFPs are of great demand in the market particularly the plants having medicinal properties The Perfume or Aromatic Oil sector, the aromatic plant has become of very high demand in the commercial world for the Aromatic plants found in the forest areas. For example, the Fruits of Emblica officinalis (Amlakhi) rich in vitamin C are in demand for its various uses, includingmedicinal. Fruits may be allowed to be collected with the restriction as in case of SyzigiumJambos. In case of Garcinia spp, the trees are found in the evergreen areas, but are not very frequent. It may be conserved as in the case of Knema and Myristica dealt with above.

To avoid over exploitation, the use of NTFP should be in such a manner and at such rate that does not lead to the long time decline of biological diversity.The concerned Range Forest Officer and his staff will closely supervise all works of collection and ensure that there is neither any violation of lease agreement nor damage to any trees.

6.6.3 Propagation: All endegeneous species of NTFPs shall be propagated and cultivated as multy crop system beneath the forest species with due sylvicultural prescriptions.

6.6.4 Harvesting andYield

No harvesting method has been prescribed and no yield is calculated as the NTFPs available in all the forest are not quantified during the field survey. As the exercise is too exhaustive,

so the NTFP could not be quantified and it is proposed, an exclusive survey should be carried out to get actual available quantity of the NTFPs. Although during the survey a long list of NTFP s was prepared in regards the various kind of NTFP available but the exact quantity of harvestable size was not done.

6.6.5 Method of Sale

As per the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 and Rules 2008 and Amendment Rules, 2012the forest dwelling tribes living in and around the forests will be allowed to collect, use and dispose off NTFP which has been traditionally collected within or outside village boundaries. The committee constituted under Grama Sabha has to prepare conservation and management plan for community forest resources in order to sustainably and equitably manage such community forest resources for the benefit of forest dwelling Scheduled Tribes and Other Traditional Forest Dwellers and integrate such conservation management plan with the working plan of the forest department after Forest Dwellers rights on such resources are recognized.

Recently launched the Biodiversity Management committees (BMC) have a pivotal role in stoppage of over exploitation of any biodiversity potential material in & around the revenue villages including the nearby forest areas. The Assam State Biodiversity Rule, 2010 has contemplated sufficient scope for the BMCs for curbing unscientific extraction of NTFPs from the non-forest areas and takes measure for sustainable use of the product. Under various programme partuclarly, NaRMIL and recently under APFBC, the local people are being trained for income generation activities with the medicinal, aromatic plants available both in villages and forest areas purely in a sustainable manner.

In such cases, the NTFP will be collected by the JFMCs and the sale proceed will be shared between the JFMCs and the Government as per the prevailing Government order. As the procedure being followed in the division is in conformity with the current policy of the Government, the same may be continued in future also.

6.6.6 General Measures

1. No NTFPs will be allowed to collect from the areas alloted under protection working circle with the exception of the cases provided under Forest RightAct.
2. The collection of NTFPs should be done in a systematic, scientific and controlled manner. Non destructive methods of extraction have to be followed. Therefore there should be proper supervision at the field level to avoid any harm to the trees. The responsibility to the proper compliance of agreement conditions will be with the Range Forest Officer concerned. In case of any violation of agreement conditions, he should report the matter to the Deputy Conservator of Forests for taking penal action against thesociety/contractor.
3. It will be the responsibility of the JFMC or SHG s to ensure that during summer season the local tribals engaged in the collection of NTFPs do not set fire to the forests to facilitate collection of any item and that they extend all co-operation to the local staff to keep the forests free from fire. In the interest of sustainability of forest and wildlife, the sensitive areas having the problem of over-exploitation, smuggling, poaching, fire etc. may be ordered forclosure.
4. The Deputy Conservator of Forests should ensure that JFMCs etc. submit regular monthly returns of the quantity of NTFP collected and disposed off. This information will give an idea about the correct potential of particular non timber forest produce in the division.

5. The restricted items found during the routine perambulation of the staff should be sentto the concerned Range Forest Officer for safe custody. Range Forest Officer in turn will give regular report in this regard to Deputy Conservator ofForests.
6. In case the seeds of any species included in the list of non timber forest produces are required for departmental purpose, the society/contractor will have to supply the same to the Department on priority as per the rates fixed by the Silviculturist.
7. The JFMC has to comply all the conditions cited in the prevailing government order and also the agreement.
8. The D.F.O. should sensitize the JFMCs and the tribal community through awareness program regarding method of collection, the time of harvesting, its grading, and storage and value addition for economically important species for sustainable management. The DCF should develop a good practice guide for sustainable harvesting, grading, effective storing and value addition. Thetribal community and the JFMC s need to workout and agree on sustainable harvesting methods as a collective enterprise.
9. The DFO should verify the present status of the NTFP yielding species in the division by special studies and if he finds that, specific NTFP species comes under RET status in the division should stop harvesting of suchspecies.

6.7 Prescriptions for Bamboo Plantation

Choice of Species should be based on availability of the following species or planting material. Following species of Bamboo is available in entire state of Assam.

Sl no	Vernacular Name	Botanical Name	Status
1	SaruBijuli	*Baambusaassamica*	Commonly cultivated, culms are used as handicrafts, fishing rod and for erecting fence.
2	Bhaluka banh	*Bambusabalcooa*	Widely cultivated and nowhere found in wild state. It is probably the best and strongest species for building purposes.
3	Kotoha banh	*Bambusabambos*	Flowering gregarious, occasionally sporadic. Sporadic flowering occurred in some parts of homestead under Kamrup district during 2008-2009.Species use in paper mill, young shoots are edible.
4	Barosi banh, Hedge banh	*Bambusa multiplex*	Indigenous to China but now available in throughout the state. Frequently cultivated as hedge .
5	Makal banh	*Bambusa nutans*	Naturally occurring in the state. Flowering sporadic ,occasionally gregarious. Use in construction.
6	Jati banh	*Bambusatulda*	Widely cultivated all over Assam, used for house building, construction , fencing etc. Although Rajkhowa (1964) mentioned that it forms extensive gregarious belts in low hills of Central Assam Zone yet after investigations could not find it in wild state. Flowering gregarious , occasionally sporadic.

			Sporadic flowering recorded in two localities, one in Marakdola and other in North Guwahati in Kamrup district during the period 2007-2009.
7	Bijuli banh	*Bambusa pallida*	Cultivated in the plains of Assam. It is used for house building , handicraft, mat etc. Flowering sporadic.
8	Kalachi banh	*Bambusa vulgaris var. Wamini*	Cultivated throughout Assam as ornamental. So far flowering is not known for this taxon.
9	Haladhia banh	*Bambusa vulgaris var. vittata*	Cultivated throughout Assam as ornamental. Flowering sporadic and rare ,does not set seeds.
10	Kako banh	*Dendrocalamushamiltonii*	Wild in the lower hills of Assam, often forming extensive patches and also occasionally cultivated in the plains. It is used in house building , making of busket, mat and containers for water and milk, tender shoots are eaten. Flowering gregarious and sporadic after 30-40 years. Gregarious flowering recorded in Kamrup during 1999. Sporadic flowering recorded in Garbhanga and khanapara RF during 2006-2008.
11	Muli banh	*Melocannabaccifera*	Cultivated all over Assam. It is used prefabricated walls calledtarja, roofing, and walls of huts etc. Flowering gregarious rarely sporadic after 35 to 60 years. Sporadic flowering and fruiting recorded in Marakdola during 2010 - 11.

6.7.1 Bamboo Cultivation:

The bamboo plantations efforts are constrained due to non – availability of planting stock or the seeds as most of the economically important bamboo species shows considerably longseeding cycles viz. 30-60 years. Seedling production is the simplest and cheapest method of producing planting stock. Vegetative propagated of bamboo van be done through rhizomes, offsets, layering, culm cutting, branch cutting etc.

6.7.2 Production through seeds: If seeds are available, after sporadic or gregarious flowering mature seeds should be collected from top portion of the clump is usually by cutting the seed-bearing culms. Due to the short viability the seeds should be sown immediately to get maximum germination.

6.7.3 Preparation of nursery bed: Seeds are usually sown in standard nursery beds (10 m x1.2 m) or raised nursery beds of any convenient dimension. The top portion of the bed must be filled with a soil sand, compost mixture (1:1:1 ratio) for proper aeration and root development. After broadcast seeds and raise the plants in nursery beds, seedlings are ready for transplant to polybags after 45 to 60 days of growth in nursery beds. The seedlings are maintained in the nursery for one year before transplanting to the field.

When seeds are not available, vegetative propagation methods are used for the production of planting stock. In vegetative propagation, conventional method like offset planting, rhizome planting, layering etc are used.

6.7.4 Offset planting: An offset is the basal portion of a single culm with the rhizome axis and roots attached to it. For offset planting, preferably one to two year old culms from the peripheral portion of a clump are cut in a slanting manner in such a way that two nodes are left at the base. The major limitation of this method is that the offsets are bulky and extraction and transportation are labour intensive and hence the method is not feasible for raising large scale plantations.

