

A photograph of a dense tropical forest. The scene is filled with tall, slender trees with light-colored bark, rising above a thick, lush canopy of green foliage. The sky is a clear, pale blue, visible through the upper branches of the trees. The overall impression is one of a healthy, undisturbed natural environment.



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भारतसरकार/ GOVERNMENT OF INDIA
 एकीकृतक्षेत्रीयकार्यालय/ INTEGRATED REGIONAL OFFICE
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No. 12-2/33/2014/RONE/AS/KAMRUP-WEST/WP/1315-16

July 22, 2022

To

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

Sub: Approval of revised Working Plan of Kamrup West – reg.

Ref: i) Your letter No. FG.62/REWP/TAWP/2016 dated 21.02.2022.
 ii) Your email dated June 28, 2022.

Sir,

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

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

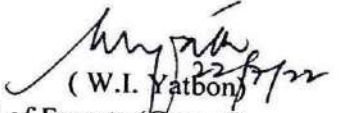
1. The approval shall be effective from the date of issuance of this letter and is for a period of 10 years i.e. 2022-23 to 2031-32.
2. All the prescriptions of the Working Plan regarding regeneration, protection and management of the forest will be strictly complied with and any change in the prescriptions of Working Plan will be treated as deviation for which prior approval of competent authority as per National Working Plan Code 2014 (Chapter V) shall be obtained in advance.
3. Any alteration in the plan leading to deviations or involving important technical points shall be made available with necessary draft amendments to the Deputy Director General of Forests (Central) through the PCCF and shall be implemented only after amendments are duly approved by the Deputy Director General of Forests (Central).
4. Sufficient budgetary allocations must be ensured for implementation of various prescriptions regarding protection, regeneration and development of the forests and 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° (steep slopes), areas having blanks or under stocked or in the areas of 20m strip on both sides along the streams and nallahs and 50m strip on both sides along the rivers.
 11. The monitoring of the thinning, if any, will be done by territorial DFO and CCF (30 % and 10%) respectively. A certificate regarding this to be submitted regularly to this office.
 12. No new construction of roads in the forest area shall be taken up for the purpose of extraction of timber.
 13. The material obtained from thinning, if any, is to be transported to the notified depots and no timber should remain in the felled compartments.
 14. Every year after any thinning as per prescription taking into consideration, a report regarding the yield removed shall be communicated to the Regional Office of MoEF&CC with an annual plan of operation to commensurate regeneration in the working plan area before commencement of new forestry operation year (in the month of September).
 15. Adequate fire protection measures shall be taken up and adequate funds for this purpose shall be made available by the State Government.
 16. Intensive protection measures against biotic interference and encroachment in forest shall be taken up. The case of forest settlement and encroachment shall be expedited and all the Acts, Rules, Orders of Hon'ble Supreme Court of India shall be followed in letter and spirit. Action should be taken for demarcation of forest areas and budgetary provision should be made for the same.
 17. It shall be ensured that no activity is permitted/taken up in forest area in violation of the provisions of Forest (Conservation) Act, 1980.
 18. No exotic 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 2024-25 so that deviations if any causing short falls in achievements of target can be adjusted by the Standing Consultative Working Plan Committee in consultation with the Deputy Director General of Forests (Central).
23. A copy each of the approved final Working Plan is to be sent to the Regional Office, MoEF&CC, Shillong, ICFRE, IGNFA and FSI, Dehradun.
24. The Central Government reserves the right to review/modify or withdraw this approval at any point of time depending upon the management needs and orders of the Central Government /Court.

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

Yours faithfully,


(W.I. Yatbon)
Deputy Inspector General of Forests (Central)

Copy to:

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


Deputy Inspector General of Forests (Central)

Message from PCCF & HoFF

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

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

(MK YADAVA, IFS)
Principal Chief Conservator of Forests
& Head of Forest Force, Assam

Message from CCF, REWP

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

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

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

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



PREFACE

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

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

Information on growing stock and its growth is necessary for efficient planning and management of forests. The forest inventory, survey and mapping provide this important input. Assessment of forests resources makes use of a combination of geomatics and field inventory data. For the first time in the country, inventory and mapping of the entire vegetation including herbs, shrubs, grasses and climbers along with trees, has been brought within the ambit of the forest resource assessment. This will also include inventory of the non timber forest products (NTFPs) and medicinal and aromatic plants (MAPs) which will ultimately help to prepare the livelihood plans for the local communities in a more effective manner. Fragmented patches of forest need to be covered in the survey and assessment so as to provide focused management prescriptions for ensuring no discontinuous forest patch is left out from the purview of survey.

A network of grid based permanent sample plots should be identified and established in different strata of the forests to provide necessary database for growth/increment. These permanent sample plots are necessary to assess the role of forests as source or sink for greenhouse gases on a long term basis and to study carbon sequestration and storage in trees both above and below ground biomass (stem

and roots), deadwood, litter, soil and harvested wood products for different forest types of India with an emphasis on different management regimes. Establishment and maintenance of these plots be carried out by silvicultural wing for continuous collection of data.

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

Working plan for the Kamrup West Division, Assam for the period 2021-22 to 2030-31 is prepared in accordance with the guidelines stipulated in the National Working Plan Code, 2014. The Division is situated within the Geographical limits of longitude 90°45' E and 92°15' E and latitude 26°00' N and 26°45' N. The working plan is prepared for sustainably managing the division, keeping in mind the availability of resources and the issues occurring and expected to occur in the coming ten years. Measures to control the pressure on the forest reserves and increase the forest productivity with increased green cover in the division have been emphasized in this working plan. The working plan of Kamrup West Division is a technical document prepared to manage the forest under Kamrup West Division on sustainable basis with the overall objective to conserve biodiversity, soil and water regime, enhance production of forest produce to meet the market needs and also the needs of the local people.

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

The working circles proposed and approved in Preliminary Working Plan Report (PWPR) for Kamrup West forest division are as follows:

- 1) Sal Working Circle
- 2) Teak Working Circle
- 3) Joint Forest Management Working Circle
- 4) Forest Protection (Overlapping) Working Circle.
- 5) Non Timber Forest Produce (Overlapping) Working Circle.
- 6) Wildlife (Overlapping) Working Circle

Sal Working Circle: In the Previous Working Plan prescribed for Sal Shelterwood system, the clear felling system was replaced by Sal Shelter Wood System with Aided Natural Regeneration. The prescription couldn't be exercised because of ban imposed by honourable Supreme Court of India on WP(C) 202 on Godavaran case restricting tree felling. The main objective of the Working Circle was to raise large areas under aided natural regeneration. The objective itself was jeopardized. Following ban on tree felling in one hand and growing market demand of timber on the other hand, had caused unabated illegal felling in the forests of the Division. Maximum destruction of forest took place during a time span of 10-12 years from 1996 onwards. The situation went beyond control. Even then Range Officer of Protection Squad was badly assaulted by timber smuggler while rendering patrolling duty. Several other staffs too faced such humiliation by illegal wood cutters. Harvestable trees were removed by illegal doers. Now coppice shoots of those illegally felled trees have come up and attained pole size. Protection of these coppice forest along with artificial regeneration is the ultimate requirement of the Sal forest. All the compartments containing Kamrup Alluvial Plain Sal and Hill Sal have been placed in this Working Circle. Teak plantations up to the extent of 10 Ha raised in such compartments in the past is also included in this Working Circle. The silvicultural operations viz. climber cutting, weeding and thinning shall be allowed.

Teak working circle: Prescription of previous Working Plan could not be exercised because of the same ground as in Sal Working Circle. All the Forest areas covered under moist mixed deciduous formations in the hill slopes, crest, ridges, spurs as well as the existing teak plantation have been allotted to this working circle. The silvicultural operations viz. climber cutting, weeding and thinning shall be allowed.

Joint Forest Management (Overlapping) Working Circle: This working circle has been constituted keeping in view of 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 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. 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 Rules 1998."

Forest Protection (Overlapping) Working Circle: The activities of Forest Protection in general like combating illicit felling, checking illegal encroachment, protection from fire, poaching and hunting of

wild animals, smuggling etc. is kept in a separate overlapping working circle, as much thrust is laid on forest protection. This will be an overlapping working circle applicable to entire Division with priorities starting from problematic areas. Creation of base camps, strike forces, mobile parties, flying squad parties, engagement of professional lawyers for prosecuting the offenders and confiscation of forest produce with vehicles, illegal encroachment eviction forces, watch towers, wildlife protection force etc. are the major activities planned under this working circle.

NTFP (overlapping) Working Circle: The NTFP Working Circle shall comprise largely of fringe forest areas or such other areas, which are fit for extraction of particular NTFP at a rate that does not lead to the long term decline of the biological diversity so as to maintain its potential to meet the needs and aspirations of present and future generation. Forest of Kamrup West Division consists of various NTFP such as Bamboo, Broom grass, thatch, Honey, Dalchini along with the various medicinal and aromatic plants. Agor also known as Sashi (*Aquilaria agallocha*) will be introduced in JFMC mode. This Working Circle aims at production and harvesting of high quality bamboo on a sustainable basis. All the poorly stock bamboo bearing areas, particularly, in the fringe areas, shall be restocked with indigenous and commercially viable species. The Working Circle shall not only meet the demands of Paper Mill, Households, Crafts and Cottage Industries but also provide proper facilities for processing, storing and marketing of bamboo. The main objectives of this Working Circle are

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

Wildlife Management (overlapping) Working Circle: Kamrup West Division lies in Zoo-Geographically under traditional zone between Indian Sub Region and Indo-Chinese sub region of oriental region. As a result, there is intermingling of species of both regions. Though previously this region was very rich in diversity of its wildlife, at present diversity has reduced. The objective of this Working Circle is to create and manage good habitat for wild animals. The main criteria of wildlife habitat i.e., food, water and shelter shall be looked into and all necessary measures shall be taken to improve the habitat. Fruits trees and fodder species will be planted. Measures shall be taken to reduce man-animal conflicts. Eco-tourism which is an effective tool for wildlife management and Biodiversity conservation shall be encouraged in the Division.

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

Yunush Salim, AFS, DCF

Acknowledgement

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

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The Process of data collection for writing this Working Plan was initiated by Sri B.C. Das, AFS, the then DFO and SWPO of the Division. His works were carried forward by Sri. Mrinal Baruah, AFS, Sri. B.C. Kalita, AFS, Sri Ranjan Goswami, AFS and finally by Smt Dimpy Bora IFS who hold the charge of Kamrup West Division one after another. Their contributions in the form of various information and data which were vital for the Working Plan are commendable. I am thankful to all these senior officers. I am also thankful to Ms. Preeti Buragohain, AFS, ACF for her continuous support to collect 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 the o/o. Addl. PCCF (RE&WP), Assam. The thematic maps were validated on the ground with support from IORA Ecological Solutions Pvt. Ltd (IORA). I offer my sincere acknowledgement to NESAC, IORA and staffs of GIS Cell of o/o. Addl. PCCF (RE&WP), Assam for their valuable contributions.

**Yunush Salim, M.Sc. (Env. Sc.), AFS, DCF
SWPO for Kamrup West Division**



Abbreviations

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

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

EXECUTIVE SUMMARY

I. Introduction:

The working plan for the Kamrup West forest Division, Assam for the period 2022-23 to 2031-32 is prepared as per the National Working Plan Code-2014. The proposed Plan deals with the Forest of Kamrup West Division situated within the Geographical limits of 25.43° and 26.51° N latitude and between 90.36° and 92.12° E longitude.

The Division is located within the Kamrup (Rural) administrative District as the northern boundary flanks with the River Brahmaputra and district Barpeta, to the east with district Kamrup (M), southern boundary is an interstate boundary with Meghalaya and western boundary is formed with the district Goalpara. The R.F.s in southern region of the Division are located in the hilly terrain that are actually in continuation with the Khasi hills ranges in the form of spurs. The northern part is mainly consisted with Taris (alluvial terraces), and Julis (narrow winding, low-lying tracts). Most of the parts of this area are located in the plain ultimately connected with the southern valley of the river Brahmaputra. That is composed mainly of alluvial of recent to sub-recent origin and rocks of pre-cambrian gneissic complex.

The intense pressure on the forest reserves are due to the intrusion of humans and illegal felling. Most of the natural capital grown in the form of valuable Sal, Teak and other species had been lost due to unabated illegal logging by timber smugglers. Increased population and demand for land for cultivation as well as for habitation coupled with poverty results into growing rate of encroachments. To deal with such issues upliftment of socio-economic condition of village communities, Infrastructure development, positioning of front line staffs and adequate surveillance near the inter-State boundary need to be done.

Most of the Reserved Forests of Kamrup West Division are surrounded by human habitations/ cultivations and due to the constant disturbances, wildlife habitat has been destroyed resulting large animals been wiped out or have moved else-where. Sometimes man-animal conflicts are also observed in the Division for which provision of financial aid to the victim needs to be provided. From the point of view of soil-conservation, the practice of 'Shifting cultivation' or Jhumming prevalent in the hilly areas in some of the Reserved Forests is to be discouraged.

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. The clear vision of the Working Plan of Kamrup West Division is that on implementation of this Working Plan prescriptions, one can see -

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

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

b) Goals and objectives of management:

The goal of this working plan is to restock the degraded forest and to maintain the green cover in the Reserved forest favoring the intactness of natural vegetation and commencement of massive plantation drive in the Reserved forests. The management practice includes incorporation of the community people through JFMC approach for protection and regeneration of the forest area. The secondary thought behind this management practice is that livelihood generation and awareness shall be raised among the community people. Rehabilitation of the encroachers from the Reserved forest and to reduce man animal conflict and finding ways of extraction of minor minerals without causing harm to the standing forest, that will help in the revenue generation source for the Division. Further the plan shall deal with the reduction of the jhum agricultural practices and stern action against the illegal doers. The specific goal of this Working Plan are-

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

The objectives of the Working Plan to achieve the goals are -

- Reforest the degraded Forests areas by aided natural regeneration as well as artificial regeneration with indigenous species with a view to restock those areas as it was 50 years back with good stock of wood so as to bring the forest to such a state that it can yield maximum timber product to meet the growing need and to produce good amount of revenue to the State.
- To protect the natural capital by intensive protection measures including smart patrolling, enforcing and implementing various forest protection Acts/Rules/ Regulations and ensuring utilization of full capacity of the officers and staffs.
- Increase the forest cover by raising endemic diverse plantation in large scale with intensive system of management so that lushes of green foliages can supply maximum oxygen to the atmosphere and at the same time the stems can sequester maximum carbon.
- To identify and demarcate the *Juli* lands under cultivation and to introduce economically viable agro-forestry practice and thus saving the forests from deliberate destruction.
- Involve the village communities in forest protection, development and management; and to improve the socio-economic conditions of the communities. The schedule tribes and other forest dependent communities shall also be included for this purpose.
- Maintain a steady yield of NTFP and firewood without diminishing the existing growing stock.
- To conserve and protect the natural water bodies existing within the division.

c) SWOT analysis:

The Kamrup West Division is prospered with excellent floral diversity, dense forest of natural Sal in the alluvial and low hill zones that holds the reason for controlled land degradation. Presence of trained and skilful staffs in the Division helps in the well administered Division and the perennial water bodies in the watershed embraces proper moisture content into the Division. The JFMC's cooperation, wider prospect of ecotourism and presence of adequate minerals may raise the livelihood opportunity in the Division.