6.7.5 Rhizome cuttings: Rhizome cuttings are sections of fresh living rhizomes with at least a bud of the preceding year along with a portion of the culm (about 15 to 30 cm long). If transportation is involved the rhizome s should be protected from drying as in offset. This technique is mainly suitable for monopodial bamboos with runner type of rhizome.Vegetative propagation through techniques like divisions, rhizomes, offsets, layering etc. yield limited number of planting stocks and hence are not appropriate for large scale plantation. In order to meet the ever increasing demand of planting stocks on regular basis and also to study the different vegetative propagation technique of bamboo species , Research and Education circle under state Forest Department in 2007-2008, developed , a new ,easy and low cost technique for production of quality planting stock of commercially important bamboo species of Assam vegetatively through two noded culm cutting with macro proliferation technique which yields planting stock with survival rate of 90-100%.

6.7.6 Plantation Management:

Production of field planting stock of bamboo species through two noded culm cutting with macro proliferation technique:

6.7.6.1 Methodology:

1) **Bed preparation:** Nursery beds of 10 m x1.2 mx 0.5 m are prepared. Beds should be filled up with a mixture of soil, sand and FYM in a ratio of 1: 1: 1. Seven days prior to the planting all the beds are fumigated with Formaldehyde solution to prevent insect attack. For each bed, 15 Lit. of 0.4 % Formaldehyde solution required.
2) **Preparation of culm cuttings:** From the already identified healthy non- congested clumps 1 year 6 months old culms should be selected and extracted with a sharp instrument leaving at least two node at the base. After extraction culms should be transported to the nursery site and prepare two noded cuttings (leaving 5-8 cm on either side).
3) **Planting of Cuttings:** Two noded cutting can be planted in the nursery beds horizontally, about 25 numbers of cuttings are required in one bed.
4) **Maintenance of nursery beds and sprouts:** Nursery beds should be provided with Shade (Agronet) to protect the cuttings from direct sunlight. Beds should be watered regularly and also maintained by regular weeding and soil working.
5) **Macroproliferation:** Nodes of the each cutting will be sprouted within 7 to 10 days and root development takes within 30 to 60 days after planting. After root development completed the sprouts (propagules) are ready for separation. At the time of separation of propagules from the nodes of each cutting the care should be taken to ensure that the

segregated propagules comes out with a portion of rhizome as well as roots. The segregated propagules are again planted to the already prepared macroproliferation beds (10 m x 1.2 m x 0.5 m beds filled with a mixture of soil, sand and vermin-compost in the ratio of 1 : 1 : 1).

Through this simple technique from a single bamboo node average 120 nos of bamboo saplings can be produced in a year, which could be increased gradually by continuing macroproliferation.

Propagules ready for field planting: The propagules /saplings do not need to the planted in polybags. It can directly be transferred to the earthen beds or to the fields.

Transportation: The bare rooted planting can be transported from nursery to the field directly with 100% survival.

6.8 Silvicultural System

The silvicultural system to be followed here will be selection system.

6.8.1 Pre-monsoon Works:

Demarcation of the patches suitable for existing bamboo plantations will be done in the year of demarcation of the bamboo coupe. Plantable patches not less than 5 ha. in extent of plantable area will bear separate demarcation. Pits will be dug at 6m x 6m and of size 45 cm x 45 cm x 45 cm negotiating the overwood and bamboo clumps etc. to bring up the bamboo population to sufficient extent. Preplanting operations will be carried out in the year of harvesting the bamboo in the coupe. Planting operations will be carried out in the rainssubsequent to bamboo harvesting. In case of uderplanting the bamboo, it will be done in the 4th year of main planting. The coupe will be demarcated soon after the rains in the year in which the pre-monsoon works are to be undertaken by erecting posts at suitable intervals. This demarcation will exclude the working coupes of the main working circle to which this working circle overlaps to avoid confusion. On the posts, compartments number, coupe number and name of the planting series should be written with black paint.

6.8.2 Cutting Cycle

6.8.2.1 Working Cycle: The minimum age at which culm is harvestable and age of full maturity of culm determine the length of working cycle. The minimum age of harvest is two years and the age of full maturity of a culm is about 5 years. Smaller working cycle may result in over exploitation of clumps whereas longer working cycles result in over crowding of clumps. In view of the prevailing biotic conditions, a working cycle of 3 years has been prescribed from technical and administrative c onvenience.

6.8.2.2 Method of Treatment: The bamboos are in great demand and it will be harvested under periodic thinning in the clumps. A cutting cycle of 3 years has been fixed as it has been found that the yield reduces considerably at a short rotation of 2 years 1st and 2nd year bamboo culms provide food and nourishment to the rhizomes under soil and should not be cut. They are also deficient in lignifications and are brittle and highly vulnerable to fungal attack. Only 3rd year culms are fit for harvesting.

6.8.2.3 Formation of Cutting Series: It is not possible to establish cutting Seris as on date and it will entirely depend on extend of plantation and species selected.

6.8.2.4 Regulation of Yield: It is regulated by area.

6.8.3 Identification of Age of Bamboo

Since the marking of bamboo is highly selective, it is necessary to distinguish, current year, previous year and mature culms from one another.

Current Year: Culm sheath is present on lower half of the culm, branches are present throughout the length of the culm and bloom (White powdery dust) is present abundantly and comes off easily when touched.

Second Year: Culm sheath absent, branches are present practically at all nodes. Bloom is patchy and does not come off easily.

Third Year: Culm sheath absent branches are present practically at all nodes, white bloom is absent and it becomes blackish grey.

6.9 Harvesting: Harvesting should be done under strict supervision of the Department.

6.9.1 Methods of Working: Present practice of working bamboo forests areas on three years felling cycle shall continue.

I) No harvesting works should be permitted between 15th June to 30th September.

ii) No culms below the age of two years will be felled.

Following culms shall be removed from all clumps:-

i) All dead, decayed and dry bamboos.

ii) Culms whose half or more top part is broken or damaged.

iii) Twisted or malformed culms.

iv) In a mature clump the following types of culms (green and living) will be retained.

v) All current season's (i.e. less than one year old) culms.

vi) From the rest culms equal in number to the current season's (i.e. less than one year old) culms or eight, whichever is more.

The remaining culms will be considered available for harvesting.

The cutting height of culms will be between 15 cm to 45 cm. above the ground level i.e. above the first internode above the ground. The cut shall be slant with a sharp instrument. In case of any flowering, no culms from flowered clump shall be felled in the year of flowering.

No clump should be considered fit for harvesting unless it contains more than 12 mature culms (one year as well as two years old included)

Harvesting of bamboo shall be done in a manner so as to ensure that the retained culms are evenly spaced and that some mature culms i.e. more than two years old are retained on periphery for the purposes of support to the new culms.

h) Following Acts will be strictly prohibited: Digging of rhizome, lopping of bamboo culms for fodder, use of tender bamboo culms bundling, Climbers infesting with growth of bamboo clump shall be cut. After cutting the debris will be removed away from the clumps

and will be stacked at a distance not less than 2 meter away from the outer periphery of each clump.

i) Tending Operations: After completion of seeding it is essential to properly look after the young regenerated crop till a time the clump formation starts. The following operations will be carried out depending upon the age of the crop.

6.9.2 Crop age between 1 to 3 years:

During this period the area will normally contain thick seedling crop and the clump formation does not start. During this period following tending operations will be carried out. i) The area will be thoroughly gone over and 0.6 meter diameter foci at the rate of 300 per hectare will be formed, distributed evenly over the whole area.

ii) All the rank growth of grasses, weeds and even bamboo seedlings upto a distance of 1.5 meter all around the foci formed as above, will be cleared so that the growth of the bamboo seedlings in the selected foci are not hampered.

iii) All climbers within and around the foci upto1.5 meter distance will be completely removed.

iv) The whole area will be strictly protected from fire and grazing.

6.9.3 Crop age between 3 to 8 years. :

During this period the clump formations starts but the crop is yet immature for harvesting. During this period following operations will be carried out.

i) All badly grown, twisted and damaged culms from the selected foci, will be removed.

ii) All weeds, grasses and climbers, within and around the foci upto a distance of 1.5 meter, will be completely removed.

iii) Tree growth of species, others than teak, ain, shisham, bija, tinsa, tiwas ,dhaora, haldu, karam, semal, mowai and bhirra over topping the clumps, will be removed.

iv) The whole area will be strictly protected from fire.

6.9.4 Cycle of tending operations:

The operations, as prescribed under (A) and (B) above, will be carried out annually. Where there is not possible due to administrative reasons, these operations, except fire protection, will be carried out on 2 years or at the most 3 years cycle. The territorial Conservator of Forests will decide and tending cycle to be followed in each area. The fire protection operations will be carried out every year and the area will be closed to grazing till completion of clump formation.

6.9.5 Protection of regeneration of bamboo area : Protection of regeneration bamboo seedlings in flowered area is most important for the future of the bamboo stand. Since abundant seeds is available near the flowered clumps , sufficient regeneration usually occur in areas except where soil is deficient or soil surface is too hard.

6.9.6 Bamboo plantation and Economics for vegetative planting stocks :

For one hacter Plantation of clump forming bamboo 400 vegetative planting stocks (rhizome, offset, culm cutting etc.) required with 5m x 5m spacing. After plantation it takes 3 -4 years to produce culms of harvestable. A well-managed bamboo plantation can yields 2700 to 3000 culms /ha yearly after 3 years of growth.

6.9.7 Economics of Bamboo (clump forming) cultivation (5.0 ha area) and harvesting

a) Spacing : 5.0m x 5.0m
b) Number of clumps : 400/ha
c) Number of productive clumps : 350/ha
d) Total Number of productive clumps for 5 ha plantation : 350 x 5 =1750.

Table 6.9.7.a : Cultivation and harvesting plan for 5 Ha plantation model of bamboo

Year	Yield			
	No of culms to be recruited per clump	No of culms to be harvested (3-yr old)/clump	Total no of culms to be harvested (350 clumps)	Total no of culms to be harvested for 5 ha plantation (350 x5 clumps)
1	1.5			
2	4.5			
3	7.5	1.5	525	2625
4	8.0	3.0	1050	5250
5	8.0	6.0	2100	10,500
6	8.0	7.5	2625	13,125
7	8.0	8.0	2800	14,000
8	8.0	8.0	2800	14,000
9	8.0	8.0	2800	14,000
>10	8.0	8.0	2800	14,000

Table 6.9.7.b Projected yield calculation for the Bamboo Plantations as per presumptions of

Year of creation of Plantation in Ha	Year of Harvesting of Bamboo Culms 5th Year Onwards	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30
2020-21	75	78750	157500	196875	210000	210000	210000	210000		
2021-22	125		131250	262500	328125	350000	350000	350000	350000	
2022-23	180			189000	378000	472500	504000	504000	504000	504000
2023-24	180				189000	378000	472500	504000	504000	504000
2024-25	155					162750	325500	406875	434000	434000
2025-26	105						110250	220500	275625	294000
2026-27	30							31500	63000	78750
Total culms to be harvested		**78750**	**288750**	**648375**	**1105125**	**1573250**	**1972250**	**2226875**	**2130625**	**1814750**

6.9.8 Analysis and Valuation of the Crop

The bamboo crop was not undertaken during the tree enumeration exercise. For development of the working plan the following FSI data on bamboo was taken into account.

Table 6.9.8.a

Species	Clumps	Culm	<2 yr culm	2 yr culm	>2 yr culm	Damaged culm
Bhaluka	141	10077	4348	2338	2608	750
Bijuli	23	2351	1199	501	465	186
Jati	539	42571	17449	9939	12799	2385
Bakal	8	695	268	197	183	47

Total	711	55694	23265	12973	16055	3368
Dry weight (t)		532	177	123	198	33

Species	Clumps	Clump diameter class			
		0 – 200 cm	200 – 300 cm	300 – 400 cm	>400 cm
Bhaluka	141	29	24	29	59
Bijuli	23	12	6	1	4
Jati	539	140	146	92	161
Bakal	8	1	0	0	7
Total	711	182	176	122	231

6.9.8.1 Fire Protection: Fires cause extensive damage to the new shoots of bamboos and, therefore, these areas will be completely protected from fire.

6.9.8.2 Grazing Control: These areas should be protected from grazing especially after flowering and in the rainy seasons in which the recruitment of new culms will takes place.

6.10 Associated Regulations andMeasures: 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 additionetc.

6.11 Cultivation ofAgarwood (Aquilaria agallocha)

Agar oil and wood are highly sought after products around the world, and Agar tress 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 braught 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, cardiotonic, carminative, aphrodisiac, alternative anodyne, antidiarrheal, antiasthamatic, 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.

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 20ºC to 28ºC 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 tilth. 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), *Withaniasomnifera* (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 Heortiavitessoides 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.

Harvest Management:

Agar-wood develops a peculiar, persisting strong odour because of infestation by a fungal identified as Zeuzeraconferta, it penetrates the hard wood, through wounds, injury or borers. All attempts to induce artificial infestation have failed; it is a natural phenomeon. 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 from0.1to2.1%.

Yield and Cost of Cultivation (Hectare): This oil is exceptionally costly.

Treatment prescribed: Areas allotted under JFMC Working Circle and NTFP Working Circle will be selected for Agarwood cultivation. 30 % of such area shall be braught 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.

Table: 6.12: Year-wise activities to be undertaken in NTFP Working Circle:

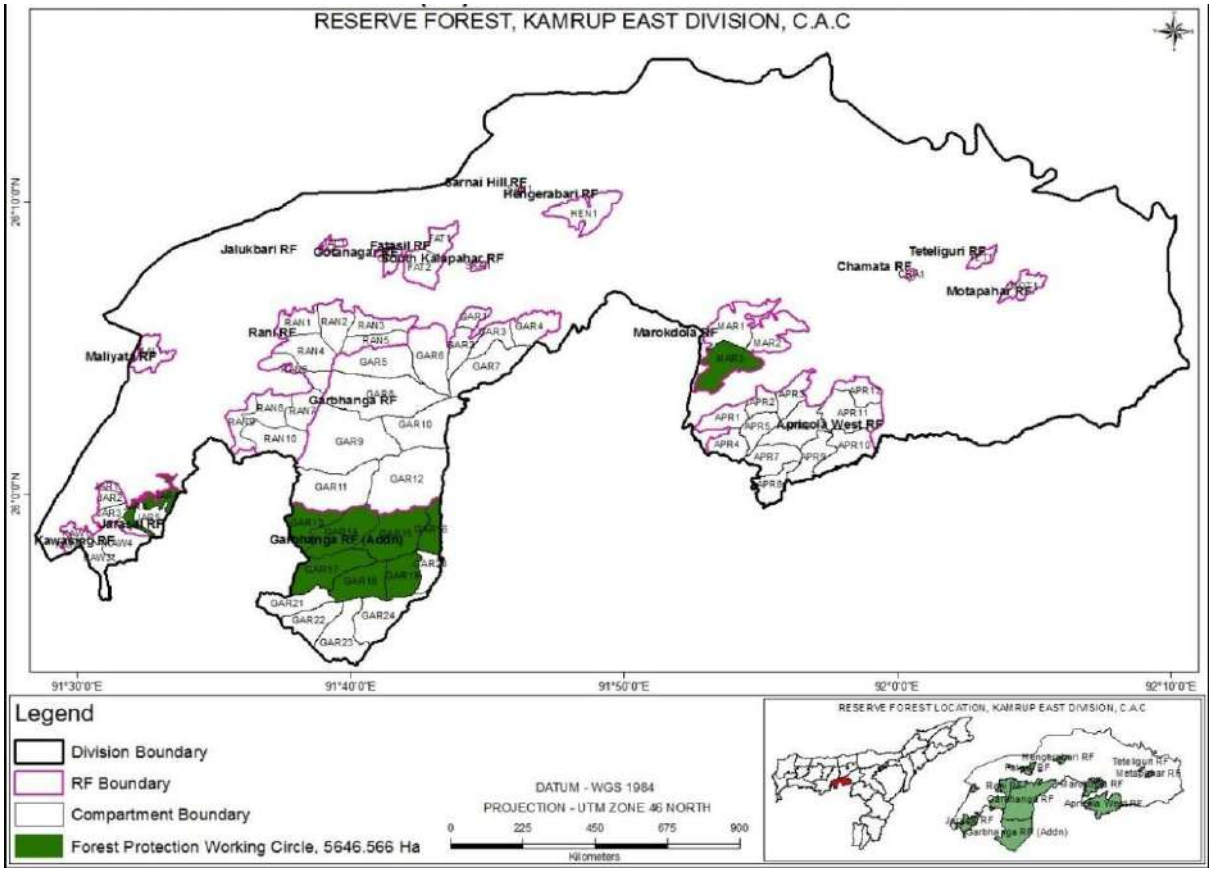
Activities	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
NTFP Plantation = 756 hectares	75	75	75	75	76	76	76	76	76	76
NTFP Maintenance = 1812 hect.	-	75	150	225	225	226	227	228	228	228
Bamboo Plantation = 714 hect	73	73	73	73	72	70	70	70	70	70
Bamboo Maintenance = 1722 h	-	73	146	219	219	218	215	212	210	210

CHAPTER 7

FOREST PROTECTION (Overlapping) WORKING CIRCLE

7.1 Name of the Working Circle: Forest protection (Overlapping) working circle. The detail map of this working circle is shown in thefigure.7.1

Figure7.1:MapofProtection Working Circleasperexistingcompartments.