Poor socio-economic condition of village communities, inadequate number of staff, deficiency of young blood in the department, underground ethnic problems etc. are the major issues for the development of the Division. Poor infrastructure along with the unmarked inter-State boundary happens to be the chances of illegal activities in the Division. Whereas encroachment, illegal felling are the most prominent threat to the Division.

Means of livelihood development for the forest dependent people are proposed in the present plan such that poverty and dependency in the forest area are cut. Management of the forest through parallel organization of the different activities in the Division will be easier and has been proposed in Kamrup West, Assam through this working plan.

The detail SWOT analysis carried out for prescriptions and strategies for achieving the goals and objectives is shown in the table 1.0 below.

Table 1: SWOT analysis of the Kamrup West Division Assam.

STRENGTHS	WEAKNESS
➤ Availability of adequate species of flora. ➤ Fertile Soil. ➤ Existence of perennial water bodies. ➤ Natural Sal plantation. ➤ Presence of trained and experienced staffs.	➤ Inadequate number of staffs and deficiency of new blood in department. ➤ Underground ethnic problems. ➤ Lack of infrastructure. ➤ Poor fund flow. ➤ Large degraded area. ➤ Disputed inter-State boundary.
OPPORTUNITIES	THREATS
➤ Co-operation from social local organization/JFMC. ➤ Ecotourism potential. ➤ Presence of adequate minor minerals. ➤ Forest dependant community transformable to opportunity. ➤ Potential to become enhanced carbon sink	➤ Illegal felling ➤ Encroachment ➤ Jhum cultivation. ➤ Uncontrolled collection of firewood. ➤ Poor condition of adjoining village people of the RF areas.

d) Expected outcome:

The forest cover in the alluvial plain and the lower slopes of the Division will be enriched with green cover as the massive plantation program will be arranged on needful interval of time. Plantation will be focused on the gap filling strategies to maintain the intactness of the natural forest as well as the restoration of the degraded land in the Reserved forest. The JFMC's will be working with the implementation of several management practices and conservation of the forest that will fetch the community nice livelihood options. Encroachment issues will be controlled and the rehabilitation programme for the encroachers will also be carried out. Both Man-animal conflict and Jhum cultivation will be brought under vigil of the forest department such that reduced rate of occurrence shall be experienced.

e) Abstract of plan prescriptions: The abstract of works prescribed in the working plan of Kamrup West Forest Division, Assam, for the plan period 2021-22 to 2030-31 is shown in table 2 as per the format laid out under National Working Plan Code 2014.

Table:2 Abstract of works prescribed for 2021-22 to 2030-31

Chapter No.	Name of the W.C.	Prescribed activity	Physical target over a 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 = 28629.00	Area earmarked for Sal regeneration = 4300 hect
		Silvicultural operation Cleaning and Thinning in Periodic Block I,II,III and IV Operations in Periodic Blocks is in Para 2.6.7	28629.00 hect area shall be covered
		1 st weeding = May/June 2 nd weeding = July/August 3 ^{rs} weeding = September Pressing and Control burning = Late	4300 hect

		October to early November	
		Raising of Sal polypot seedling for vacancy filling 10,00,000	Polypot seedling 10,00,000
Part 2 Chapter 3 Para 3.6.7	Teak Regeneration Working Circle	Silvicultural operation Cleaning and Thinning in Periodic Block I,II, and III	19057.00 hect.
		Creation of Nursery for 3800 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
		Regeneration plantation of Teak in Kamrup West Division during the Working Plan period to cover at least 20% of area of Teak Regeation Working Circle	Area earmarked for Teak regeneration = 3800 hect. Requirement of stumps= 3800 x 2600/hect = 98,80,000
		Weeding: 3 rain weedings in 1 st & 2 nd year 2 weedings in 3 rd & 4 th year year It should be ensured that the plantations are established at the end of 5 th 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 = 6500 hect Maintenance 6500 hect x 5years	Plantation = 6500 hect Maintenance 6500 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, Ethnic cuisine, night halt at cottages etc.	5 units.
Part 2 Chapter 5 Para- 5.5.3, 5.5.4	Forest Protection (Overlapping) Working Circle	Intensive protection measures will be taken for protection, Strengthening the forest protection squads/ personnel with modern equipments, logistics, vehicle and manpower.	Procurement of vehicles, logistics, construction of barrack, watch-tower etc.
		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 allotment net area under encroachment shall be worked out and eviction plan will be implemented.
		Boundary pillars (Main pillars 1 every 1 kilometer and sub pillars 3 every 1 km). Creation of barriers including rajor-wire permanent fencing etc. to check biotic interference wherever necessary. Main Pillars = 215 Sub Pillar = 641	a) Main boundary pillars = 215 b) Sub pillars 504 = 641 c) Creation of barriers including rajor-wire permanent fencing etc. to check biotic interference

Part 2 Chapter 6 Para- 6.6.2, 6.6.6	Non timber forest produce (overlapping) working circle	a) NTFP Plantation = 2100 hectares a) NTFP Maintenance = 1250 hect. b) Bamboo Plantation = 850 hectares b) Bamboo Maintenance = 2550 hect	c) 2100 hectares d) Maintenance = 1250 hect e) 850 hectares f) Maintenance = 2550 hect
Part 2 Chapter 7 Para- 7.6, 7.7	Wildlife Management W.C	Habitat enrichment: a) Regeneration of various fruit, fodder species b) Maintenance of Plantation 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	750 hect. 1000 hect 10 nos a) As shown in detailed estimate. b) Total 10 Bolero SUV and 5 Mini trucks c) 2 Kumki Elephants during elephant depredation season. d) 10 Watch towers e) Total 50 kms f) 50 km g) 80 programmes

f) Abstract of works prescribed during the Plan period along with annual target: The abstract of works prescribed in the working plan of Kamrup West forest Division, Assam, for the plan period 2021-22 to 2030-31 showing its year wise target is shown in table 3.

Table 3. Abstract of annual targets of Kamrup West 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	Silvicultural operation Cleaning and Thinning	3781	3381	3076	3041	2992	2817	2191	2415	2565	2370
		Regeneration (Natural) ANR supported by artificial regeneration 4300 hect area shall be covered up for ANR work during the plan period.	450	450	450	450	450	450	450	450	350	350
		1 st weeding = May/June 2 nd weeding = July/August 3 ^{rs} weeding = September Pressing and Control burning = Late October to early November	-	450	900	1350	1800	2250	2250	2250	2250	2150
Part 2 Chapt- 3 Para 3.6.7	Teak Regeneration Working Circle	Silvicultural operation Cleaning and Thinning Area earmarked for Teak regeneration = 19057.00 hect.	2130	2207	2113	2086	1895	1825	1915	1805	1475	1606
		Creation of Nursery for 3800 hect plantation during the Working Plan period. No of Nursery = 5, one each in every Range for 10 years 1.95 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 of Teak in Kamrup West Division during the Working Plan period. Area earmarked for Teak regeneration = 3800 hect. Requirement of stumps = $3800 \times 2600/\text{hect} = 98,80,000$	400	400	400	400	400	400	400	350	350	300
		Weeding: 3 rain weeding in 1 st & 2 nd year 2 weedingss in 3 rd & 4 th year year. It should be ensured that the plantations are established at the end of 5 th year.	-	400	800	1200	1600	2000	2000	2000	1950	1900
Part- 2 Chapt- 4 Para- 4.7.1, 4.7.5	Joint Forest Management Working Circle	Nursery and Plantation and entry point activity: Plantation = 6500 hect	650	650	650	650	650	650	650	650	650	650
		Maintenance 6500 hect x 5 years	-	650	1300	1950	2600	3250	3250	3250	3250	3250
		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 Chandubi, Kulsi, Ukium, Jongakhuli, gamarimura (<i>Jeep safari, Boat riding, Ethnic cuisine, night halt at cottages etc.</i>	5	5	5	5	5	5	5	5	5	5
Part 2 Chapt-5 Para- 5.5.3, 5.5.4	Forest Protection (Overlapping) Working Circle	a) 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 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 kilometer 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	-	-	-
Part 2 Chapt- 6 Para- 6.6.2, 6.6.6	Non timber forest produce (overlapping) working circle	NTFP Plantation = 2100 hectares	210	210	210	210	210	210	210	210	210	210
		NTFP Maintenance = 5040 hect. (2100 hect x 3 years)	-	210	420	630	630	630	630	630	630	630
		Bamboo Plantation = 850 hectares	85	85	85	85	85	85	85	85	85	85
		Bamboo Maintenance = 2040 hect (850 hectares x 3 years)	-	85	170	255	255	255	255	255	255	255
Part 2 Chapt- 7 Para- 7.6, 7.7	Wildlife Management and Biodiversity Conservation (overlapping) Working Circle	Habitat enrichment: a) Regeneration of various fruit, fodder species = 750 hect.	75	75	75	75	75	75	75	75	75	75
		b) Maintenance of Plantation =1800 hect (750 x 3 Yrs)	-	75	150	225	225	225	225	225	225	225
		c) 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 Kumki 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

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	Age Class	A group of trees in a stand that are at or nearly the same age.
4	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.
5	Artificial Regeneration	Establishing a new forest by planting seedlings or by direct seeding (as opposed to natural regeneration).
6	Aspect	The direction toward which a slope faces; its exposure in relation to the sun.
7	Basal Area	The area of the circle formed by the cross-section of a tree taken 1.3 m above the ground.
8	Benefit/Cost Analysis	A set of procedures for defining and comparing the quantified benefits and costs of a project or a course of action; used as an aid to decision making

9	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.
10	Biofuel	Biomass or materials derived from biomass that can be used to generate energy.
11	Biomass	The dry weight of all organic material, living or dead, above or below the soil surface.
12	Biosphere	The portion of the earth comprising the lower atmosphere, the seas, and the land surface (mantle rock) in which living organisms exist.
13	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.
14	Biota	The animal and plant life (fauna and flora) of a given area.
15	Block Cutting	Removal of the crop in blocks in one or more operations, generally for wildlife management purposes, encouraging regeneration, or protecting fragile sites.
16	Breast Height	The standard height, 1.3 m above ground level, at which the diameter of a standing tree is measured.
17	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.
18	Canopy	The more or less continuous cover of branches and foliage formed collectively by the crowns of adjacent trees.
19	Carbon Sequestration	The uptake and storage of carbon. Trees and plants, for example, absorb carbon dioxide, release the oxygen and store the carbon. Fossil fuels were at one time biomass and continue to store the carbon until burned.
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	Cleaning	A release treatment made in an age class not past the sapling stage in order to free the favored trees from less desirable individuals of the same age class which overtop them or are likely to do so.
23	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.
24	Clear-Cut	An even-age method of regenerating a stand through the removal, in a single cut, of all trees larger than seedlings. The new age class develops in a fully exposed microclimate. In some situations, small numbers of trees may be left within the clear-cut opening for some special purpose.
25	Climax forest	The final stage of succession, that is relatively stable and self-perpetuating.
26	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.
27	Composition, Stand	The proportion of each tree species in a stand expressed as a percentage of either the total number, basal area, or volume of all tree species in the stand.
28	Contour Map	A topographic map that portrays relief by means of lines that connect points of equal elevation.
29	Conditioning cut	A harvest cut which is used to improve the overall health of the stand by removing mature, overmature, low vigor and poor quality trees. The result is a stand of better stocking, more vigorous and desirable species, increased diversity, quality and growth potential.
30	Crown	The live branches and foliage of a tree.

31	Crown cover	The ground area covered by the crowns of trees or woody vegetation as delimited by the vertical projection of crown perimeters and commonly expressed as percent of total ground area (syn. Canopy Cover).
32	Crown Density	The amount and compactness of foliage of a tree crown.
33	Dbh (Diameter At Breast Height)	The stem diameter of a tree measured at breast height, 1.3 m above the ground.
34	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.
35	Deforestation	The long-term removal of trees from a forested site to permit other site uses.
36	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.
37	Diameter classes	A group of trees or logs of similar sizes at a common point. Usually in two-inch increments at DBH for trees and one-inch increments, inside the bark on the small end for logs.
38	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.
39	Ecosystem Services	Valuable, ongoing streams of benefits provided by healthy ecosystems, such as air and water purification, biodiversity maintenance, climate stabilization, mitigation of floods and droughts, detoxification and decomposition of wastes, generation and renewal of soil and soil fertility
40	Endangered species	Any life form which is in danger of extinction throughout all or a significant portion of its range. Its population level is so critically low and/or its habitat is so degraded that immediate action must be taken to avoid the loss of the species.
41	Endemic Species	A species that is indigenous to a particular area; not introduced and often with a limited geographical range.
42	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.
43	Ecological approach	Natural resource planning and management activities that assure consideration of the relationship between all organisms (including humans) and their environment.
44	Evergreen	Never entirely without green foliage, leaves persisting until a new set has appeared.
45	Even-aged Stand	A stand of trees containing a single age class in which the range of tree ages is usually less than 20 percent of rotation.
46	Forage	Grasses, herbs, and small shrubs that can be used as feed for livestock or wildlife.
47	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.
48	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.
49	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.
50	Forest Encroachment	The intrusion or establishment of a significant number of trees on grassland(s).
51	Forest Fire	Any wildfire or prescribed fire that is burning in forest, grass, alpine, or tundra vegetation types
52	Forest Floor	“Layers of fresh leaf and needle litter, moderately decomposed organic matter, and humus or well-decomposed organic residue.
53	Forest health	Forest can be considered healthy when there is a balance between growth and mortality, and the forest has the resiliency to react and overcome various forest impacts. Potential forest stressors include insects, pathogens, weather, climate, pollution, and others.

54	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.
55	Forest Productivity	The ability of tree species to grow on a particular site; influenced by internal (tree physiology) and external (soil, climate) factors.
56	Forest resources	Natural resources associated with forested ecosystems, included but not limited to; fish, air, clean water, wildlife, vegetation, soil, recreation and aesthetics.
57	Gap Analysis	A technique that assesses conservation plans and identifies ecosystems, land formations, or habitat types that are not currently adequately represented in the existing system of protected areas and reserves. Should be performed at regional, subregional, landscape, and watershed scales.
58	Genetic Diversity	Variation among and within species that is attributable to differences in hereditary material.
59	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.
60	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.
61	Greenbelt	A strip of undisturbed soil and vegetation left along waterways or access routes to minimize the environmental impact from development.
62	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.
63	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.
64	Ground Truthing	The use of a ground survey to confirm the findings of an aerial survey or to calibrate quantitative aerial observations.
65	Groundwater	Water below the level of the water table in the ground; water occupying the subsurface saturated zone.
66	Group selection	A method of regenerating uneven-aged stands in which trees are removed, and new age classes are established, in small groups. The maximum width of the group is approximately twice the height of the mature trees, with these small openings providing micro-environments suitable to regenerate shade intolerant tree species (requiring direct sunlight for growth). These areas are generally not more than one-quarter acre in size.
67	Growing Stock	The volume estimate for all standing timber at a particular time.
68	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.
69	Harvest	To fell or remove timber, other than under a silviculture treatment.
70	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.
71	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.