7.2 General Constituemts of this Working Circle: The whole of the Kamrup East Division is shall be under this working circle. The areas with canopy coverabove70% with biotic pressure and natural hazard prone areas will be brought under intensive protection measure. Acute biotic pressure is changing the conditions of forests. It becomes absolutely essential to keep the core of the forest areas intact and free from anthropogenic/ human disturbances. In future when the condition of forests improves sustainable extraction from these forests may be allowed. Till that time, forests fallingunder the identified working circle shall function as nature's laboratories, which willkeep on imparting insights about the functioning of the nature, to a keen observer.Specifically, these forests include areas of unique flora and fauna with rich biological diversity and genetic resources. The forest provides habitat of wildlife especially elephants and straying cats and other hebivores so it is necessary to protect these areas. The division, serves as catchments to critical wetlands, its denudation

facilitates erosion especially after heavy monsoonrains and it is absolutely essential to maintain a permanent vegetation cover over the catchments. The role of the forests in these catchments, which receive very heavy rainfall in a short span of fourmonths from June to September, needs no emphasis. In the past, these forests were worked repeatedly and heavily in accessible areas and along river banks. The protection of forest will be carried out for the entire Division.

7.3 Objectives of the Working Circle: The broad objective of this Working Circle is to protect the reserve forests from all sort of forest degradation factors. Specific objectives are given below:

1. To protect the forests of the Division from all sort of forest degradation drivers including encroachment, illegal felling, lopping, grazing, illegal collection of NTFP, illegal clearance of forests for coal mining, illegal removal of minor minerals etc.
2. Augmenting forest growth including restotation of degraded forest to maintain environmental stability and ecological balance wherever it has been disturbed. And to protect the biological diversity of the area.
3. To sensitize local people about forest protection and involve them in preventing forest offences.
4. To raise the moral of staff and strengthen their capabilities to deal with illicit felling, encroachment, poaching etc.
5. To develop database to monitor various offence cases.

The broad objective of this working circle is to improve the stocks of the forest of this division by regeneration and plantation. Specific objectives are givenbelow:

7.4 Blocks & Compartment Allotment of Areas: Forest protection working circle comprises all the forest area of Kamrup West Division comprising 469.26 sq. km.

7.5 Forest Protection Aspect:

7.5.1 General: The forest protection is one of the most important and difficult aspects of forest management. Lot of degradation of forest has already taken place due to increased anthropogenic (human) activities. The increase of human population and requirement of timber to meet their luxurious demands combined with other developmental works requiring diversion of forest land for cultivation, irrigation projects, industries etc. resulted degradation of forest and in shrinkage of forest area. This situation has created huge gap in demand and supply of forest produce. The forests of Kamrup East division have tremendous pressure of illicit felling and encroachment. Because of predominance of Sal and Teak species in forests, the problem of illicit felling and transport of timber is severe in the forests of Bondapara, Singra, Bamunigaon, Kulsi and Loharghat Ranges. The local people move in groups, indulge in illicit felling and there have been many cases of assault on staff by illicit cutters. Out of 108 beats, 64 beats are considered hyper sensitive and 14 are sensitive beats and 30 beats are normal. The forest offenders are agricultural labourers and the intensity of forest offences increases during lean season of agriculture. Offenders indulge in forest offences prior to festival occasions such as Durga Puja, Bihu, Dipawali etc. They resort to illicit felling of Teak and Sal for easy money for festival celebration.

There were illicit fellings for meeting domestic needs of the villagers and the degree was not alarming. But during last couple of decades illicit felling of trees increased so high that at a point of time it went out of control. Following ban on tree felling by honourable Supreme Court in WP(C) 202/1995 in famous Godavaran Vs Union of India case, timber became scarce in market. On the other hand demand for timber was grown very high. Real Estate (Apartment/Flat) business in Assam got momentum during those decades and demand for wood reached the sky. As a result, forests had to bear the adverse effect. Organised timber smugglers involved in tree felling in such a way that the division had to witness massive forest destruction.

The general modus operandi of the illegal felling was that the smugglers engage the poor unemployed labours, in organised manner, to cut trees and carry to char areas and other nearby villages where they convert and it then sell to another group of smugglers. Syndicates had grown up in those areas. 20 years back, the then Range Officer, Protection Squad in his letter No.PS/KW/Illegalities/95 dated 15/07/1999 brought the menace to the higher authority quoting that there might be more 1000 numbers of Saw pits converting 500-1000 cum of timbers every day. The Saw pits which used to convert timber manually 20 years back have now been improved to Mechanical Band Saw increasing conversion capacity. However, number of such illegal Band Saw Mills has reduced than the number of Saw pits because of shortage of raw materials in the forests. Higher girth class trees have been wiped out from the forest.

It is not that the forest staffs never tried to resist the illegal doers from illegal activities. The DFO is assisted by 3/4 ACFs, 5 Territorial RFOs. Protection Squad Range Officer and 150-200 frontline staffs have been being strugling for protection of forests. They have been provided with 7 vehicles. There were 9 Check Gates established at strategic points with 24 hours working. Yet, it has never been a full proof protection measure. In some of the places the forest offenders indulge in offences in groups and it is very much difficult to control them by few Forest Guards. There are instances of staffs being assaulted by timber smugglers.

Several hundred M^3 (cubic meter) of timbers were seized by the forest staffs besides drawing up Offence Reports and accused been sent to jail.

7.5.2 Special objectives of management:

(i) Economic objective: To protect the forest from various forest destruction factor e.g., illegal felling, encroachment, grazing etc. with a view to restock the forest with valuable timber species to fetch revenue to the State.

(ii) Social objective: To engage village communities in protection works ensuring employment to them uplifting socio-economic condition of such people. Consistent with above to meet the part of local demand for firewood, timber etc. from the out turns that would come out from the thinning of the plantation crop.

i) Biodiversity & Ecological objective: To create forest of heterogeneous nature with valuable species as well as with other indegeneous species to maintain Forest Eco-system. The increased growth of biomass will help in carbon sequestration.

7.5.3 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 reserve 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.

7.5.4 Protection measures:

7.5.4.1 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.

7.5.4.2 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.

7.5.4.3 Protection Squad: The Protection Squad of the Division is very much weak. It shall bestrengthenedwith 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 Kamrup East 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 (Bamunigaon). The DFO should closely monitor the work of Protection squad and should obtain weekly reports to monitor the protection activities.

7.5.4.4 Wireless network: Presently there is no wireless network in this division. In the present day society offenders posses 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.

7.5.4.5 Mobility of staff: In Kamrup East 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.

7.5.4.6 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 handled carefully following all protocols.

7.5.4.7 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.

7.5.4.8 Fire protection: The areas of Kamrup East 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.

7.5.4.9 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.

7.5.4.10 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 East Division 20734.977 hectare (30.44%) of forest land are under encroachment. However the figure is inclusive of the areas inhabitated by Schedule Tribes and other forest dwellers. Population increase and requirement of land for agriculture and settlements besides greed of land hungers 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 5.5.4.10 reflects the status of encroachment in Kamrup East Division.
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 Rgulation' 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/PRF, 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. Range Officer must inspect at least 50% of the boundary demarcation, ACF at least 10% of the boundary demarcation, DFO at least 2% of the boundary demarcation. RFO Mobile Squad shall check 2 % of the boundary demarcation.
14. Not 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.

7.5.4.11 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.

7.5.4.12 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.

7.5.4.13 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.

7.5.4.14 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 Kamrup East Division with supporting staff.

7.5.4.15 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.

7.5.4.16 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 this register must be updated regularly. A secrete fund to gather intelligence and information is proposed to setup under the control of DFO.

7.5.4.17 Register of habitual offenders Name & address of the offender Previous record POR No./qty/Action taken Modus – operandi Photograph if available

7.5.4.18 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.

7.5.5 Consolidation of Boundary:

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 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 jurisdiction and send the necessary report to the Forest Range Officer. The Beat Officers should keep the records of boundaries of their beats in the Beat Book.Theprogramme 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 year period. Cost of maintenance is 25 % of cost of creation of Boundary Pillar.

Table: 7.5.5a: Approximate Number of Pillars Proposed to be constructed

Total no Pillars to be Consructed (10 year)						
SL No	**Item**	**Length of Boundary of All Reserve Forests (km)**	**No of Pillars/ 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	232	3	696	17	679
2	Sub Pillars	232	7	1624	55	1569

Footnote: Requirement of Boundary Pillars is as per the ground confuguration and change of direction of boundary (traverse) line. The number shown in the above table is an approximation assuming 3 (three) Main pillars and 7 (seven) Sub pillars per kilometer in average.

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.

Year-wise activities to be undertaken under Forest Protection Working Circle

Activities	**Y1**	**Y2**	**Y3**	**Y4**	**Y5**	**Y6**	**Y7**	**Y8**	**Y9**	**Y10**
Intensive protection measures will be taken for protection, Strengthening the forest protection squads/ personnel with modern equipments, logistics, vehicle and manpower.	5	5	5	5	5	5	5	5	5	5
Ejection plan: areas under encroachment shall be covered under ejection plan 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	-	250	250	250	-	-	-	-	-	-

Report (OR) shall be drawn against such encroacher and be sent to Court for prosecution.										
Boundary pillars (Main pillars 1 every 1 klilometer and sub pillars 3 every 1 km). Creation of barriers includingrajor-wire permanent fencing etc. to check biotic interference wherever necessary. Main Pillars = 679	100	100	100	100	100	100	79	-	-	-
Sub Pillars = 1569	225	225	225	225	225	225	219	-	-	-

Apart from erecting boundary pillars, strategic boundaries of Reserve Forests (i.e., which are vulnerable to encroachment) may be fenced up by heavy and permanent type fencing as in picture above.