72	Improvement cutting	A cutting made in a stand past the sapling stage primarily to improve composition and quality by removing less desirable trees.
73	Institutional Arrangements	"The laws, regulations, policies, social norms, and organizations governing and participating in resource use. Institutional arrangements specify who has access to resources, guide resource development activities, and define who will monitor and enforce the rules.
74	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.
75	Intermediate treatments	A collective term for any treatment designed to enhance growth, quality, vigor, and composition of the stand after establishment of regeneration and prior to final harvest.
76	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.
77	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.
78	Livestock	Farm animals regarded as an asset.
79	Lopping	Chopping branches, tops, and small trees after felling into lengths such that the resultant slash will lie close to the ground.
80	Mature forest	Generally used in an economic sense to indicate that a forest has attained harvest age.
81	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.
82	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.
83	Microplan	Microplan is a community based empowering tool for preparing a road map for development and management of forest and livelihood enhancement of the forest dependent communities with properly defined roles and responsibilities of all stakeholders, clearly set targets and well discussed deadlines.
84	Mitigation	To minimize, reduce, or moderate a certain force such as potential for wildfires.
85	Mortality	Death or destruction of forest trees as a result of competition, disease, insect damage, drought, wind, fire, and other factors (excluding harvesting).
86	Native Species	A species known to have existed on a site before the influence of humans.
87	Natural regeneration	A stand of trees created from natural seeding, sprouting, suckering, or layering.
88	Net Present Value (NPV)	A stand's present worth before harvesting once costs associated with its establishment and tending have been subtracted.
89	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.
90	Nurse Tree (Nurse Crop)	A tree, group of trees, shrubs, or other plants, either naturally occurring or introduced, used to nurture or improve the form of a more important tree or crop during youth by protecting it from frost, sun scald or wind.
91	Old-growth forest	Forests that contain a wide range of tree sizes and ages, a deep, multilayered crown canopy, diverse shrub and forb layers, and significant accumulations of coarse woody debris including snags and fallen logs. Stands typically appear all-aged rather than even-aged. Large trees can be evidence that the old growth ecosystem has had sufficient time to develop diverse structure, although not all old growth stands have large trees, particularly on less productive sites. Large trees can exist in relatively young stands on very productive sites.

92	Partial cutting	The removal of a specific segment or component of a stand in a single operation, followed by a series of operations which remove other components until a specific goal is attained.
93	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.
94	Plot	A carefully measured area laid out for experimentation or measurement.
95	Precommercial thinning	A thinning that does not yield trees of commercial value, usually designed to improve crop spacing.
96	Prescriptions	The written instructions by a forester for the preparation and administration of a resource management practice.
97	Preservation	The act of guarding, securing, or sustaining an item so as to retain its character and quality.
98	Propagation	To breed or multiply by regeneration, seed or cuttings.
99	Pruning	To cut off or remove dead or living tree branches to improve tree growth, quality and commercial value of the tree.
100	Rare (species)	Species of a given region that are found in unusual habitats where local edaphic, topographic or biotic factors provide conditions unfavorable for those species having a more widespread distribution. Examples of such areas in WV are; rock cliffs, rocky water splashed river banks, sphagnum bogs (or glades) and shale barrens.
101	Regeneration (reproduction) method	A cutting method by which a new age class is created. The major methods are clear cutting, seed tree, shelterwood, selection, and coppice.
102	Reforestation	The re-establishment of trees on denuded forest land by natural or artificial means, such as planting and seeding.
103	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.
104	Regular uneven-aged (balanced) stand	A stand in which three or more distinct age classes occupy approximately equal areas and provide a balanced distribution of diameter classes.
105	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.
106	Rotation	The planned number of years between the regeneration of a forest stand and its final cutting.
107	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.
108	Secondary growth forest	The forest subsequent to a harvest or other disturbance.
109	Secondary succession	The succession or progression of plant communities that occurs on a site that previously contained a plant community that was removed by natural or man-caused disturbance. Primary succession is a term applied to vegetational changes that occur on sites where no vegetation has grown before (e.g., a new island, newly exposed rock).
110	Seed tree method	An even-aged regeneration method in which a new age class develops from seedlings that germinate in fully exposed micro-environments after removal of all the previous stand except a small number of trees left to provide seed. Seed trees are removed after regeneration is established.
111	Shade intolerant	A description assigned to any tree species whose seedlings are incapable of sustained development in low light.
112	Shade tolerant	Plants that are more competitive in shaded environments through selection for low respiration rates, they also tend to have lower photosynthetic rates and hence grow slowly in all environments.
113	Shrub	A woody plant of relatively low height, distinguished from a tree by having several stems rather than a single trunk.

114	Shelterwood method	A method of regenerating an even-aged stand in which a new age class develops beneath the partially-shaded micro-environment provided by the residual trees. In one or more succeeding harvests the residual stand is removed to fully release the established regeneration.
115	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.
116	Silviculture system	A planned process whereby a stand is tended, harvested, and re-established. The system name is based on the number of age classes and/or the regeneration method used.
117	Single tree selection	A method of creating new age classes in uneven-aged stands in which individual trees of all size classes are removed more or less uniformly throughout the stand to achieve desired stand structural characteristics.
118	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.
119	Species	A group of individuals that have their major characteristics in common and (usually) can only breed with each other.
120	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.
121	Temperate Forest	One of three main forest zones in the world. The woodland of rather mild climatic areas; composed mainly of deciduous trees.
122	Timber	Trees, whether standing, fallen, living, dead, limbed, bucked, or peeled.
123	Topography	The collective physical features of a geographic area, such as those represented on a map, especially the relief and contours of the land.
124	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.
125	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 West Division, Assam: The Kamrup West Forest Division is a habitat of diverse flora. Detail list of different flora is given in Table- 4.

Table 4: List of diverse flora found in Kamrup West forest Division, Assam.

A. Plant species		
Sl. No.	Vernacular Name	Botanical Name
1	Aam	<i>Mangifera indica</i>
2	Amara	<i>Spondis magnifera</i>
3	Autha-dimaru	<i>Ficus roxburghii</i>
4	Ahoi	<i>Vitex peduncularis</i>
5	Ahot	<i>Ficus religiosa</i>
6	Azar	<i>Lagaestromia speciosa</i>
7	Amlokhi	<i>Emblca officinalis</i>
8	Amari, Lali	<i>Amoora wallichii</i>
9	Atha-Bor	<i>Ficus elastic</i>
10	Bandardima	<i>Dysoxylum binectariferum</i>
11	Bel	<i>Aegle marmelos</i>
12	Bhakul-potol, Phulat	<i>Styrax serrulatum</i>
13	Barthekera	<i>Garcinia pedunculata</i>
14	Bhatghila	<i>Oroxylum indicum</i>
15	Bhomora, Bohera	<i>Terminalia bellerica</i>

16	Bogori	<i>Zizyphus jujube</i>
17	Banbagari	<i>Zizyphus mauritiana</i>
18	Bar	<i>Ficus bengalensis</i>
19	Bhedeli	<i>Saproma tematum</i>
20	Bajranali	<i>Fagara budrunga</i>
21	Baghnala, Haaluka	<i>Lisea glutinosa</i>
22	Boga-Ameri	<i>Aphanamasix polystachy</i>
23	Bogipoma	<i>Chukrasia tubularis</i>
24	Barun	<i>Creataeva nurvala</i>
25	Bhomrati	<i>Symplocos oxyphylla</i>
26	Boga-Kalti, Bhela	<i>Carthium nurvala</i>
27	Belphoi, Sakho	<i>Castonopsis purpurella</i>
28	Bharatmuni, Bhoira, Rotha	<i>Symplocos laurina</i>
29	Bhadia	<i>Vitex pinnata</i>
30	Bola	<i>Morus laevigata</i>
31	Bhe	<i>Salix tetrasperma</i>
32	Bijon-gach	<i>Grewia elastic</i>
33	Bohot	<i>Artocarpus lakoocha</i>
34	Bhellu, Bolom	<i>Tetramelos nudiflora</i>
35	Bhelkor	<i>Trewia nudiflora</i>
36	Beal, Gabarhuta	<i>Cordia dichotoma</i>
37	Bhela	<i>Semicarpus anacardium</i>
38	Bhotola	<i>Trevesia palmate</i>
39	Bonbholuka, Poreng	<i>Olea diocia</i>
40	Boga-Kotra, Kurol	<i>Bauhinia variegata</i>
41	Bonposola, Memoi	<i>Meliosma pinnata</i>
42	Bonhualu, Harupadrai	<i>Belisciedia brandisii</i>
43	Bhritokon	<i>Mallotus roxburghii</i>
44	Bansum	<i>Phoebe goalparensis</i>
45	Borpat	<i>Ailanthus grandis</i>
46	Bakul	<i>Mimousops elengi</i>
47	Bon-Am	<i>Mangifera sylvetica</i>
48	Bottle Brush	<i>Callistemon linearis</i>
49	Bogijamun	<i>Eugenia praecox</i>
50	Bon Pitha	<i>Chrysophyllum roxburgii</i>
51	Chalmugra	<i>Hydnocarpur kurzii</i>
52	Chirpine	<i>Pinus roxburaghii</i>
53	Choi-parali	<i>Oreocnide integrifolia</i>
54	Chika-maruli, Kodalkania	<i>Alangium Chinense</i> (Syn. <i>A.begoniaefolium</i>)
55	Dimoru	<i>Ficus glomerata</i>
56	Dukoha	<i>Drypetes assamica</i>
57	Dewa, Cham	<i>Artocarpus chaplasha</i>
58	Daini-Jam, Kathalboul	<i>Carallia brachiate</i> (Syn. <i>C. integenium</i>)
59	Dol Poduli	<i>Glochidion velutinum</i>
60	Dhopabar	<i>Ficus mysorensis</i> (Syn. <i>F.Drupacea</i>)
61	Dudhkhuri	<i>Holarrhena pubescens</i>
62	Dhopaparali	<i>Hapiophregma adenophyllum</i>

63	Dudhi	<i>Wrightia tomentosa</i>
64	Dhuna	<i>Canarium bengalense</i>
65	Dalchine	<i>Cinnamomum zeylanium</i>
66	Debdaru	<i>Polyanthia longifolia</i>
67	Eucalyputs	<i>Eucalyptus globules</i>
68	Garobhala	<i>Myristica linifolia</i> (Syn. <i>M. Longifolia</i>)
69	Godhajam	<i>Syzigium cerasoideum</i>
70	Gaborhita, Samsuku	<i>Pavetta indica</i>
71	Gainali, Gunaru, Gonderi	<i>Premna latifolia</i>
72	Gaunkeuta, Rangapatiagach	<i>Wendlandia tinctoria</i>
73	Gaborhitha, Gaborhura	<i>Micromelum pubescence</i>
74	Gomari	<i>Gmelia arborea</i>
75	Gadgubar	<i>Ficus latifolia</i>
76	Garokhuta	<i>Aporosa aurea</i>
77	Garobhangra	<i>Symplocos ferruginea</i>
78	Gorumara	<i>Crypteronia paniculata</i>
79	Garogine	<i>Aporosa roxburghii</i>
80	Gohora	<i>Premna bengalensis</i>
81	Garjan	<i>Dipterocarpus trubinatus</i>
82	Ghora nim	<i>Melia azadarach</i>
83	Gunaro	<i>Premna latifolia</i>
84	Gol nemu	<i>Citrus paradise</i>
85	Gandsoroi	<i>Cinnamomum cecicodaphne</i>
86	Ghila	<i>Entada pursaetha</i>
87	Hilikha	<i>Terminalia chebula</i>
88	Haldu	<i>Adina excels</i>
89	Harumoin	<i>Randia fasciculate</i>
90	Hingori	<i>Castanopsis indica</i>
91	Helok, Poreng	<i>Elaeocarpus rohusus</i>
92	Hiharu	<i>Albizzia odoratissima</i>
93	Honalu, Muga	<i>Litsea monopetala</i>
94	Heloch, Mikhantenga	<i>Antidesma ghesaembila</i>
95	Hatikerapa	<i>Liex godajam</i>
96	Hatipolia	<i>Pterospermum acerifolium</i>
97	Hollokh	<i>Terminallia myriocarpa</i>
98	Hollong	<i>Dipterocarpus macrocarpa</i>
99	Jam	<i>Syzygium cumini</i>
100	Jaribar	<i>Ficus gobbosa</i>
101	Juglo	<i>Macaranga indica</i>
102	Jarath	<i>Mallotus philippinesis</i>
103	Jari-udal	<i>Fermiana colorata</i>
104	Jari	<i>Ficus benamina</i>
105	Jatipoma	<i>Toona ciliate</i>
106	Joba-hingori	<i>Sloanea assamica</i>
107	Jooba, Lewa	<i>Engelhardtia spicata</i>
108	Jutuli	<i>Altingia excels</i>
109	Jamuk	<i>Eugenia jambolma</i>
110	Jalpai	<i>Elaeocarpus varuma</i>

111	Jyagya Dimoru	<i>Ficus glomerata</i>
112	Jiya	<i>Lannea grandis</i>
113	Kathal	<i>Artocarpus integrifolia</i>
114	Kanchan	<i>Bauhinia malabarica</i>
115	Kadam	<i>Anthocephalus cadamba</i>
116	Koroi	<i>Albizzia procera</i>
117	Kau-Thekera	<i>Garcinia cowa</i>
118	Kharipati Dimaru	<i>Ficus nervosa</i>
119	Kanthalpatia, Arnchoi	<i>Beilschmiedia assamica</i>
120	Khokon	<i>Daubanga grandiflora</i>
121	Kathia-Koroi, Datbijli	<i>Denis robusta</i>
122	Kethora, Moin	<i>Vanguiera spinosa</i>
123	Kuji-Thekera	<i>Gareinia kydia</i>
124	Kendu	<i>Diospyros toposia</i>
125	Kaunla	<i>Machilus globosa</i>
126	Kurila	<i>Brassiopsis speciosa</i>
127	Kotra, Tengakotra	<i>Bauhinia maladarica</i>
128	Khukru, Garokhukru	<i>Tricalysia singularis</i>
129	Kuhir	<i>Bischofia retusa</i>
130	Kotold	<i>Liex sulcata</i>
131	Kolti, Kollari	<i>Mitrephora tomentosa</i>
132	Kum	<i>Careya aroborea</i>
133	Koronda, Keseru, Karangiya	<i>Hteropanax fragrans</i>
134	Kumbhi	<i>Careya aroborea</i>
135	Kordoi	<i>Averrhoa carmbola</i>
136	Krishnasura	<i>Delonix rejia</i>
137	Kurta	<i>Polaquium polyanthum</i>
138	Kauripine	<i>Agathis robusta</i>
139	Korosh	<i>Derris indica</i>
140	Kaju badam	<i>Anacardium occidentale</i>
141	Komola	<i>Citrus reticulate</i>
142	Khokon	<i>Daubalga grandiflora</i>
143	Lichu	<i>Litchi chinensis</i>
144	Leteku	<i>Daccaurea remiflora</i>
145	Makurisal	<i>Schima wallichii</i>
146	Mekai	<i>Shorea assamica</i>
147	Mahagoni	<i>Swietania mehagoni</i>
148	Makhiti	<i>Flemingia strobilifera</i>
149	Mirtenga	<i>Bursera serrata</i>
150	Manipururohi	<i>Parkia roxburgii</i>
151	Modar	<i>Erythra stricta</i>
152	Mouhita	<i>Celtris timorensis</i>
153	Monisal	<i>Sppindus mukurosai</i>
154	Nahar	<i>Mesua ferrea</i>
155	Neem	<i>Azadiractha indica</i>
156	Nuni	<i>Morus acidosa</i>
157	Narahingha	<i>Murraya koenighii</i>
158	Nogatenga	<i>Myrica esculenta</i>

159	Outenga	<i>Dillenia indica</i>
160	Odal	<i>Sterculia villosa</i>
161	Okshi, Oxi	<i>Dillenia pentagyna</i>
162	Phulgamari	<i>Endospermum Chinense</i>
163	Panial	<i>Flacourtia cataphracta</i>
164	Pasatia	<i>Buddleia asiatica</i>
165	Pakribon	<i>Ficus rumphii</i>
166	Pareng	<i>Linoceria macrophylla</i>
167	Pajihuta	<i>Actinodaphne obovata</i>
168	Pichala, Bankapahi	<i>Kydia calycina</i>
169	Panikodom	<i>Hymenodictyon excelsum</i>
170	Patkuhir, Markuhir	<i>Bridelia tomentosa</i>
171	Parul	<i>Lagerstroemia indica</i>
172	Pisoli	<i>Grewia microcos</i>
173	Phoko, Dhapapatia	<i>Meliosma simplicifolia</i>
174	Pakdima, Sobaigach	<i>Trema orientalis</i>
175	Petarichawa	<i>Actiondaphne augustifolia</i>
176	Palas	<i>Butea monospermum</i>
177	Poma	<i>Cedrela toona</i>
178	Paspotia	<i>Vitex canescens</i>
179	Pokori	<i>Ficus ryuphii</i>
180	Panial	<i>Flacourtia jangonus</i>
181	Putranjeeva	<i>Drypetes roxburghii</i>
182	Parolli	<i>Stereospermum chelenoides</i>
183	Pansopa	<i>Michelia montana</i>
184	Polash	<i>Butea monosperma</i>
185	Rohimola	<i>Garuga pinnata</i>
186	Robabtenga	<i>Citrus grandis</i>
187	Radhasura	<i>Caesalpinia pulcherrima</i>
188	Sunaru	<i>Cassia fistula</i>
189	Siris	<i>Albizzia lebek</i>
190	Sau	<i>Albizzia stipulate</i>
191	Sain	<i>Terminallia tromentosa</i>
192	Sidha	<i>Lagerstromia parviflora</i>
193	Segun	<i>Tectona grandis</i>
194	Sal	<i>Shorea robusta</i>
195	Simolu	<i>Bombax malabaricum</i>
196	Sisso	<i>Dalbargia sisso</i>
197	Sam Kothal	<i>Artocarpus chama</i>
198	Sojena	<i>Moringa officinalis</i>
199	Sewalli	<i>Nyctanthes arbortristis</i>
200	Sarpagandha	<i>Rouwolfia serpentina</i>
201	Sandan	<i>Santallum album</i>
202	Sam Koro	<i>Albia adoratisima</i>
203	Sendur	<i>Bixa orellena</i>
204	Sotiona	<i>Alstonia scholaris</i>
205	Teteli	<i>Tamarindus indica</i>
206	Titasopa	<i>Michelia champaca</i>

207	Tejpat	<i>Cinnamomum obtusifolium</i>
208	Tal	<i>Borassus flabelliformis</i>
209	Tokou	<i>Livistona jenkinsiana</i>
210	Tengabor	<i>Ficus infectoria</i>
211	Teta	<i>Vitex canescens</i>
212	Tezronga	<i>Myristica angustifolia</i>
213	Tepora	<i>Garcinia zanthochymus</i>
214	Urium	<i>Bischofia javanica</i>

Bamboo

Sl. No	Scientific Name	Local Name
1	<i>Bambusa balcooa</i>	Bhaluka
2	<i>Bambusa bambos</i>	Kotoha, Kotabanh
3	<i>Bambusa mastersii.</i>	Beti banh
4	<i>Bambusa nutans</i>	Deobanh, Jotia,
5	<i>Bambusa pallida</i>	Bijuli, Jowa, Makal.
6	<i>Bambusa teres</i>	Bhaluki, paura
7	<i>Bambusa tulda</i>	Jati, Nal banh.
8	<i>Dendrocalamus strictus</i>	Karail, Jati
9	<i>Dendrocalamus giganteus.</i>	Worra
10	<i>Dendrocalamus hamiltonii.</i>	Kakoa, Kakeo banh
11	<i>Schizostachyum pergracile</i>	Madang
12	<i>Schizostachyum griffithii</i>	Behti banh
13	<i>Schizostachyum dullooa</i>	Dalu banh
14	<i>Schizostachyum polymorphum</i>	Bajal banh, bajah banh.
15	<i>Melocanna baccifera=M.bambusoides</i>	Tarai banh, Nah banh, Muli ban

Cane

Sl. No	Scientific Name	Local Name
1	<i>Calamustennuis</i>	Jati Bet
2	<i>Calamus flagellum</i>	Raidang Bet

B, Shrubs, Herbs etc.

1	Agra	<i>Urena lobata</i>
2	Athubanga	<i>Leea sp.</i>
3	Akan	<i>Calotropis gigantean</i>
4	Abutenga	<i>Antidesma diaandrum</i>
5	Anchukath, Asugach	<i>Morinda angustifolia</i>
6	Akalbih	<i>Clerodendron indicum</i>
7	Awuapat, Machpora	<i>Maesa indica</i>
8	Arakchantita	<i>Rouvolifa serpentina</i>
9	Bhedelilata	<i>Hedyotis scandens</i>
10	Bonbabori	<i>Phyllanthus simplex</i>
11	Bahak	<i>Adhatoda Vasica</i>
12	Bormanmuni	<i>Hdrocotyle asiatica</i>
13	Bogitora	<i>Alpinia allughas</i>
14	Baghanchora,	<i>Zanthoxylum hamiltonium</i>

15	Bontulasi	<i>Geniosporum strobiliferum</i>
16	Bhekuri	<i>Solanum indicum</i>
17	Bhang	<i>Cannabis sativa</i>
18	Bonkapahi	<i>Abroma augusta</i>
19	Boriala	<i>Sida carpinifolia</i>
20	Bitmora, Dhublokhla	<i>Gardenia campanulata</i>
21	Bontil	<i>Anisomeles ovate</i>
22	Biringa, Biring-guli	<i>Rhamnus nepalensis</i>
23	Biyonihaputa	<i>Desmodium labumifolium</i>
24	Bonjora	<i>Paramignya griffithii</i>
25	Bhita-tita	<i>Solanum torvum</i>
26	Bishalyakarani, Titabahak	<i>Justicia gendarussa</i>
27	Chaul-Dhoa	<i>Ardisia solanacea</i>
28	Chagal-Ladi	<i>Glocosmis pentaphylla</i>
29	Chirata	<i>Exacum tetragonum</i>
30	Dighlati	<i>Litsaea Salicifolia</i>
31	Dhopat-tita	<i>Clerodendron viscosum</i>
32	Doukhiguti	<i>Elaeagnus pyrifolia</i>
33	Daridiga, Bonmedelua	<i>Cassia tora</i>
34	Eragach	<i>Bicinus communis</i>
35	Gohoralota	<i>Myxopyrum smilacifolium</i>
36	Gachbionihaputa	<i>Desmodium latifolium</i>
37	Genderi, Gainoli	<i>Premna croymbosa</i>
38	Hankha-Ojar-mons	<i>Dichidia rafflesiana</i>
39	Haut-Tenga	<i>Casia occidentalis</i>
40	Hukta – Puta	<i>Grewia hirsuta</i>
41	Haru-manimuni	<i>Hydrocotyle rotundifolia</i>
42	Hoklati	<i>Sambucus javanica</i>
43	Heko-Toko	<i>Aphania rubra</i>
44	Hil-Kadam	<i>Homonia riparia</i>
45	Jhapipat	<i>Acanthopana trifoliatum</i>
46	Jor-Jewa	<i>Unona longiflora</i>
47	Jarmaniban	<i>Eupatorium odoratum</i>
48	Kathandaphul	<i>Coffea bengalensis</i>
49	Kaurikata	<i>Mimosa himalayana</i>
50	Kana dimaru	<i>Ficus heterophylla</i>
51	Kuhila	<i>Aeschynomene indica</i>
52	Kath-tenga, Kukurtenga	<i>Leea acuminata</i>
53	Kho jo	<i>Pouzolzia viminea</i>
54	Katurui	<i>Curcuma aromatica</i>
55	Kuhum Kenta	<i>Argemone mexicana</i>
56	Kaupat	<i>Phrynium imbricatum</i>
57	Kol	<i>Musa sanguine</i>
58	Matijam	<i>Premna herbacea</i>
59	Makhiati	<i>Flemingia strobilifera</i>
60	Manmani, Mathak-thuka	<i>Deningea amranthoides</i>
61	Mesaki	<i>Sarcochlamys pulchenima</i>
62	Makhiloti	<i>Desmodium cephalotes</i>

63	Manukataphul	<i>Holmskiodia sanguinea</i>
64	Moiratikoni	<i>Reidia hamitoniana</i>
65	Matikatota	<i>Bauhinia acuminata</i>
66	Narasimha	<i>Murraya koenigii</i>
67	Nangalbhanaga	<i>Clerodendron</i>
68	Owa	<i>Leea crispa</i>
69	Ogra	<i>Xanthium strumarium</i>
70	Phul-Jeleng	<i>Baliospeomum montanum</i>
71	Paniphuti	<i>Vibrunum colebrookianum</i>
72	Panimudi	<i>Glochidion sp.</i>
73	Phutkola	<i>Melastoma malabathricum</i>
74	Patidoi	<i>Clingyne dichotoma</i>
75	Pulikaint	<i>Cudrania javanensis</i>
76	Phutki	<i>Osbeckia rostrata</i>
77	Sokiati	<i>Mussaenda roxburghii</i>
78	Sorotgach	<i>Dendrocide sinuate</i>
79	Titaphul	<i>Phlogacanthus thyrstiflorus</i>
80	Thowraguti	<i>Grewia sapida</i>
81	Tit-bhakuri	<i>Solanum verbascifolium</i>
82	Thaljimura	<i>Cycus pectinata</i>
83	Thukurakhamal	<i>Dischidia nummularia</i>
84	Tara	<i>Gostus speciosus</i>
85	Ulucha	<i>Desmodium triguetrum</i>
86	Ulti-hot	<i>Achyranthes aspera</i>
87	Ursi, Takamala	<i>Desmodium pulchellum</i>
C. Climbers:		
1	Bhedelata	<i>Paederia tomentosa</i>
2	Bonpui	<i>Embelia nagushia</i>
3	Bandar-Kekowa	<i>Mucuna prurita and Dysolobiu grande</i>
4	Bokul Lata	<i>Embelia ribes</i>
5	Barkhi Lata	<i>Embelia ribes</i>
6	Bakal Bih	<i>Denis elliptica</i>
7	Bon Marich	<i>Clematis cadmia</i>
8	Chowrasi-fewa, Bonmirica	<i>Embelia nutans</i>
9	Changallata, Gorapchai	<i>Naravelia zeylanica</i>
10	Chagalsingalata	<i>Myriopterion extensum</i>
11	Dhekia-Lata	<i>Stenochieana palustre</i>
12	Deo-Jakhala	<i>Bauhinia anguinea</i>
13	Dhindaubagarilata	<i>Tapiria hirsta</i>
14	Dat-bijli	<i>Dalbergia tamarindifolia</i>
15	Ghilla-Lata	<i>Entada phaseoloides</i>
16	Ghahelewa	<i>Croton caudatus</i>
17	Gobanglata, Latadimar	<i>Conocephalus suaveolens</i>
18	Helolokha	<i>Millettia auriculata</i>
19	Hatibandhalata	<i>Butea parviflora</i>
20	Jokhuni-Lata, Dhobalata	<i>Heptapleurum venulosum</i>
21	Kharika-Lata	<i>Jasminum coarctatum</i>

22	Katagach	<i>Dalbergia rimosa</i>
23	Khamal Lata	<i>Wattakaka volubilis</i>
24	Kolilata	<i>Merremia umbellate</i>
25	Kukualata	<i>Thunbergia grandiflora</i>
26	Kirkirilata	<i>Jasminum scandens & Jasminum laurifolium</i>
27	Kuchai, Kuchialata	<i>Accacia pinnata</i>
28	Kusia-Kaint, Suselewa	<i>Accacia concinna</i>
29	Lataguti	<i>Cae salpinia crista</i>
30	Loti-Sorot	<i>Cnesmone javanica</i>
31	Lata-Dimaru	<i>Ficus scandens</i>
32	Lata Sali	<i>Combretum decandrum</i>
33	Nakkatilewa	<i>Bauhinia vahii</i>
34	Ow-Lata	<i>Delima sarmentosa</i>
35	Pani-Lata	<i>Cissus repanda</i>
36	Pahari-Lata	<i>Dalhousia bracteata</i>
37	Pichola-Lata	<i>Hibiscus fragrans</i>
38	Padri-Lewa	<i>Paederia foetida</i>
39	Sonarupa	<i>Mussaenda glabra</i>
40	Theboulata, Topouguti	<i>Hodgsonia hiteroclita</i>

III. List of fauna in Kamrup West division, Assam

The Kamrup West forest Division provides suitable habitat for a diverse fauna. The detail list of different fauna found in this Division is shown in table 5.

Table 5: List of diverse fauna found in Kamrup West forest Division, Assam

Mammals:			
Sl. No.	Local Names	English Name	Scientific Names
1	Hati	Indian Elephant	<i>Elephas maximus</i>
2	Axomiya Bandar	Monkey	<i>Macaca assamensis</i>
3	Bhaluk	Sloth Bear	<i>Melursus ursinus</i>
4	Xial	Jackal	<i>Canis aureus</i>
5	Langur	Common Languor	<i>Presbytis entellus</i>
6	Hollo Bandar	White Browed Gibbon	<i>Hylobates hoolock</i>
7	Nahar-Phutuki Bagh	Panther or Leopard	<i>Panthera pardus</i>
8	Dhekia-Patia Bagh	Royal Bengal Tiger	<i>Panthera tigris</i>
9	Banoria Chagali	Goral	<i>Neomorphedus goral</i>
10	Banaria Garu	Indian Bison	<i>Bos gaurus</i>
11	Banaria Gahori	Indian Wild Boar	<i>Sus scrofa</i>
12	Joha Mal	Indian Cirat	<i>Viverricula indica</i>
13	Kerkettua	Indian Squirrels	<i>Funambulus palmarum</i>
14	Ketela Pohu	Corcupanie	<i>Hystrix indica</i>
15	Xoha Pohu	Hare	<i>Lepus ruficaudatus</i>
16	Kemtai Pohu/Bonrou	Pangolin	<i>Manis crassicaudata</i>
17	Sar Pohu	Sambhar	<i>Cervus unicolor</i>
18	Xugori Pohu	Barking Deer	<i>Muntiacus muntjak</i>
19	Neul	Mongoose	<i>Herpestes auropunctatus</i>