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CHAPTER 8
General financial forecast and financial plan of operation

8.1 Revenue Collection: Except in thinning operation, in Sal and Plantation Working Circles, no harvesting prescription is given in the Working Plan. The expected revenue collection from the thinning operations are shown as under:

Expected revenue collection from thinnings operation of Sal regeneration working circle

No.	Detailed Itemof Work	Qty (Nos.)	Rate (Rs)	Amount (Rs)
1	Sale of poles extracted during thinning in the 5thyear	129588	5	647940.00
2	Sale of poles extracted during thinning in the 6th year	347311	10	3473110.00
3	Sale of poles extracted during thinning in the 7th year	560065	10	5600650.00
4	Sale of poles extracted during thinning in the 8th year	650889	23.9	15556247.00
5	Sale of poles extracted during thinning in the 9th year	631538	23.9	15093758.00
6	Sale of poles extracted during thinning in the 10th year	547781	23.9	13091966.00
	TOTAL			5,34,63,671.00

8.2 Estimated Expenditure: Estimated expenditure for the implementation of working plan prescriptions are worked out as per prevailing nursery and plantation norms of CAMPA, and PWD SOR'2013-14 besides other schedule of rates of various works. The rates and quantity of works are subjected to be revised. As such the estimate given here are not final. The estimates are to give an idea of approximate expenditure in implementing the Working Plan prescription.

I.Proposed estimate for Sal regeneration. W.C. for the period of 2022-2023 to 2031-2032.

Total activity area consolidating all compartments = 7102.00 hect
Area earmarked for Sal regeneration = 2643hect

No	Detailed Item of Work	Qty (Ha)	Rate	Amount
1	Regeneration of Sal in	2643	52528.00	13,88,31,504.00
2	Maintenance of Sal Plantation	13215	18864.00	24,92,87,760.00
	Total			38,81,19,264.00

II. Proposed estimate for Plantation W.C. for the period of 2022-2023 to 2031-2032.

Total activity area consolidating all compartments = 15210.00hect.
Area earmarked for Plantation= 13431hect

No	Detailed Item of Work	Qty (Ha)	Rate	Amount
1	Plantation	13431	52528.00	705503568.00
2	Maintenance of Plantation	67155	18864.00	1266811920.00
	Total			1972315488.00

III. Proposed estimate for JFMC Working Circle

a. Nursery Development–

Proposed estimate for development of nursery under Joint Forest Management Working Circle in Kamrup West Division for the period of 2019-2020 to 2028-2029.

Sl.No.	Detail item of works	Mandays
1.	Nursery development	2462
2.	Sapling rasing – 1,00,000 saplings wil be produced per nursery / JFMC	22,308
3.	Maintenance (lumpsum)	507
4.	**Total**	**25,277**

b. JFMC Plantation –

Proposed estimate for JFMC plantations under Joint Forest Management working circle in Kamrup East Division for the period of 2018-2019 to 2027-2028.

Sl.No.	Detail item of works	Mandays
1.	Creation of Plantation – including land preparation, pit digging, manuring , watering and maintenance @395 ha/yr x 50 x 10 yrs	1,97,500
2.	Maintenance	2,50,000
3.	**Total**	**4,47,500**

Proposed estimate (Rs. in lakhs) for JFMC plantations under Joint Forest Management working circle in Kamrup East Division for the period of 2021-2022 to 2027-2028.

Sl.No.	Detail item of works	Area	Rate	Amount (Rs)
1.	Creation of Plantation – including land preparation, pit digging, manuring , watering and maintenance	2926	52528.00	153696928.00
2.	Maintenance	8778	18864.00	165588192.00
3.	**Total**			319285120**.00**

C. JFMC Training and awareness programmes –

Proposed estimate for JFMC training and awareness programme under Joint Forest Management working circle Kamrup West Division for the period of 2019-2020 to 2028-2029.

Sl.No.	Detail item of works	Rate	Amount
1.	Awareness of identified areas (4 prog. x 2 x 10 years) = 80 programmes	5 lakh	4,00,00,000.00
2.	Community mobilization =40 programmes	3 lakh	1,20,00,000.00

3.	**Total**		**5,20,00,000.00**

D. Promotion of Eco-tourism

Sl.No.	Detail item of works	Rate	Amount
1.	Promotion of Eco-tourism in JFMC areas for 10 years	10 lakh	1,00,00,000.00
3.	**Total**		**1,00,00,000.00**

IV. Proposed estimate for Wildlife Management W.C.

Plantation of fruit, fodder spacies				
No	**Detailed Item of Work**	**Qty (Ha)**	**Rate**	**Amount**
1	Regeneration of various fruit, fodder species	1218	52528.00	63979104.00
2	Maintenance of Plantation	3654	18864.00	68929056.00
	Total			132908160.00

Estimate for Fund Requirement for Wild life Anti Depredation Squad			
Item of works	**Activities**	**Area in Ha/ Km/ Nos.**	**Amount Required**
1. Habitat Improvement	Planting of fodder fruit species	50 ha / yr	Rs. 12500 /ha
2.Deepening of Ponds /Wells	Desiltation	10 nos / yr	Rs. 50000 / unit
3. Elephant proof trenches	20 Km		Rs. 4,00,000 / km
4. Solar fencing		25 Km	Rs. 4,50,000 /Km
5. Purchase of crackers			Rs.3,00,000 /yr
6.Purchase of Arms & ammunition	DBBL/SBBL Gun	10 Nos.	Rs.30000 / unit - DBBL Rs.25000 / unit- SBBL
	Ammunition Cartages	500 / yr	Rs 120 / unit
7. Purchase of ropes etc.			Rs. 60,000 /yr
8. Hiring of Kunki elephant for Anti-Depredation			Rs. 3000/ day / elephant
9.Purchase of vehicles	Bolero Camper	5 Nos.	Rs. 6,85,000 per unit
10. Vehicle maintenance Rs. 30000/- year			Rs. 1,50,000 per yr
11. Food for Kunki& rescued elephant calf etc.			Rs. 1000 /day
12. Remuneration for crop damage			Rs. 3000 LS
13. Remuneration for human injury			Rs. 10000-20000 /case
14. For ex-gratia payment to the human casualty			Rs.1,00,000
15. Anti Depredation Squad (Rs. 4,00,000 /Range/yr)			Rs. 12,00,000/ yr

16. Tranquilizing Gun & Chemicals		Rs.1,50,000 /unit
17. Procurement of wireless handsets		Rs.20,000 /Unit
18. Construction of Watch towers		Rs. 7,00,000 /unit
19. Watch & Ward & forewarning labourers payment		Rs. 400 /DLS/day
20. Rescue & Rehabilitation fund for wild animals during flood		Rs.2,00,000 /yr
21. Protection of elephant corridor (at entry/exit point)		Rs.3,00,000 /yr
22. Reduction of invasive weeds	…… ha	Rs. 3,000 /Ha/yr
23. Provision for Trapping cage & other wildlife emergency		Rs.2,00,000 / unit

V. Proposed estimate for NTFP Working Circle:

Creation of Various NTFP Plantation

No	Detailed Item of Work	Qty (Ha)	Rate	Amount
1	Regeneration of various NTFP species	**1470**	52528	77216160.00
2	Maintenance of Plantation	4410	18864	83190240.00
	Total			160406400.00

VI. Proposed estimate for Forest Protection Working Circle

a. Estimate for eviction drive and post eviction Plantation work

Sl. No.	*Items of Work*	*Unit*	*Rate/unut (Rs.)*	*Total (in Rs.)*
1.	50 labourers/ day for 300 days	15,000	250/ unit	37,50,000.00
2.	2 trucks/day for labourers for 300 days	600	3000/day/truck	18,00,000.00
3.	10 trucks/day for seized materials for 300 days	3000	3000/day/truck	90,00,000.00
4.	5 buses/day for security forces for 300 days	1500	6000/day/bus	90,00,000.00
5.	4 small vehicles /day for officers for 300 days	1200	2000/day/vehi	24,00,000.00
6.	1 no. ambulance/day for 300 days	300	3000/day/vehi	9,00,000.00
7.	2 Nos. JCB/day for 300 days	600	3000/day/JCB	18,00,000.00
8.	2 nos. of Elephant/day for 300 days	600	1500/day	9,00,000.00
9.	Tools and equipments			1,00,000.00
10.	Contingency			5,00,000.00
11.	Tents, accommodations of Security forces			5,00,000.00
12.	Construction of new camps	10	10,00,000.00	1,00,00,000.00
13.	Construction of new security barracks	20	20,00,000.00	4,00,00,000.00

14.	Mini Truck	4	. 10,00,000	40,00,000.00
15.	Small vehicles	4	. 9,00,000	36,00,000.00
16.	Tractor	4	Rs. 20,00,000	80,00,000.00
	Sub Total			9,62,50,000.00
ROADS AND BRIDGES				
21.	Maintenance of existing roads	200 Km	. 1,00,000/km	2,00,00,000.00
25.	Solar Lights			10,00,000.00
	Sub Total			2,10,00,000.00
	Grand total			11,72,50,000.00

b. Total Number of Pillars Proposed to be Constructed

SL No	**Item**	**Number of pillars required**	**Rate**	**Amount**
1	Main Pillars	679	22500	1,52,77,500.00
2	Sub Pillars	1569	15500	2,43,19,500.00
	Total			3,95,97,000.00

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CHAPTER 9

MISCELLANEOUS REGULATIONS

9.1 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 andForests:

(i) Change in Silviculturalsystem
(ii) Clear felling of naturalforest
(iii) Formation of new felling series;and
(iv) Large scale felling due to naturalcalamities.