20	Gash Bhaluk	Malayan Bear	<i>Helarctos malayanus</i>
21	Ud	Common Otter	<i>Lutra lutra</i>
Birds:			
1	Kuli	Koel	<i>Eudynamys scolopaceus</i>
2	Bhatow	Indian Parakeet	<i>Psittacula krameri</i>
3	Moina	Grackle, Hill Myna	<i>Gracula religiosa</i>
4	Ghan Chirika	House sparros	<i>Passer domesticus</i>
5	Kaori	House crow	<i>Corvus splendens</i>
6	Dhura Kaori	Jungle crow	<i>Corvus macrorhynchos</i>
7	Kath Halika	Grey headed myna	<i>Sturnia malabarica</i>
8	Chutial Halika	Bank myna	<i>Acridotheres ginginianus</i>
9	Bulbuli, Petuluka	Bulbul	<i>Molpastes cafer</i>
10	Barhoitoka, Kathkhola	Wood Pecker	<i>Dryobates mahrattensis</i>
11	Keteki	Cuckoo	<i>Hierococcyx various</i>
12	Kamcharai	Roller or blu jay	<i>Coracias bengalensis</i>
13	Bali-mahi, Khojjan	Wagtail	<i>Motacilla alba</i>
14	Dohikotora	Magpie robin	<i>Copysychus caularis</i>
15	Tokora Charai	Baya or weaver bird	<i>Ploceus philipinus</i>
16	Phesu	Black drongo or King Crow	<i>Dicruus macrooarus</i>
17	Kukuha	Crow-pheasant	<i>Centropus sinerisis</i>
18	Bota Charai	Munia	<i>Uroloncha striate</i>
19	Bhimraj	Racket talied drongo	<i>Dissomurus paradiseus</i>
20	Kankuria	Pied myna	<i>Sturnopaster contra</i>
21	Hokhioti, Patmadoi	Golden oriole	<i>Oiolus oriolus</i>
22	Heteluka	Barbet or Copper Smith	<i>Xantholoema haemacophal</i>
23	Kolakhathi or Chakcheki	Tree pie	<i>Dandrocitta vagabunda</i>
24	Dhamesh	Hornbil	<i>Dickoceros bicornis</i>
25	Bortokola	Adjutant stork	<i>Leptoptilos dubius</i>
26	Bogoli	Cattle Egret	<i>Bubulcus ibis</i>
27	Kopow	Ring dove	<i>Streptopelia dacapcto</i>
28	Machruka	Pied king-fisher	<i>Caryle rudis</i>
29	Hudu	Great-horned owl	<i>Bubo bubo</i>
30	Chilani	Brahminy kite	<i>Haliastur Indus</i>
31	Dauk	White breastea	<i>Amauvomis phoenicurus</i>
32	Baduli	Short Nosed Fruit bat	<i>Cynopterus sphinx</i>
33	Phesa	Spotted owlet	<i>Athens brama</i>
34	Konaamusari	Pon heron or paddy bird	<i>Ardeola grayii</i>
35	Horu bortokola	Lesser adjutant	<i>Laptoptilos javanticus</i>
36	Haitha	Green pigeon	<i>Crocopus phoenicopterus</i>
37	Hogun	Bengal vulture	<i>Pseudogyps Bengalensis</i>
38	Roja-hogun	King vulture	<i>Sarcogyps calvus</i>
39	Dorik	Partridge	<i>Francolinus francolinus</i>
40	Ganga Chiloni	River tern	<i>Sterna aurantia</i>
41	Pani Kaori	Little cormorant	<i>Phalacrocorax Carbo</i>
42	Mugi hanh	Common teal	<i>Anus Cracca</i>
43	Digholi hanh	Pin tail duck	<i>Amauvor</i>
44	Ghila hanh	Cotton teal	<i>Nettapus, Coromandelianus</i>
45	Xorali hanh	Whistling teal	<i>Dendrocygna Javanica</i>

46	Chakoi-Chkua	Brahminy duck	<i>Casarca Farruginea</i>
47	Machruka	Common king-fisher	<i>Alcado atthis</i>
48	Gubar-Khusara	Hoopoe	<i>Upupa eops</i>
49	Moukhap	Serpent eagle	<i>Haematemus Cheela</i>
50	Heh	Tawny eagles	<i>Aquila rapox</i>
Reptiles:			
1	Ajagar	Indian Python	<i>Phyton molurus</i>
2	Fetisap	Cobra	<i>Naja Naja</i>
3	Chakori Fetisap	King Corba	<i>Naja Hanrah</i>
4	Daras	Rat Sanke	<i>Ptyas mucosus</i>
5	Guisap	Manitor Lizard	<i>Varanus bengalensis</i>
6	Gharial	Crocodile	<i>Gravialis gangeticus</i>
7	Bah saap	Bamboo Viper	<i>Trimicerus</i>
8	Keko saap	Gecko	<i>Gecko gecko</i>
9	Masuwa	Common Krait	<i>Bungarus cacrubus</i>
10	Kola masuwa	Black Krait	<i>Bungarus niger</i>
11	Kacha	Assam Roofed Turtle	<i>Kachuga sylhetensis</i>
12	Pani gui	Water Monitor	<i>Varanus cacrubus</i>
13	-	River Turtle	<i>Hardella thurjii</i>
14	Dura kacha	Pond Turtle	<i>Gendemys hamitouii</i>
15	-	Roofed Turtle	<i>Kachuga tecta</i>
16	-	Box Hutle	<i>Cuora amboi nensis</i>
17	-	Brown Tortoise	<i>Geochelone emys</i>
Fishes:			
1	Rou	Rohu	<i>Labeo rohita</i>
2	Barali	Boil	<i>Wallago attu</i>
3	Magur	Cat fish	<i>Clarias batrachus</i>
4	Singhee	---	<i>Heteropneustes fossilis</i>
5	Mirika	Mrigal	<i>Cirrhinus mrigala</i>
6	Chital	Knife fish	<i>Notopterus chitala</i>
7	Puthi	---	<i>Puntius sophore</i>
8	Seni-Puthi	---	<i>Puntius sarana</i>
9	Kawoi	---	<i>Anabas testudineus</i>
10	Sal	---	<i>Channa marulius</i>
11	Goroi	Snake head	<i>Channa punctatus</i>
12	Pabho	Pabda	<i>Ompok bimaculatus</i>
13	Bhakua	Catla	<i>Catla catla</i>
14	Kurhi	---	<i>Labeo gonius</i>
15	Gagol	---	<i>Mystus menoda</i>
16	Kanduli	---	<i>Notopterus notopterus</i>
17	Sol	---	<i>Channa striatus</i>
18	Pithia	Mahasheer	<i>Tor Tor</i>
19	Arii	---	<i>Mystus Seenghala</i>
20	Bheu	---	<i>Mymstus aor</i>
21	Mali	---	<i>Laqbeo calbasu</i>
22	Ritha	---	<i>Rita Rita</i>
23	Bhangon	---	<i>Labeo bata</i>
24	Lasshim	---	<i>Cirrhinus reba</i>

25	Silgharia	---	Labeo dero

IV. List of other biota in Kamrup West Division:

Lichens					
S.No	Botanical name	Family	Growth form	Substratum	Abundance
1.	<i>Bacidia incongruens</i>	<i>Ramalinaceae</i>	Crustose	Bark	Rare
2.	<i>Buellia alboatra</i>	<i>Caliciaceae</i>	Crustose	Bark	Rare
3	<i>Calopadia fusca</i>	<i>Ectolechiaceae</i>	Crustose	Leaves	Common
4	<i>Caloplaca bassiae</i>	<i>Teloschistaceae</i>	Crustose	Bark	Rare
5	<i>Chiodecton leptosporum</i>	<i>Roccellaceae</i>	Crustose	Bark	Common
6	<i>Chrysothrix chlorina</i>	<i>Chrysothricaceae</i>	Leprose	Bark	Rare
7	<i>Cladonia coniocraea</i>	<i>Cladoniaceae</i>	Fruticose	Soil and rocks	Rare
8	<i>Coccocarpia palmicola</i>	<i>Coccocarpiaceae</i>	Foliose	Bark	Rare
9	<i>Collema pulcellum</i>	<i>Collemataceae</i>	Foliose	Bark	Rare
10	<i>Cryptothecia striata</i>	<i>Arthoniaceae</i>	Crustose	Barkand rocks	Common
11	<i>Dirinaria aegialita</i>	<i>Caliciaceae</i>	Foliose	Bark and rocks	Common
12	<i>Glyphis duriuscula</i>	<i>Graphidaceae</i>	Crustose	Bark	Common
13	<i>Graphis duplicata</i>	<i>Graphidaceae</i>	Crustose	Bark	Common
14	<i>Graphis scripta</i>	<i>Graphidaceae</i>	Crustose	Bark	Common
15	<i>Haematomma puniceum</i>	<i>Haematommataceae</i>	Crustose	Bark	Common
16	<i>Heterodermia diademata</i>	<i>Physciaceae</i>	Foliose	Bark and rock	Rare
17	<i>Lecanora indica</i>	<i>Lecanoraceae</i>	Crustose	Bark	Common
18	<i>Leptogium azureum</i>	<i>Lecanoraceae</i>	Crustose	Bark	Common
19	<i>Mazosia phyllosema</i>	<i>Roccellaceae</i>	Crustose	Leaves	Common
20	<i>Parmotrema crinitoides</i>	<i>Parmeliaceae</i>	Foliose	Bark and rock	Common
21	<i>Pertusaria quassiae</i>	<i>Pertusariaceae</i>	Crustose	Bark	Common
22	<i>Phaeographina caesioradians</i>	<i>Graphidaceae</i>	Crustose	Bark	Common
23	<i>Phaeographis platycarpa</i>	<i>Graphidaceae</i>	Crustose	Bark	Common
24	<i>Pseudopyrenula pupula</i>	<i>Trypetheliaceae</i>	Crustose	Bark	Common
25	<i>Strigula antillarum</i>	<i>Strigulaceae</i>	Crustose	Leaves	Common
26	<i>Strigula elegans</i>	<i>Strigulaceae</i>	Crustose	Leaves	Common
27	<i>Strigula smaragdula</i>	<i>Strigulaceae</i>	Crustose	Leaves	Common
28	<i>Tricharia vainioi</i>	<i>Gomphillaceae</i>	Crustose	Leaves	Common
29	<i>Trichothelium annulatum</i>	<i>Trichotheliaceae</i>	Crustose	Leaves	Common
30	<i>Trypethelium eluteriae</i>	<i>Trypetheliaceae</i>	Crustose	Bark	Rare
Algae					
Group		Genus			
Cyanophyceae		a) Chroococcus,			
		b) Oscillatoria,			
		c) Phormidium,			
		d) Lyngbya,			
		e) Anabaena			
		f) Microcoleus			
		g) Pseudanabaena			
Zygnematophyceae		a) Mesotaenium,			
		b) Sprigyra			
Ulvophyceaea		a) Ulothrix			
Chlorophyceae		a) Chlamydomonas,			

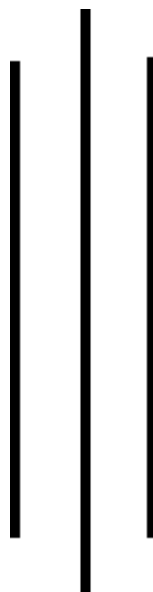
	b) Chlorella,
	c) Haematococcus
	d) Oedogonium
	e) Gonium
Bacillariophyceae	a) Pinnularia,
	b) Navicula
Euglenoidea	a) Euglena

List of macrofungi recorded with uses and ecological relationship

Sl. No.	Fungi	Family	Ecological relationship	Utilization
1	Agaricus arvensis	Agaricaceae	Saprophyte	Edible
2	Lycoperdon pyriforme	Agaricaceae	Mycorrhizal	Edible
3	Coprinus disseminates	Agaricaceae	Saprophyte	Non edible
4	Amanita pantherina	Amanitaceae	Mycorrhizal	Non edible
5	Auricularia auricula-judae	Auriculaceae	Dead wood	Edible, Medicinal
6	Boletus badius	Boletaceae	Mycorrhizal	Non edible
7	Cantharellus lateritius	Cantharellaceae	Saprophyte	Edible
8	Craterellus sp.	Cantharellaceae	Saprophyte, dead wood	Edible
9	Clavaria sp.	Clavariaceae	Saprophyte, dead & decaying wood	Non edible
10	Ganoderma lucidum	Ganodermataceae	Parasitic	Medicinal
11	Ganoderma applanatum	Ganodermataceae	Parasitic	Medicinal
12	Ramaria sp.	Gomphaceae	Saprophyte, dead wood	Edible
13	Laccaria bicolor	Hydnangiaceae	Mycorrhizal	Non edible
14	Phellinus gilvus	Hymenochaetaceae	Parasitic	Non edible
15	Marasmius androsaceus	Marasmiaceae	Saprophyte, plant debris	Non edible
16	Pleurotus sp.	Pleurotaceae	Dead wood	Edible
17	Panus fulvus	Polyporaceae	Dead and decaying wood	Edible
18	Earliella scabrosa	Polyporaceae	Dead wood	Non edible
19	Lentinus sp.	Polyporaceae	Dead wood stumps	Edible, medicinal
20	Microporus xanthopus	Polyporaceae	Dead wood	Medicinal
21	Pycnoporus sanguineus	Polyporaceae	Saprophyte, Dead wood	Non edible
22	Trametes versicolor	Polyporaceae	Wood decaying	Medicinal
23	Lactarius hygrophoroides	Russulaceae	Mycorrhizal	Edible
24	Russula amoena Mycorrhizal	Russulaceae		Edible
25	R. delica	Russulaceae	Mycorrhizal	Edible
26	R. pectinata	Russulaceae	Mycorrhizal	Edible
27	R. nobilis	Russulaceae	Mycorrhizal	Edible
28	Schizophyllum commune	Schizophyllaceae	Dead wood	Edible, medicinal
29	Scleroderma sp.	Sclerodermataceae	Mycorrhizal	Edible
30	Xylaria polymorpha	Xylariaceae	Dead wood	Non edible

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PART - I



SUMMARY OF FACTS ON WHICH PROPOSALS ARE MADE

CHAPTER-I

THE TRACT DEALT WITH

1.1 Name and situation: The working Plan for Kamrup West Forest Division covers all the forest areas of the Division. The Working Plan covers the areas of the reserved forests of Kamrup West Division, which are located within the geographical limits of 25.43° and 26.51° N latitude and between 90.36° and 92.12° E longitude. The division is located in the civil district of Kamrup(Rural).

1.1.1 Boundary of this Division is as follows:

The Division is located within the Kamrup District as the northern boundary flanks with the River Brahmaputra and District Barpeta, to the east with District Kamrup (M), southern boundary is an interstate boundary with Meghalaya and western boundary is formed with the District Goalpara. The R.F.s in southern region of the Division are located in the hilly terrain that are actually in continuation with the Khasi hills ranges in the form of spurs. The northern part is mainly consisted with Taris (alluvial terraces), and Julis (narrow winding, low-lying tracts). Most of the parts of this area are located in the plain ultimately connected with the southern valley of the river Brahmaputra. That is composed mainly of alluvial of recent to sub-recent origin and rocks of pre-cambium gneissic complex.

South: The forest in the southern part of this Division is located in the hilly area, which are actually continuation in the form of spurs of the Khasi Hills Range.

North: The Northern part is mainly constituted with Taris (Alluvial terraces) and Julis (narrow winding, low lying tracts). Most of the parts of this area are located in the plain which have been ultimately connected with the northern valley of the river Brahmaputra.

East: The eastern part is connected with the boundary of Kamrup East Division and

West: The western part is connected with the boundary of Goalpara District.

There are altogether 35 Reserved Forests in the Division which are situated on the south bank of the river Brahmaputra.

The forests in the Division are covered by one inch survey sheet No.78J15, 78J16, 78O1, 78N4, 78N8, 78O5, 78O6, 78O2, 78O9, 78N12. These sheets are recorded in the office of the DFO, who is responsible for the administration of these forests. The maps prepared with geographical coordinates recorded at the site is maintained in the GIS Cell (REWP), Guwahati for reference purposes. Table 1.1 shows the administrative set up of Kamrup West Division forests. The Range, Compartment and RF maps of the Division are shown in the Appendix.

Table 1.1: Administrative setup of the Kamrup West Forest Division Reserved Forest (RF)

Division	Name of Range	Name Reserved Forest	No. of compartments	Area in Ha
Kamrup West Division	Loharghat	Mayang Hill	4	2139.214
		Mataikhar	3	1684.338
	Range Total		7	3823.552
	Kulsi	Kulsi	9	1855.119
	Bamunigaon	Milmillia	10	1853.905

		Chhaygaon	5	1294.212
		Khuksi Sikrabura	7	1019.627
		Melaghat	1	362.606
		Dumpara	1	193.443
		Simla	1	126.264
		Gohaingurung	1	125.455
		Dudhkhuri	1	98.340
		Dimali	1	52.610
		Ghoraputa	1	47.753
		Dhaniagaon	1	36.422
	Range Total		30	5210.637
	Singra Range	Moman	9	3211.250
		Jarikhuri	3	1249.251
		Luki	3	904.896
		Sursuria	1	389.720
		Taraibari	1	319.303
		Khatkhathi Hill	1	248.482
		Mugakhal	1	129.097
		Garubaldha	1	110.076
		Khurkhuri	1	66.167
	Range Total		21	6628.242
	Bondapara	Gizang	6	3472.237
		Nampathar	9	1380.412
		Borjuli	4	1129.906
		Boradova	1	434.641
		Singra (part I)	1	379.080
		Jaipur	1	326.183
		Khatajuli	1	110.160
		Singra (part II)	1	95.180
		Mahipara	1	93.980
	Range Total		25	7421.779
	Bamunigaon-Singra	Bagaikhas	27	24668.77
	Bamunigaon-Kulsi	Pantan	23	11280.857
	Kulsi-Loharghat	Borduar	30	7235.936
	Total of RF		172	68124.892

Proposed Reserved Forest (PRF)

Division	Name of Range	Name Proposed Reserved Forest	No. of compartments	Area in Ha
Kamrup West Division	Bondapara	Charaibaha PRF	1	51.80
	Total of PRF		1	51.80
	Total of RF & PRF			68176.692

Apart from the Reserved Forests, there is 1 (one) PRF namely **Charaibaha PRF** in Bondapara Range comprising an area of 51.80 hect. Another Range namely **Riverine Range, Nagarbera** created for the purpose of protecting forest by way of checking transportation through waterways.

According to the 2011 census Kamrup District has a population of 1,517,542. The District has a population density of 489 people per square kilometer 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: The forests in the southern part of the Division are located in hilly areas, which are actually continuation in the form of spurs of the Khasi Hills Range. The plains forests are located in alluvial terraces locally known as 'Taris' and these are cut up by numerous narrow winding, lowlying tracts which are known as 'Julis'. The height of a tari may vary from 1 meter to 15 meters from the neighbouring julis. The taris are usually the result of gradual cutting out and leveling off of the various spurs and sub spurs of the hilly formations into the plains and the julis are continuation of the valleys between these spurs.

1.3 Geology, rock and soil: Geologically, the basement of the entire region is similar to those of the Meghalaya plateau which is a detached part of the Deccan plateau composed of Gondwana rock mass. Major portion of the region has been built up by alluvial deposits of recent to sub-recent origin on the Pre-Cambrian rock basement. The Forest Division includes two major physiographic zones namely, (i) Part of the Middle Plain belonging to the south bank of Brahmaputra River which is composed of alluvial deposits; and (ii) The Southern Foothill zone comprising of the extended spurs of Khasi Hills composed of red ferruginous soils and usually encompassing isolated monadnocks and wetlands (including *beefs*) covered by forests.

The alluvial tract of the Brahmaputra valley, which covers a major portion of the Division, composes mainly of silt, sand and clay with occasional pebble beds. Occurrence of iron-ore, quartz and feldspar deposits are reported from the outlying hilly portion in the south and economic importance of some of these minerals are under investigation. The alluvial clays of the Brahmaputra valley offer good raw material for manufacture of bricks, earthen ware etc. The granite and gneissic rocks of the scattered hillocks are used as road ballast and building materials.

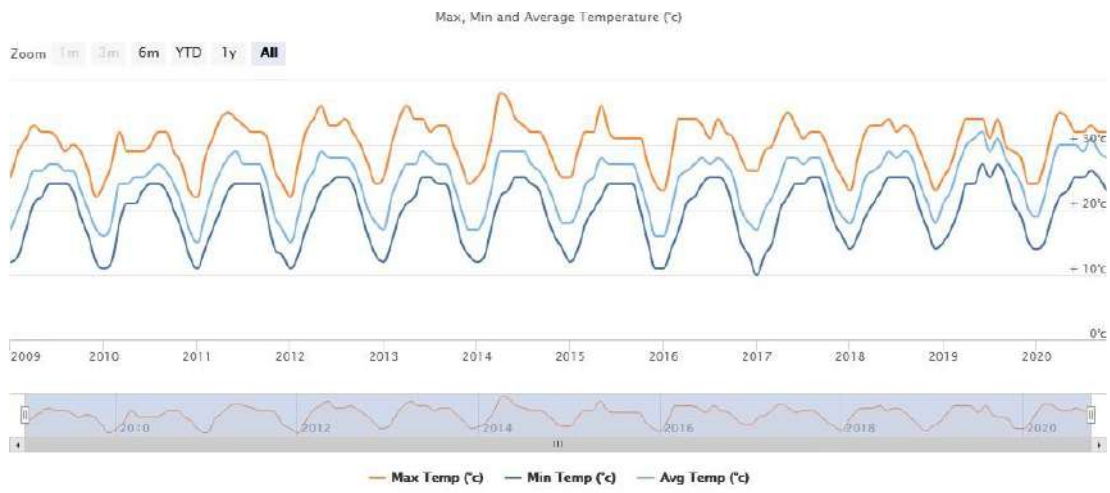
Due to the effect of weathering of the rocks and erosion the soil in the crests and ridges of the hills are coarse & gritty and lacks in depth, with entrapped pockets of good loam in between boulders. The middle and lower slopes including the foothills are composed of a deep tropical red-loam, except for places subjected to heavy erosion in some southern slopes. The soil covered by the plains forests is generally formed of deep alluvium consisting mostly of sandy loam. This alluvium tends to be clayey in stretches adjoining broad julis and frequent patches of "Khorkani" land occur, formed by throwing up of mounds of activities of some types of earthworm. The channels intervening these mounds become water-logged during the rainy season.

1.4. Climate: Entire region has distinctive climatological attributes which are not comparable with any other part of the sub-continent. This distinctiveness, has resulted mainly from the region's

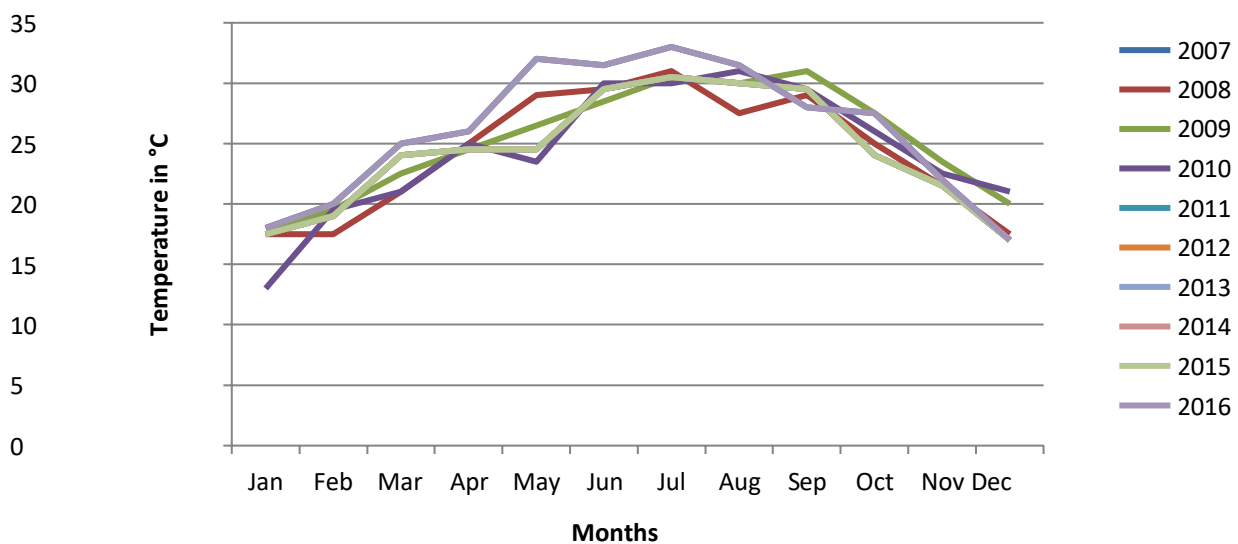
geographical location and its physiography. Based on these local conditions, the region's climate is classified into four main types, viz, humid continental severe winter, moist in all seasons and short summer (Dfh); sub-tropical monsoon, mild and dry winter, warm and humid summer (Cwb); sub-tropical monsoon, mild and dry winter (Cwa); and sub-tropical monsoon with with very heavy rain (Cwm). The region is under the influence of the Cwb type of climate. The region in general, enjoys a climate characterized by adequate rain during summer and cold foggy winter associated with highly humid atmosphere. Each year could be roughly divided into four seasons. The cold season starting from November and ending around February with practically no rain. This is followed by the pre-monsoon season associated with mild to severe thunderstorms from March to May. This represents a hot season with the earlier half of this season being relatively dry, the latter half of the season there occurs quite a few thunder storms with light rain. These storms cause considerable damage to the forest resulting in wind fallen or mid broken trees. Occasionally, all immature seeds of Sal in the area are blown off the trees by such storms. The period from June to about the beginning of October is influenced by the south west monsoons. It depends much on the appearance monsoon trough over northern India. As soon as the trough reaches the Himalayas, monsoon breaks in the northeast India. High rainfall, high temperature and humidity accompany the southwest monsoon. October and the early part of November constitutes the post monsoon season. Following the monsoon withdrawals, light unsteady winds are experienced which become northeasterly. The region receives an average rainfall of 400mm to 900mm during the months of April-May. During monsoon season the average annual rainfall ranges between 1500mm and 2600mm. The average minimum and maximum temperature recorded are 10°C and 30°C respectively with relative humidity of more than 86%. This climate is congenial for the luxuriant growth of mixed deciduous forests.

Mean monthly temperature (°C) of Kamrup West division, Assam										
Month	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Jan	18	17.5	17.5	13	17.5	17.5	17.5	17.5	17.5	13
Feb	20	17.5	19.5	19.5	19	19	19	19	19	19.5
Mar	25	21	22.5	21	24	24	24	24	24	21
Apr	26	25	24.5	25	24.5	24.5	24.5	24.5	24.5	25
May	32	29	26.5	23.5	24.5	24.5	24.5	24.5	24.5	23.5
Jun	31.5	29.5	28.5	30	29.5	29.5	29.5	29.5	29.5	30
Jul	33	31	30.5	30	30.5	30.5	30.5	30.5	30.5	30
Aug	31.5	27.5	30	31	30	30	30	30	30	31
Sep	28	29	31	29.5	29.5	29.5	29.5	29.5	29.5	29.5
Oct	27.5	25	27.5	26	24	24	24	24	24	26
Nov	22	21.5	23.5	22.5	21.5	21.5	21.5	21.5	21.5	22.5
Dec	17	17.5	20	21	17	17	17	17	17	21

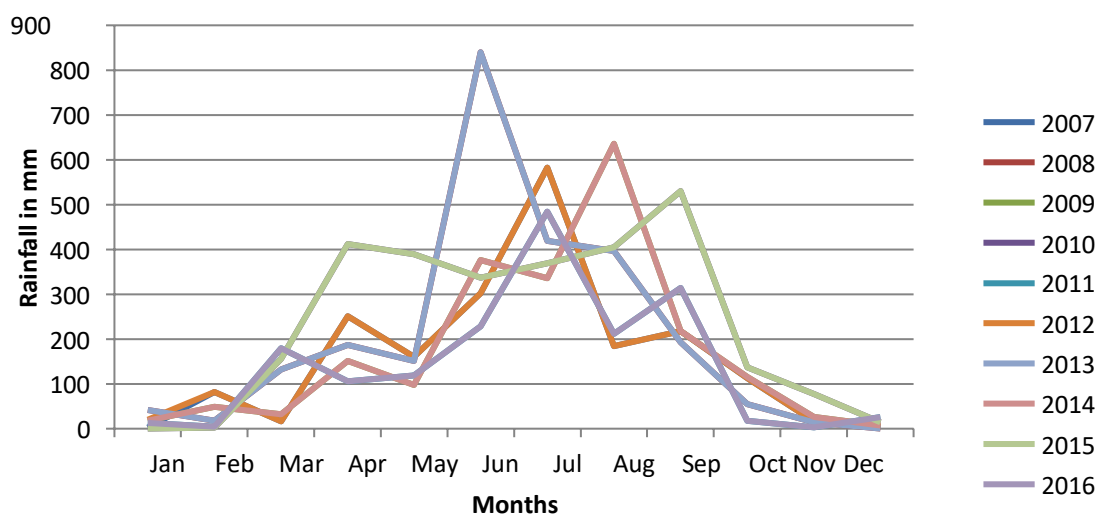
Monthly average rainfall (mm) in Kamrup West Division from 2007 to 2015										
Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Jan	2.5	40.9	18	0	13.2	20	40.9	18	0	13.2
Feb	81.7	17.3	48.5	1.8	4.6	81.7	17.3	48.5	1.8	4.6
Mar	16.5	132.2	31.7	156	179.9	16.5	132.2	31.7	156	179.9
April	251.2	187.2	150.6	411.2	105.9	251.2	187.2	150.6	411.2	105.9
May	161	150.4	97	388.9	119.1	161	150.4	97	388.9	119.1
June	302	839.7	376.2	337	228.3	302	839.7	376.2	337	228.3
July	582.4	418.8	335	369.1	484.1	582.4	418.8	335	369.1	484.1
Aug	184.9	395.7	635.5	404.4	212	184.9	395.7	635.5	404.4	212
Sept	217.9	192.5	217.2	529.8	313.9	217.9	192.5	217.2	529.8	313.9
Oct	112.6	54.6	114.8	136.6	18	112.6	54.6	114.8	136.6	18
Novr	16	13.5	26.2	77.2	3	16	13.5	26.2	77.2	3
Dec	4.1	0	6.9	14.5	25.9	4.1	0	6.9	14.5	25.9