For all major deviations with respect to prescriptions where sanction of the MoEF is mandatory, an explanatory note alongwith 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, No.page**	**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.

9.2 Construction of Roads/Link roads: No construction of roads/link roads passing through the forests shall be allowed without the sanction of the competent authority/Government of India, as they attract the provisions of the Forest (Conservation) Act,1980.

9.3 Buildings: The old buildings requiring repair needs to be approved by the PCCF. Those building that are not put to use needs to beused.

9.4 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 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 WorkingCircle.

9.5 Fire Protection: There are as such no significant damages from fires, hwowver the following miscellaneous regulations are necessary to ward of forestfires:

i) Annual maintenance of fire lines to be done in the January through vegetation clearing from firelines.
ii) Fire risks should be notified by the DFO to the staff for necessary preventivemeasures.
iii) Entry of people inside the forests for extraction of MFP should beregulated.

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 thefuture.

9.6 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 beensured.

9.7 Nurseries: To meet the needs of plantation in the area, new nursery for raising tree species, medicinal plants, fruit species needs to be initiated.To raise good quality seedlings, the following steps should be taken up in thenurseries:

i) Seeds of Sal from identified geotagged mother Trees should be used. In case of other species seed from reliable seed orchards should beused.
ii) Production through vegetative means like root, stem, shoot cuttings, tissue culture, tree improvement techniques, cloning, rhizomes to raise the plantingstock.
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.

9.8 Petty Sales: Dry, dead and wind fallen trees after getting sanction from the CCF through the DFO may be disposed off as early as possible to avoid financial loss. Thatch and other grass if falling inside the JFMC areas may be handed over to the JFM committees. However, if there are problems with JFMC or they are not willing to take over, various minor forest produces should be auctioned.

9.9 Stone Mahals: All stone mahals should be geotagged, inspection carried out and quarying in stone mahals may be in operation adhering all the formailities. It should be ensured that in no way there are any environmental and ecosystem disturbances and its services degradation/deterioration through stone quarryingactivities.

9.10 Sand Mahals: All sand mahals should be geotagged, inspection carried out and sand mining in sand mahals may be in operation adhering all the formailities. It should be ensured that in no way there are any environmental and ecosystem and its services degradation / deterioration through sand miningactivities.

9.11 Fishery Mahals: All fishery mahals should be geotagged, inspection carried out and fishing adhering all the formailities / 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.

9.12 Departmental supply of wind fallen logs: The competitive sale needs to be improved to prevent further deterioration of wind fallen, dead, dying and decay trees in the process of disposal. No removal of such woods from carbon sequestration workingcircle.

9.13 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.

9.14 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. Besides, staffs shall be exposed to various successful States in respect of forest management.

9.15 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

Kamrup West Forest Division shall contribute for achieving Sustainable Development Goals.

9.16 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 labelingthe 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.

9.17 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 – Gramin Kaushalya 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 FasalBima 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 SamagraGramyaUnnayan Yojana' also referred as Assam Milk, Meat & Egg Mission society (AMMEMS-CMSGUY).
   Livestock, Health & Disease Control Programme

Fishery department:

1. Development of Inland Fisheries and Aquaculture

9.18 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.

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CHAPTER 10

MOINTORING, ASSESSMENT AND REPORTING

10.1 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 Mangement 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 Officer on the 1st of January for scrutiny and obtaining sanctions of deviations, ifany.
The following control forms will be used for monitoring all the important operations prescribed and suggested in this working plan:

Bamboo Harvesting Control Form*:* For cutting bamboo identified for felling and bamboo left out, the Control Form 1 shall beused.

Silvicultural Control Form*:* For control of all silvicultural operations such as subsidiary cultural operations, cleanings, burnings etc., Form No. 2 shall beused.

NTFP Control Form: For controlling and maintaining a record of all NTFPs harvest so as to make the removal/harvesting of NTFP sustainable, Form No. 3 shall BEused.

Wildlife Management and Biodiversity Conservation Control Form: For improvement of wildlife habitat and conservation and preservation of biodiversity, Form No. 4a, 4b & 4c shall beused.

Plantation Control Form: For any plantation block, gap, regeneration natural and assisted Form No. Pa, 4a, 4b & 4c shall beused.
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 later 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).

10.2 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 maintaued 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 workingcircles.

10.3 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 complicacy at any level, the controlling officers should inspect the following documents during inspection and enter signedobservations.

i. Annual Plan of Operations(APO)
ii. PlantationsJournals
iii. NurseryRegisters
iv. MeasurementBooks
v. Divisional NoteBook
vi. Fire ControlForms
vii. BeatBook

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 ofForests.

PLANTATION FORMS AND JOURNALS: The existing system of filling plantation forms and 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 maintaued 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 workingcircles.

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, compartment wise/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 to be recorded. Instructions of the PCCF/APCCF on checking of plantations issued from time to time should also be followed.

NURSERY REGISTER: The existing system of filling plantation forms and 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 maintaued 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 workingcircles.

For each nursery, separate registers need to be maintained. It shall have monthly detail of operations and expenditure incurred, plants raised, plants used departmentally, plants supplied to the public during the month etc. Detail of plants supplied free of cost to other Government Departments, public institutions, NGOs etc. shall also be recorded in the register. Plants destroyed as a result of natural calamities or otherwise destroyed shall be got written off from the competent authority. A copy of the nursery statement showing details of species wise nursery stock should be sent to the Divisional officemonthly.

Divisional Note-Book: The Divisional Forest Officer should maintain a note-book in which the following information shall berecorded.

a) Flowering of important treespecies.
b) Seeding of important tree species including geocordinates of mothertrees
b) Gregarious flowering ofbamboos.
c) Climate-rainfall and temperature experienced during this year and its effect of theforest crop.
d) Pests and diseases noticed in the crop, treatment and resultthereof.
e) Growth date of trees collected during theyear.
f) Labour related problems faced during theyear.
g) Market trend of forestproduce.
h) Working of JFMcommittees.
i) Any other major important issue from the forest management point ofview.

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 ofForests.

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 MiscellaneousRegulations.

Beat Books: Each beat guard will maintain a Beat-Book to be prepared and issued by the Divisional Office. The Beat-Book shall contain the followinginformation:

c) Beat map
d) Detail of forests in thebeat
e) Copy of boundary register of forests
f) Duties of ForestGuard
g) Legal status of the forest area withnotifications
h) Abstract copy of the relevant sections of the Indian Forest Act, 1927; Wildlife

(Protection) Act, 1972; Forest (Conservation) Act, 1980 and vernacular translationthereof.

i) List of buildings, roads, paths, fire-lines in thebeat
j) List of plantations raised during the past 10years
k) Record of water table at various places in thearea

Registers and Records: The following updated (till last financial year) register and recordswill be maintained by theDivision:

i) Compartmenthistories
ii) Fire records andregisters
iii) Register of BoundaryPillars
iv) Register of Rights andConcessions
v) Record of forest produceharvested
vi) Freegrants
vii) Register of land transferred to other departments under FCAct.
viii) Register of soil and water conservationworks
ix) Register of rotational grazing
x) Register of invasive species e.g. Lantanaeradication
xi) Register of wildlife management may include detailed record of humanwildlife conflicts that includes data on human casualities and injuries, loss of domestic animals and crop damage and compensation paidetc.
xii) Register of Government buildings that includes log of the repairs and addition (if any) undertakeninthebuilding.
xiii) Register of registered saw-mills in theDivision.

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.

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CHAPTER 11

SUMMARY OF THE PRESCRIPTIONS

The brief summaries of prescription against each Working Circle are narrated in table 11.

Table 11: Summary of prescriptions for each Working Circle.