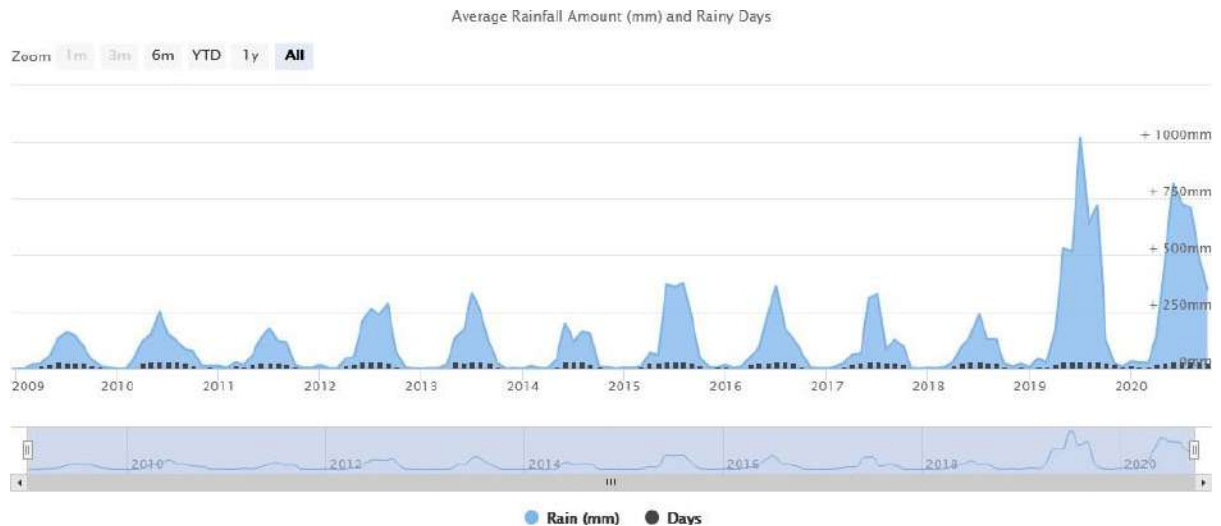
Max, Min and Average Temperature in Kamrup West Division



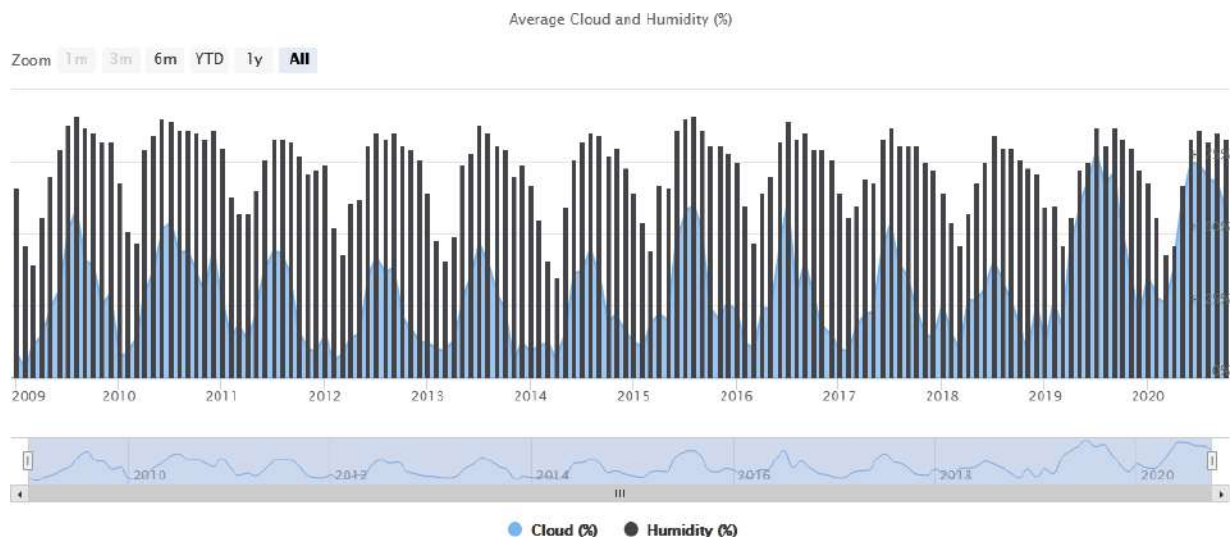
Monthly mean temperature (°C) from 2007 to 2016 in Kamrup West Division,



Monthly mean rainfall (mm) in Kamrup West Division(2007-2016)



Rainfall and Rain Days



Cloud and Humidity

CHAPTER-2

MAINTENANCE/INCREASE IN THE EXTENT OF TREE COVER

2.1 Area of forest under different legal classes:

The Reserved Forests have been constituted under the relevant provisions of the Assam Forest Regulation, 1891 and the Indian Forest Act, 1972. A statement showing the details of the notification numbers and dates of area of forest under different legal classes is shown in the following table.

Table 2.1.a Area of forest under different legal classes in Kamrup West division, Assam

Sl. No	Name of Range	Name of R.F.	Year & month of Notification	Remarks
1	Loharghat	Mayang Hill	12 dtd. 7.3.1883	
			605 GT dtd. 24.1.1938	Partial dereservation amended description
2		Mataikhar	5 dtd. 17.10.1878	
3	Kulsi	Kulsi	5 dtd. 17.10.1879	
			12 dtd. 13.6.1882	1st Addition
			026 R dtd. 1.12.1883	2nd & 3rd Addition
			1258 R dtd. 11.5.1923	4th Addition
			4381 R dtd. 13.11.1930	Amended Description
4	Bamunigaon	Milmillia	5 dtd. 17.10.1878	
			12 D dtd. 7.3.1883	1st Addition
			1231 R dtd. 22.3.1894	2nd, 3rd & 4th Addition
			4381 R dtd. 13.11.1930	Amended Description
5		Chhaygaon	25 dtd. Sept. 1885	
			2766 R dtd. 1.8.1921	1st Addition
			800 R dtd. 1.4.1927	2nd Addition
			14 R dtd. 4.1.1926	3rd Addition
			927 R dtd. 11.3.1926	4th Addition
			4381 dtd. 13.11.1930	Amended Description
6		Khaksi Sikrabura	12 D dtd. 7.3.1883	
			3552 R dtd. 25.11.1933	1st Addition
			3551 R dtd. 25.11.1933	2nd Addition
7		Melaghat	793 R dtd. 27.2.1929	
			FRS.274/72/2 dtd. 9.10.1972	Upto date mended description
8		Dumpara	12 D dtd. 7.3.1883	
			FRS 149/71/2 dtd. 6.4.1972	
9		Simla	12 D dtd. 7.3.1885	
10		Gohaingurun g	1112 R dtd. 20.4.1993	
11		Dudhkhuri	390 R dtd. 12.2.1962	
			1454 R dtd. 21.5.1934	
12		Dimali	794 R dtd. 27.2.1929	
13		Ghoraputa	12 D dtd. 7.3.1883	
			FRS 242/7/2 dtd. 28.7.1972	
14		Dhuniagaon	928 R dtd, 11,3,1929	
15	Singra Range	Moman	2597 R dtd. 26.5.1917	
			2183 R dtd. 3.9.1924	1st Addition
			1508 R dtd. 16.6.1925	2nd Addition
			1509 R dtd. 16.6.1925	3rd Addition
			1641 R dtd. 9.6.1933	4th Addition
16		Jarikhuri	1192 R dtd. 29.3.1884	
			2320 R dtd. 14.6.1902	1st to 6th Addition

17		Luki	2598 R dtd. 26.5.1917	7th Addition
			9147 F dtd. 16.10.1920	Ought to be 8th Addition
			2495 R dtd. 3.10.1925	Ought to be 9th Addition
18		Sursuria	2601 R dtd. 26.5.1917	
			739 R dtd. 28.3.1927	Partial deforestation
			2072 dtd. 12.6.1928	1st to 5th addition
19		Taraibari	12 D dtd. 7.3.1883	
			12 D dtd. 7.3.1883	
			12 D dtd. 7.3.1883	
20		Khatkhathi Hill	1192 R dtd. 19.3.1894	
			FRS. 366/71/2 dtd. 25.2.1972	Upto date amended description
			12 D dtd. 7.3.1883	
21		Mugakhal	215 R dtd. 19.1.1901	Ought to be 1st addition
			1064 R dtd. 4.4.1932	Ought to be 2nd Addition
			12 D dtd. 7.3.1883	
22		Garubaldha .	908 R dtd. 29.3.1932	
			12 D dtd. 7.3.1883	
			12 D dtd. 7.3.1883	
23		Khurkhuri	1570 R dtd. 16.4.1894	1st Addition
			2600 R dtd. 26.5.1927	2nd & 3rd Addition
			1257 F dtd. 17.2.1919	Partial deforestation
24		Gizang	1953 R dtd. 4.8.1923	Amended description
			12 D dtd. 7.3.1883	
			2599 R dtd. 26.5.1917	1st & 2nd addition
25		Nampathar	3359 R dtd. 21.12.1925	3rd addition
			12 D dtd. 7.3.1883	
			2705 R dtd. 7.9.1933	1st Addition
26		Borjuli	12 D dtd. 7.3.1883	
			2705 R dtd. 7.9.1933	1st Addition
			12 D dtd. 7.3.1883	
27		Boradova	2602 R dtd. 26.5.1917	
			553 R dtd. 8.3.1923	Amended description
			FRS 117/72/2 dtd. 9.4.1972	Upto date amended escription
28		Singra (part I)	12 D dtd. 7.3.1883	
			1570 R dtd. 16.4.1891	1st Addition
			Khatajuli	
29		Jaipur	2518 R dtd. 19.8.1933	
			FRS.53/90/14 dtd. 21st Sept. 1990	
			FRS.37/4/89/15 dtd. 23rd Nov.1989	
30		Mahipara	FRS.380/84/25 dtd. 2.Nov.1984	
			5 dtd. 17.10.1878	
			12 D dtd. 7.3.1883	1st Addition
31		Pantan	4194 R dtd. 22.9.1904	2nd Addition
			14 R dtd. 4.1.1926	3rd Addition
			927 R dtd. 11.3.1029	4th Addition
32		Barduar	4381 dtd. 13.11.1930	Amended description
			5 dtd. 17.10.1875	
			12 dtd. 13.7.1882	
33		Bamunigaon- Singra	8942 dtd. 2.12.1893	
			1257 R dtd. 11.5.1923	
			1958 R dtd. 5.6.1928	
34		Bamunigaon- Kuls	869 R dtd. 7.3.1929	
			4381 R dtd. 13.11.1930	

Boundaries of the R.F.s are demarcated mostly by artificial lines, roads, village area under this and natural features like rivers, streams and edges of swamp area. The artificial lines are maintained by lines usually cleared of all shrub growth of width 8' to 12' and demarcated by earthen mounds of R.C.C. pillars. The general state of artificial boundaries is not quite satisfactory in the case of some R.F.s surrounded by villages. Some of the boundaries do not appear to have been maintained properly for some years and no systematic clearing appears to have been done. Block and

Compartment-wise details of forest areas of the Division is shown in the following table.

Table 2.1.b: Statement showing encroached area under different landuse under different R.Fs

SI No.	Division	Name of RF	Area of RF (in ha)	Encroached area (in ha.)	Agricultural area (in Ha)	Built up area (in Ha)
1	2	3	4	5	6	7
1	Kamrup West	Barduar	7235.94	1523.6	1196.93	527.25
2		Mataikhar	1684.338	52.0	105.73	35.41
3		Mayang	2139.214	166.4	159.07	21.14
4		Kulsi	1855.119	1169.0	423.98	110.55
5		Milmillia	1853.905	456.3	564.28	214.55
6		Chhaygaon	1294.212	673.9	164.95	29.07
7		Khuksi Sikrabora	1019.627	82.7	114.20	14.61
8		Melaghat	362.606	15.2	125.03	13.85
9		Dumpara	193.443	21.0	27.09	1.29
10		Simla	126.264	13.0	24.96	2.41
11		Gohaingurung	125.455	109.1	14.96	1.38
12		Dudhkhuri	98.34	9.9	19.86	2.14
13		Dimali	52.61	9.2	14.38	0.54
14		Ghoraputa	47.753	22.0	16.40	1.34
15		Dhaniagaon	36.422	11.6	7.27	3.95
16		Moman	3211.25	1300.1	387.64	49.52
17		Jarikhuri	1249.251	619.0	307.85	18.8
18		Luki	904.896	588.0	117.86	12.26
19		Sursuria	389.72	267.0	41.95	3.45
20		Taraibari	319.303	301.0	107.91	2.23
21		Khatkhathi Hill	248.482	207.1	30.75	N/A
22		Mugakhal	129.097	60.3	27.99	0.71
23		Garubaldha .	110.076	112.4	16.54	2.39
24		Khurkhuri	66.167	7.9	18.25	2.28
25		Gizang	3472.237	700.0	378.58	46.32
26		Nampathar	1380.412	493.0	255.60	25.65
27		Borjuli	1129.906	612.0	210.92	41.08
28		Boradova	434.641	250.0	107.52	6.14
29		Singra (part I)	379.08	106.0	42.94	3.47
30		Jaipur	326.183	133.0	105.53	16.43
31		Khatajuli	110.16	12.8	12.43	2.49
32		Singra (part II)	95.18	14.8	23.07	13.12
33		Mahipara	93.98	45.0	23.62	12.56
34		Bagaikhas	24668.77	5450.7	1171.28	16.73
35		Pantan	11280.86	5454.0	1119.23	104.5
	Total		68124.895	21069.0	7486.55	1359.61

2.2 Forest area under different Working Circle: RF wise forest area earmarked for different Working Circles are shown in table 2.2a

Table: 2.2a Compartment wise forest area earmarked for different Working Circles

Name of W.S.	Name Reserved Forest	Compartment No.	Area in Ha	Net workable area	Sal WC	Teak WC	Area allotted in JFMC Overlapping W.C.	Area allotted in NTFP Overlapping W.C.
Loharghat	Mayang Hill	1	348.772	250.00	348.772	-	100.00	10.00
	Mayang Hill	2	531.560	375.00	-	531.560	100.00	-
	Mayang Hill	3	783.697	500.00	783.697	-	100.00	-
	Mayang Hill	4	360.899	310.00	-	360.899	100.00	15.00
	Mataikhar R F	1	558.057	400.00	783.697	-	100.00	-
	Mataikhar R F	3	579.850	400.00	783.697	-	100.00	10.00