Chapter No.	Name of the Working Circle	Prescribed activity	Physical target over a period of ten years
Part-2 Chapter-2	Sal Regeneration Working Circle	Regeneration (Natural) ANR supported by artificial regeneration Total activity area consolidating all compartments =**2643.00** hect.	Area earmarked for Sal regeneration = 2643.00hect
		Sylvicultural operation Cleaning and Thinning in Periodic Block I,II,III and IV Operations in Periodic Blocks is in Para 2.6.7	**7102.21** hect area shall be covered
		1st weeding = May/June 2nd weeding = July/August 3rs weeding = September Pressing and Control burning = Late October to early November	2643hect
		Raising of Sal polypot seedling for vacancy filling 10,00,000	Polypot seedling 10,00,000
		The area intended to be undertaken for regeneration must be fenced with permanent nature of fencing with chainlink fencing 2.0 meter high supported by concertina (rajor wire) coil and multy strand fencing. The posts being placed closely 2 meter apart with RCC 150mm 150mm prestressed or MS 75mm x5mm angle posts (Base should be of Concrete). While ercting such permanent type of fencing, it must be kept in mind that leaving buffer area in between human habitation and actual plantation area may cause encroachment in the buffer area. So, fencing should invariably be erected along Reserve boundary. 2. Seedling strips 1 (one) meter wide at 2 meter interval (edge to edge) should then be laid out in the aera irrespective of presence or absence of regeneration with proper lining and stacking with sticks and pegs. These seedling strips should preferably be laid in an east-west direction. This operation is to be completed by the end of March. 3. 3. In the areas in need of regeneration being induced, the central 70 cm of seedling strips should properly be hoed and raised seed beds (7-10) prepared during April providing bed surface with	

		slight camber and no clods should be left. In Konkani soil, hoeing should be continued to the top of raised mounds and seed bed should be prepared in the form of Thali. This work should be completed latest by 1st week of May. 4. As soon as mature Sal seeds are available (within 25th of May), these should be dibbled in on the seed beds at spacing 5cm x 5cm. It should be ensured that only mature seeds are dibbled in and that takes place preferably within 48 hours of seed fall. This can be ensured by confirming collection of seeds from the floor of seed stands, where the floor can be swept every day and fresh fallen seeds can be collected. 5. 5. In areas containing groups and patches of established Sal, the laying out of strips should be carried out in such a way as to accommodate all such groups and patches if necessary by widening the strips or by not following strictly straight alignment. Smaller patches or individual Sal seedlings falling in the interval between the strips need not be bothered about. All the cut materials and felling debrises should be heaped in the intervening space between the two seedling strips and should be burnt. 6. 1st rain weeding (i.e., cutting of shrubs etc.) is to be carried out in whole of annual regeneration area during July. 7. 2nd rain weeding in August to be carried out in whole area with particular attention to removal of climbers like Michanea etc. 8. 3rd weeding is to be carried out in September, where alongwith shrubs and climber cutting, the singling out of thick patch of regeneration either of coppice or seed origin are to be done. 9. The plantation area is to be subjected to an early controlled burning at the outset of dry winter months. For this, firelines4-meter wide are to be cut along the boundaries of the plantation and in case of large plots, intermediate firelines 3-metre wide are to be cleared to sub divide the plots. Shrubs etc. occurring in seedling strips are to be placed along the middle of the intermediate space (two meter). Thatch and other growths occurring in the intermediate space are then to be pressed down. The cut and pressed materials are then to be burnt under control during the late evening or early morning by repeated torching. Care should be taken to ensure that no fire creeps into the seedling's strips and seedling patcthes. The control burning areas containing thatch should be done on the same evening or next morning of the day on which the materials are cut and pressed down. In areas having shrubby evergreen undergrowth, a day or two may be allowed to pass for drying up the debrises. All imflamable materials should also be burnt together with debrises. This operation must be completed by 15th November.

		10. The fire links should be swept clean of all inflammable materials and burnt periodically during the remaider part of dry season. 11. The operations outlined under item no. 5,6,7,8 & 9 alongwith repairs/renewals of fencings are to be repeated duting the end year of the plantations onward till the Sal seedlings are established in the area. The time table to be followed is- 1st weeding = May/June 2nd weeding = July/August 3rs weeding = September Pressing and Control burning = Late October to early November 1st weeding in May/June, the vacancies are to be filled up by dibbling seeds or planting polypot raised Sal seedling. Every year, alongwith the planting works by dibbling, some polypots are to be dibbled with Sal seeds in nursery so that these polypot raised Sal seedlings can be used for beating up operation in the next year. During the working and operations, the singling out coppice shoots are also to be done. 12. Thease operations are to be repeated in 3rd, 4th and 5th years too. 13. The fireline cutting and early burning firelines are to be done for 6th and 7th year plantations too. 14. During the 5th year of the plantation, the congested patch of Salseedlings in the strips may be given a clearing. 15. The 1st thinning in the plantations would be due and should be carried out on 10th year of the plantations.	
Part 2 Chapter 3	Plantation Working Circle	Sylvicultural operation Cleaning and Thinning	15210.804hect.
		Creation of Nursery for 13431.00hect plantation during the Working Plan period. No of Nursery = 5, one each in every Range for 10 years	No. of nursery beds 40000 No of Nursery = 5, one each in every Range for 10 years
		Regeneration plantation of Teak in Kamrup West Division during the Working Plan period to cover at least 20% of earea of Teak Regeration Working Circle	Area earmarked for Teak regeneration = 13431.00hect. Requirement of stumps= 13431x2600/hect= 34920600
		Weeding: 3 rain weedings in 1st& 2nd year 2 weedings in 3rd& 4th year It should be ensured that the plantations are established at the end of 5th year.	Area to be covered =13431.00hect.
		i. First mechanical cum silvicultural thinning at the 10th year by	

		retaining about 50% of the total trees by marking the stems silviculturally in the alternativediagonals. ii. Second mechanical cum silvicultural thinning at the 20th year by retaining about 30% by marking the trees silviculturally in the alternatelines. iii. First silviculture thinning at the 30thyear (leaving about 15% of the balancetrees). iv. Second silviculture thinning at the 40thyear (leaving about 7.5 % of the balance trees). Third silvicultural thinning at the 50th year by operating balace 7.5% of thetrees.	
		• The planting sites should be ready by March every year. The advance works include the site clearance, debris collection, burning and stacking at spacing of 2m x 2m. • The stump planting of Teak should be done in 1st part of April each year. • The planting of other spacies is to be started during April/May. • 3(three) Rain Weedings should be done in first 2 (two) years. • In third year, number of weeding may be reduced to 2 (two). • The plantation should be established at the end of 5th year. • Grazing and fire shall strictly be prohibited.	
Part 2 Chapter 4	Joint Forest Management (Overlapping) Working Circle	Nursery and Plantation and entry point activity: Plantation = 2926hect Maintenance 22750hect	Plantation = 2926hect Maintenance 22750hect
		JFMC training and awareness programmes for the period of 2019-2020 to 2028-2029. (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 Chandubi, Kulsi, Ukium, Jongakhuli, gamarimura (Jeep safari, Boat riding, Ethnicuising,night halt at cottages etc.	5 units.
		1. Raising of grafted fruit plants in forest areas, nearby fringevillages. 2. Raising of fast growing timber yielding species such as Azar, Titasopa, Kadam, Bandordima, Hatipoliya, etc. endemic to thedivision. 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 Kamrup West division along the catchment of those *suti's*(river course) flowing from the Khasi and Jaintia hills. DFO should conduct field investigations and initiate watershed development projects. Looking at the sociocultural 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 theirhomesteads. 8. As entry point activities promotion of improved cooking mechanism - biogas, improved chullas,solar lamps etc. Eco-tourism activities shall be developed in the Eco-tourism spots mentioned in para 8.6 (Part-I).
		Additional Prescriptions: 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 funders norms. Before implementing the project Government orders, any amendments to be strictly followed. There should be monthly review meeting of the JFMCs under the Chairmanship of JFMC president. Range Forest Officer should attend meeting at leastquarterly. ii) NTFPs to be collected and sustainably harvested from forest fringe areas under the JFMC and shall be sold by the concernedJFMC. iii) Continuous efforts should be made to create and sustain the JFMC movement by creating required awareness among the people and the staff through trainingprogrammes. iv) Agroforestry plantations should be carried out in the encroached areas through the JFMC. In between tree lines ginger, turmeric and other medicinal herbs should becultivated. v) JFMC areas to practice minimum tillage, organicformulations. vi) 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. vii) System of rice intensification ensures higher productivity with optimum utilizing the resources, may be promoted in JFMC cultivated paddy fields to increaseproductivity. viii) Establishment of biogas plant as an entry point activity based on themicroplans. ix) JFMC plantation assistance will be released as per the

		standard government norms, funder norms based on the survival of theplants. x) 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 followedstrictly. xi) 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. xii) 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 landresources. xiii) JFMC members may be consulted in choosing the species to be planted, keeping due regard to the biodiversity of the area and silviculturalsuitability. xiv) 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 thisprocess. xv) 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 otherdepartments. xvi) Soil and land development works may be undertaken in forest areas. Water harvesting structures may be constructed for soil and water conservation andfisheries. xvii) 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 otherareas. xviii) Whereas, demand of planting trees on private land is increasing, the JFMC members may be allowed Social Forestry benefits on their individualland. xix) 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. xx) 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 planningdevices. xxi) The JFMC members should have a meeting place. A community hall may be constructed for use of the JFMCmembers. xxii) 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 have inconformity with National Forest Policy and Forest ConservationAct. xxiii) 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 thatextent. xxiv) 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 theirjurisdiction. xxv) No new human settlement in any part of the Reserve 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) Act1980.	
Part 2 Chapter 5	Wildlife Management W.C	Habitat enrichment: d) Regeneration of various fruit, fodder species e) Maintenance of Plantation f) Maintenance of Water hole	 1218 hect. 10 nos
		h) Formation of Anti depredation Squad and equip with logistics i) Purchase of vehicle j) Engagement of Kunki Elephant k) Construction of watch towers l) Digging of Elephant proof trenches m) Erection of elephant	h) As shown in detailed estimate. i) Total 10 Bolero SUV and 5 Mini trucks j) 2 Kunki Elephants during elephant depredation season. k) 10 Watch towers

		(battery/solar) fence n) Awareness campaign	l) Total 50 kms m) 50 km n) 80 programmes
		Control of illegal felling: The forest staff shall keep vigil all the time through patrolling, information sharing through network development with the help of local people. Illegal felling must be stopped for wildlife habitat repairing. Timber smugglers engage local poor people to cut trees and the poor people in return of a little emoluments/wages cut a valuable tree. Government has to come up with major policies to give more benefits in the form of employment or any other incentive to these poor people to restrain them from cutting the trees. There are a number of rural development schemes some of which donot percolate to the bottom line and remain inaccessible from the reach of such poor people. Forest Department may play a pivotal role liaisoning between the development departments and the poor people. Persons arrested for illegal felling should be booked as per provision of WLPA1972 in addition to AFR1891 for destroying of Wildlife habitat. All other prescription given in Forest Protection Working Circle are to be followed. **Eviction of Encroachment:** Identifying the encroachments, evictions are to be done with a standard procedure of eviction. No new villages or new dwellers should be permitted to come out in future in close proximity of the wildlife habitats. **Control of Grazing:** The grazing has no much impact in the Division. However, domestic cattle sometimes stray out to the forests of the division. All domestic cattle need to be immunized from time to time. Initiation in this regard should be taken by facilitating vaccination camps in collaboration of Veterinary Department for cattle of the fringevillagers. **Habitat improvement:** Due to anthropogenic pressure, the wild life habitat has been degraded. 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 habitat. During water scares seasons, probability of wildlife increases near water holes or near villages and thereby increases their susceptibility to poaching and conflict. So it is proposed to create water holes, density shall be commensurate with the density of wild animals found in thearea. Special emphasis should be given to improve and maintain the characteristic waterbodies. Water	

		bodies, small and large should be developed and maintained for migratory birds and other bird species. **Fruit and fodder plantations:** Plantation of elephants favourite fruit plants like *Dilenia*spp., *Syzygium*spp., *Guajava* spp., *Artocarpus* spp., *Mangifera* spp., *Tamarindus* spp., *Emblica*spp. *Eugenia* spp., etc. in wildlife area; plantation of fodder species like *Musa spp*. *Bambusa*spp. *Bauhinia* spp., *Andropogon* spp., *Buchanania*spp., *Cassia* spp., *Croton* spp., *Dioscorea*spp., *Eragrostis*spp., *Eugenia* spp., *Ficus* spp., *Lagerstroemia* spp., *Saccharum* spp. Is prescribed. **Development of Nesting Sites:** 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. Two dead trees per hectare is to be left out for wildlifehabitat. **Managing Man Animal Conflict:** In Kamrup West Division conflict of humans are observed with Elephants. Man-elephant conflict has become one of the most challenging problems in modern wildlife management. With continuous loss of habitat qualitatively as well as quantitatively, elephants are forced to extend their range and raid crops to meet their energy requirements. During such forays of elephants into villages or agricultural lands and human forays into forests, confrontation is inevitable. **Causes of man-elephant conflict:** Besides the usual causes like habitat destruction, encroachment, increased activities in forest by humans, etc., one more reason is observed to be a cause of increased man-elephant conflict. It is observed that maximum people make country liquor in their homes for commercial purposes. Elephants are also fond of this liquor. When they get the smell of the liquor they tear down a house in search of the liquor **Unscientific methods to scare away elephants:** This is one of important cause due to which human are killed. It was usually seen that when an elephant herd comes to raid an agricultural field, people try different ways to scare away the elephants. Some fire crackers, while others throw stones or shouts at them from different places. The elephant herd breaks due to so much noise and in the process some men comes in front of the elephant and gets killed. **Control measures** Measures for controlling man-elephant conflict has been divided into two categories, viz. the short-term measures and the long-term measures. **Short term measures:** Short-term measures aimed at providing immediate relief to the

		people such as: 1. Driving away elephants physically. 2. Use of trained elephants (koonkie) to chase away wild elephants. 3. Use of barriers (Elephant – proof trench and watch towers). **Long term measures:**Long term measures aim at removing the factors responsible for the elephant depredation and at creating ideal living conditions for elephants within the forests, viz, habitat development works, eco-development works, establish elephant corridors, promote conservation education and public awareness. Following measures were recommended: - **Vegetative Barrier:** In this type of barrier, thorny plants or other plants which acts as repellent to elephants such as lemon trees, red chilly and citronella grass can be sown around the boundary of the protected area. Elephants, to some extent, avoid the way where this type of vegetation is grown. **Trenches:** Trenches may be dug in around the boundaries of the area to be protected from elephant depredation. (Trench specification-Top width = 2.50 mt; Bottom width = 1.50 mt; Depth = 2.50 mt.). The dugout earth is to be used as mound towards the inner-side of the protected area. **Power fencing:** Battery operated Power fencing are used to prevent elephant movement into human habitation. But there is a negative side of this, which is experienced from Salona area of Nagaon Division. After the battery and energiger got defected, some hostile and unscrupulous person connected direct 230-250 V power to the fencing wires which caused casualty of number of elephants in several instances. This is why the Power fencing should be avoided except in very important premises. **4. Reforestation:** The habitat of the elephants should be restored. This can be achieved by plantation of natural fodder species and bamboos in the forest. If sufficient amount of fodder, bamboos and other plant species are available in the forest, elephants will seldom come down to raid crops. **5. Change of Crop Pattern:** People in area are mainly dependent on the paddy, which the elephants are also accustomed to. A change in the pattern of cultivation of the crop may be tried viz. the vacant area between the forest and the agricultural land, which are full of edible grass, are to be removed and planted with red chilly, lemon trees, citronella grass or other plants with thorns and spikes.	
Part 2 Chapter 6	Non timber forest produce (overlapping)	NTFP Plantation = 210 hectares NTFP Maintenance = 1500 hect. Bamboo Plantation = 850 hectares Bamboo Maintenance = 2550 hect	2100 hectares Maintenance = 1500 hect 850 hectares Maintenance = 2550 hect

	working circle		
		1. No NTFPs will be allowed to collect from the areas alloted under protection working circle with the exception of the cases provided under Forest RightAct. 2. The collection of NTFPs should be done in a systematic, scientific and controlled manner. Non destructive methods of extraction have to be followed. Therefore there should be proper supervision at the field level to avoid any harm to the trees. The responsibility to the proper compliance of agreement conditions will be with the Range Forest Officer concerned. In case of any violation of agreement conditions, he should report the matter to the Deputy Conservator of Forests for taking penal action against thesociety/contractor. 3. It will be the responsibility of the JFMC or SHG s to ensure that during summer season the local tribals engaged in the collection of NTFPs do not set fire to the forests to facilitate collection of any item and that they extend all co-operation to the local staff to keep the forests free from fire. In the interest of sustainability of forest and wildlife, the sensitive areas having the problem of over-exploitation, smuggling, poaching, fire etc. may be ordered forclosure. 4. The Deputy Conservator of Forests should ensure that JFMCs etc. submit regular monthly returns of the quantity of NTFP collected and disposed off. This information will give an idea about the correct potential of particular non timber forest produce in the division. 5. The restricted items found during the routine perambulation of the staff should be sentto the concerned Range Forest Officer for safe custody. Range Forest Officer in turn will give regular report in this regard to Deputy Conservator ofForests. 6. In case the seeds of any species included in the list of non timber forest produces are required for departmental purpose, the society/contractor will have to supply the same to the Department on priority as per the rates fixed by the Silviculturist,Madikeri. 7. The JFMC has to comply all the conditions cited in the prevailing government order and also theagreement. 8. The Deputy Conservator of Forests should sensitize the JFMCs and the tribal community through awareness program regarding method of collection, the time of harvesting, its grading, and storage and value addition for economically important species for sustainable management. The DCF should develop a good practice guide for sustainable harvesting, grading, effective storing and value addition. Thetribal community and the JFMC s need to workout and agree on sustainable harvesting methods as a	

		collective enterprise. The Deputy Conservator of Forests should verify the present status of the NTFP yielding species in the division by special studies and if he finds that, specific NTFP species comes under RET status in the division should stop harvesting of suchspecies.	
Part 2 Chapter 7	Forest Protection WC	Boundary pillars (Main pillars 1 every 1 klilometer and sub pillars 3 every 1 km). Creation of barriers including rajor-wire permanent fencing etc. to check biotic interference wherever necessary. Main Pillars = 679 Sub Pillar = 1569	a) Main boundary pillars = 679 b) Sub pillars 504 = 1569 c) Creation of barriers includingrajor-wire permanent fencing etc. to check biotic interference

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