	Mataikhar R F	2	546.929	490.00	-	546.929	100.00	10.00
W.S. Total			3709.764	2725.00	2699.863	1439.388	700.00	45.00
Kulsi	Kulsi R F	7	337.080	186.00	-	337.080	100.00	20.00
	Kulsi R F	1	154.468	75.00	-	154.468	75.00	-
	Kulsi R F	2	58.0158	44.00	-	58.0158	-	-
	Kulsi R F	6	114.162	59.00	-	114.162	-	-
	Kulsi R F	9	210.066	50.00	-	210.066	100.00	10.00
	Kulsi R F	8	226.925	170.00	-	226.925	100.00	10.00
	Kulsi R F	3	37.688	32.00	37.688	-	-	-
	Kulsi R F	4	192.577	130.00	192.577	-	-	-
	Kulsi R F	5	270.733	170.00	-	270.733	100.00	10.00
W.S. Total			1601.715	916.00	230.265	1371.45	475.00	50.00
Bamunigaon	Milmilia R F	1	167.251	100.00	167.251	-	100.00	10.00
	Milmilia R F	2	59.800	25.00	59.800	-	-	-
	Milmilia R F	3	91.593	60.00	91.593	-	-	-
	Milmilia R F	4	233.744	190.00	233.744	-	150.00	12.00
	Milmilia R F	5	88.785	65.00	88.785	-	50.00	10.00
	Milmilia R F	6	87.440	45.00	87.440	-	40.00	10.00
	Milmilia R F	7	287.931	170.00	287.931	-	200.00	10.00
	Milmilia R F	8	304.381	200.00	304.381	-	100.00	12.00
	Milmilia R F	9	342.312	210.00	342.312	-	200.00	10.00
	Milmilia R F	10	240.244	160.00	240.244	-	100.00	-
	Chhaygaon	1	71.065	45.00	-	71.065	-	-
	Chhaygaon	2	334.472	300.00	-	334.472	200.00	-
	Chhaygaon	3	544.218	430.00	544.218	-	300.00	10.00
	Chhaygaon	4	161.749	100.00	-	161.749	100.00	10.00
	Chhaygaon	5	144.675	95.00	144.675	-	55.00	8.00
	Khaksi Sikratura	6	320.176	200.00	320.176	-	100.00	-
	Khaksi Sikratura	1	117.132	80.00	117.132	-	-	-
	Khaksi Sikratura	2	54.022	42.00	54.022	-	-	-
	Khaksi Sikratura	3	101.741	72.00	-	101.741	25.00	10.00
	Khaksi Sikratura	7	85.120	65.00	85.120	-	25.00	10.00
	Khaksi Sikratura	4	142.612	118.00	-	142.612	65.00	12.00
	Khaksi Sikratura	5	141.138	100.00	141.138	-	-	-
	Melaghat	1	362.606	271.00	362.606	-	200.00	10.00
	Dumpara	1	193.443	177.00	193.443	-	100.00	10.00
	Simla	1	126.264	90.00	126.264	-	55.00	-
	Gohaingurung	1	125.455	96.00	125.455	-	45.00	-
	Dudhkhuri	1	98.340	86.00	98.340	-	85.00	-
	Dimali	1	52.610	42.00	52.610	-	25.00	10.00
	Ghoraputa	1	47.753	31.00	47.753	-	-	-
	Dhuniagaon	1	36.422	23.00	36.422	-	20.00	10.00
W.S. Total			5164.494	3688.00	4352.855	811.639	2340.00	174.00
Singra Range	Moman R F	H1	400.303	345.00	-	400.303	200.00	-
	Moman R F	H2	265.143	250.00	-	265.143	200.00	10.00
	Moman R F	H3	421.966	420.00	-	421.966	200.00	10.00
	Moman R F	H4	981.848	793.00	-	981.848	400.00	10.00
	Moman R F	P1	417.086	400.00	417.086	-	300.00	-
	Moman R F	P2	90.934	50.00	90.934	-	50.00	-
	Moman R F	P3	112.439	90.00	112.439	-	100.00	10.00
	Moman R F	P4	572.125	529.00	572.125	-	-	12.00
	Moman R F	P5	239.715	223.00	239.715	-	-	10.00
	Jharikhuri R F	1	457.663	400.00	457.663	-	400.00	-
	Jharikhuri R F	2	638.056	600.00	638.056	-	600.00	11.00

	Jharikhuri R F	3	127.505	100.00	127.505	-	100.00	-
	Luki R F	3	338.210	290.00	338.210	-	200.00	10.00
	Luki R F	1	96.861	80.00	96.861	-	50.00	10.00
	Luki R F	2	324.013	267.00	324.013	-	200.00	-
	Sursuria	1	389.720	350.00	389.720	-	300.00	-
	Taraibari	1	319.303	280.00	319.303	-	200.00	10.00
	Khatkhathi Hill	1	248.482	225.00	-	248.482	100.00	10.00
	Mugakhal	1	129.097	119.00	129.097	-	100.00	10.00
	Garubaldha	1	110.076	90.00	110.076	-	100.00	-
	Khurkhuri	1	66.167	50.00	66.167	-	20.00	10.00
W.S. Total			6746.713	5609.00	4428.97	2317.742	3820.00	133.00
Bondapara	Gizang R F	H1	913.762	900.00	-	913.762	100.00	10.00
	Gizang R F	H2	1311.594	1300.00	-	1311.594	100.00	10.00
	Gizang R F	P3	235.823	123.00	235.823	-	150.00	-
	Gizang R F	P2	237.425	160.00	237.425	-	150.00	-
	Gizang R F	P1B	165.349	93.00	165.349	-	100.00	11.00
	Gizang R F	P1A	495.480	272.00	495.480	-	100.00	12.00
	Nampathar R F	U2	234.442	125.00	234.442	-	100.00	12.00
	Nampathar R F	D5	179.089	100.00	-	179.089	100.00	11.00
	Nampathar R F	D3B	81.207	50.00	-	81.207	100.00	-
	Nampathar R F	D3A	72.321	50.00	-	72.321	100.00	-
	Nampathar R F	U3	177.316	100.00	-	177.316	100.00	-
	Nampathar R F	D4	281.499	200.00	-	281.499	100.00	10.00
	Nampathar R F	D2	99.648	29.00	99.648	-	45.00	12.00
	Nampathar R F	D1	117.242	42.00	117.242	-	100.00	10.00
	Nampathar R F	U1	98.632	93.00	98.632	-	100.00	10.00
	Barjuli R F	3B	234.548	165.00	234.548	-	50.00	10.00
	Barjuli R F	1	396.042	225.00	396.042	-	100.00	11.00
	Barjuli R F	3A	279.414	164.00	279.414	-	100.00	11.00
	Barjuli R F	2	165.534	140.00	165.534	-	100.00	11.00
	Boradova	1	434.641	329.00	434.641	-	100.00	10.00
	Singra (part I)	1	379.080	342.00	379.080	-	100.00	10.00
	Jaipur	1	326.183	286.00	326.183	-	100.00	11.00
	Khatajuli	1	110.160	80.00	110.160	-	100.00	10.00
	Singra (part II)	1	95.180	80.00	95.180	-	100.00	10.00
	Mahipara	1	93.980	40.00	93.980	-	100.00	10.00
W.S. Total			7215.591	5488.00	4198.803	3016.788	2495.00	212.00
Bamunigaon-Singra	Bogaikhas R F	1	707.733	600.00	-	707.733	100.00	10.00
	Bogaikhas R F	2	819.126	685.00	-	819.126	20.00	20.00
	Bogaikhas R F	3	483.010	350.00	-	483.010	20.00	25.00
	Bogaikhas R F	4	536.686	400.00	-	536.686	80.00	50.00
	Bogaikhas R F	5	687.551	515.00	-	687.551	80.00	45.00
	Bogaikhas R F	6	945.932	800.00	-	945.932	100.00	32.00
	Bogaikhas R F	8	815.435	690.00	-	815.435	100.00	35.00
	Bogaikhas R F	7	786.374	650.00	-	786.374	100.00	30.00
	Bogaikhas R F	9	514.044	400.00	-	514.044	100.00	28.00
	Bogaikhas R F	10	846.344	650.00	-	846.344	150.00	22.00
	Bogaikhas R F	11	889.210	680.00	-	889.210	200.00	18.00
	Bogaikhas R F	12	733.606	580.00	-	733.606	85.00	33.00
	Bogaikhas R F	13	873.423	700.00	-	873.423	200.00	38.00
	Bogaikhas R F	14	973.484	770.00	-	973.484	50.00	35.00
	Bogaikhas R F	15	550.500	400.00	-	550.500	200.00	36.00
	Bogaikhas R F	16	970.783	805.00	970.783	-	300.00	20.00
	Bogaikhas R F	17	1177.738	800.00	1177.738	-	200.00	18.00

	Bogaikhas R F	18	1052.970	840.00	1052.970	-	100.00	16.00
	Bogaikhas R F	19	577.223	350.00	577.223	-	100.00	12.00
	Bogaikhas R F	20	876.759	700.00	876.759	-	100.00	14.00
	Bogaikhas R F	21	839.076	700.00	839.076	-	20.00	16.00
	Bogaikhas R F	22	884.242	600.00	884.242	-	200.00	30.00
	Bogaikhas R F	23	897.741	605.00	897.741	-	50.00	33.00
	Bogaikhas R F	24	411.841	300.00	411.841	-	200.00	38.00
	Bogaikhas R F	25	863.242	600.00	863.242	-	300.00	50.00
	Bogaikhas R F	26	1052.631	815.00	1052.631	-	100.00	50.00
	Bogaikhas R F	27	918.061	715.00	918.061	-	100.00	45.00
W.S. Total			21684.770	16700.00	10522.31	11162.46	3355	799.00
Bamunigaon-Kulsi	Pantan R F	H6	915.686	715.00	915.686		200.00	-
	Pantan R F	K6	89.605	50.00	89.605		50.00	25.00
	Pantan R F	1A	256.851	195.00	256.851		200.00	20.00
	Pantan R F	1B	103.154	85.00	103.154		300.00	15.00
	Pantan R F	C2	478.773	300.00	478.773		200.00	16.00
	Pantan R F	C1	362.059	215.00	362.059		100.00	20.00
	Pantan R F	H11	1060.835	750.00	-	1060.835	100.00	20.00
	Pantan R F	H9	370.482	200.00	-	370.482	100.00	22.00
	Pantan R F	H10	1003.323	740.00	-	1003.323	20.00	25.00
	Pantan R F	H8	665.567	300.00	665.567		100.00	25.00
	Pantan R F	H5	493.441	315.00	493.441		20.00	30.00
	Pantan R F	H7	611.903	405.00	611.903		20.00	25.00
	Pantan R F	H4	269.769	120.00	269.769		55.00	27.00
	Pantan R F	H3	263.367	130.00	263.367		25.00	29.00
	Pantan R F	H2	266.034	160.00	266.034		18.00	30.00
	Pantan R F	H1	291.944	180.00	291.944		100.00	32.00
	Pantan R F	C5	233.298	190.00	-	233.298	300.00	-
	Pantan R F	C4	147.872	90.00	-	147.872	200.00	-
	Pantan R F	C3	254.600	195.00	-	254.600	100.00	-
	Pantan R F	2	686.321	260.00	686.321	-	300.00	-
	Pantan R F	3	355.661	285.00	355.661	-	200.00	-
	Pantan R F	4	943.623	700.00	943.623	-	100.00	-
	Pantan R F	5	552.000	415.00	552.000	-	150.00	-
W.S. Total			10676.170	6995.00	7605.758	3070.41	2938.00	361.00
Kulsi-Loharghat	Barduar R F	1	206.041	180.00	-	206.041	100.00	-
	Barduar R F	2	72.330	50.00	-	72.330	20.00	-
	Barduar R F	3	34.919	20.00	-	34.919	20.00	-
	Barduar R F	4A	128.975	90.00	-	128.975	55.00	17.00
	Barduar R F	4B	77.642	50.00	-	77.642	25.00	15.00
	Barduar R F	5	121.013	80.00	121.013	-	18.00	16.00
	Barduar R F	H1	154.797	100.00	154.797	-	100.00	14.00
	Barduar R F	H2	197.101	125.00	197.101	-	50.00	28.00
	Barduar R F	H3	337.873	300.00	337.873	-	100.00	22.00
	Barduar R F	H4	387.433	300.00	387.433	-	100.00	24.00
	Barduar R F	H5	214.214	180.00	214.214	-	100.00	30.00
	Barduar R F	H6	345.151	290.00	345.151	-	200.00	15.00
	Barduar R F	H7	530.059	420.00	530.059	-	300.00	20.00
	Barduar R F	C1	195.204	125.00	-	195.204	100.00	18.00
	Barduar R F	C2	64.744	50.00	-	64.744	20.00	15.00
	Barduar R F	C3	183.775	120.00	-	183.775	20.00	17.00
	Barduar R F	C4	68.221	40.00	-	68.221	85.00	23.00
	Barduar R F	KG1	90.589	60.00	90.589	-	50.00	14.00
	Barduar R F	KG2	195.409	120.00	195.409	-	100.00	10.00
	Barduar R F	KG3	56.450	40.00	56.450	-	20.00	28.00
	Barduar R F	KG4	170.051	120.00	170.051	-	100.00	-

	Barduar R F	KG5	257.664	200.00	257.664	-	200.00	-
	Barduar R F	KG6	521.477	485.00	521.477	-	335.00	-
	Barduar R F	KG7	133.273	100.00	133.273	-	100.00	-
	Barduar R F	KG8	304.375	260.00	304.375	-	100.00	-
	Barduar R F	KG9	594.298	500.00	594.298	-	400.00	-
	Barduar R F	KG10	78.787	50.00	78.787	-	100.00	-
	Barduar R F	KG11	83.250	55.00	83.250	-	100.00	-
	Barduar R F	KG12	506.538	405.00	506.538	-	400.00	-
	Barduar R F	KG13	803.192	700.00	803.192	-	200.00	-
W.S. Total			7114.845	5615.00	6082.994	1031.851	3598.00	326.00
Division Total			63914.060	47736.00	39692.33	24221.73	13575.00	2100.00

- Net workable area= Gross area of Compartment - (Ridge & crest + Area under Water Body/marshy land + area under Forest Village + area under encroachment)
- Discrepancy in total RF area as shown in table 2.1b and 2.2a exists may be because of errors in measurement by Chain Compass survey or in GPS survey. DFO is to recheck the area.

2.3 Percentage of forest with secured boundaries:

The existing description of boundaries of most of the Reserved forests are rather vague (e.g. 'North-Western' "Slightly North of East, between lowlying cultivated pathar and foothills", natural boundary at the foot of the hills, north west corner of village land etc. etc.) and it was emphasized in earlier working plans that this state of affair should be rectified by fresh survey and amended notifications containing compass bearings and distance from pillar to pillar.

Although such vague descriptions might have been considered adequate at the time of the original constitution of these reserves, for meeting the existing circumstances these are entirely unsatisfactory and verifications on ground with such descriptions is next to impossible. Encroachments etc. detected during the course of field works were brought to the notice of the territorial staff and as far practicable these have been indicated in the stock map also.

The work of fresh survey of the boundaries and publication of amended notifications with accurate description has at last been taken up by a functional Division (i.e. Consolidation Division), and the survey (along with erection of concrete pillars) in respect of the boundaries of Dumpara, Mughakhal, Garuputa, Melaghat, Singra, Borodhoba, Gohaingurung, Dimali, Simla-Hill, Khaki-Sikratura, Dudhkhuri, Moman, Barduar, Mataikhar, Mayang-Hills and few other reserved forests have been reported to be completed. Out of these, amended notifications in respect of some of the reserved forests have already been published. Similar work in respect of other Reserved forests are continuing.

2.4 Land use, land use change and forestry (LULUCF): The land use and land use change in forests was assessed and compared among two assessment base years of 2005-06 and 2015- 16 The analysis of the data reflects that there is considerable land use change in the Division due to increasing urbanization. Owing to increase in population, urbanization and industrialization, there is an ever increasing demand of land to cater the requirements. As a result significant area under forest has been transformed to build up areas for both rural and urban settlements. Due to increase in agricultural practices, the area along the forest fringe has also witnessed major shift. Due to anthropogenic pressure, the areas under forests have also significantly deteriorated.

Table 2.4.a: table showing extent of changes (hectares) in LULUCF detected between 2005-2006 and 2015- 2016 at Kamrup West Division.

Land use, land use change and forestry (LULUCF)	2005-2006	2015-2016	Change in landuse (Ha)
Agriculture Cropland	69884.8	62778.6	-7106.2
Agriculture Plantation (Tea garden)	1853.5	651.8	-1201.7
Built Up	3.8	2853.4	2849.6
Deciduous Forest	53765.3	49274.3	-4491
Forest-Scrub Forest	10039.1	10758.4	20797.5
Forest-Tree Clad Area	21370.5	32287.2	10916.7
Grassland & Grazing land	3906.7	2428.7	-1478
Shifting Cultivation	1090.3	1163.4	73.1
Wastelands	313.9	2597.1	2283.2
Waterbodies/Reservoir/ Tank	361.7	321.1	-40.6
Waterbodies/River/Stream	25286.1	22646.3	-2639.8
Wetlands-Inland- Natural	3653.8	3769.5	115.7
Grand Total	191529.6	191529.6	0.00

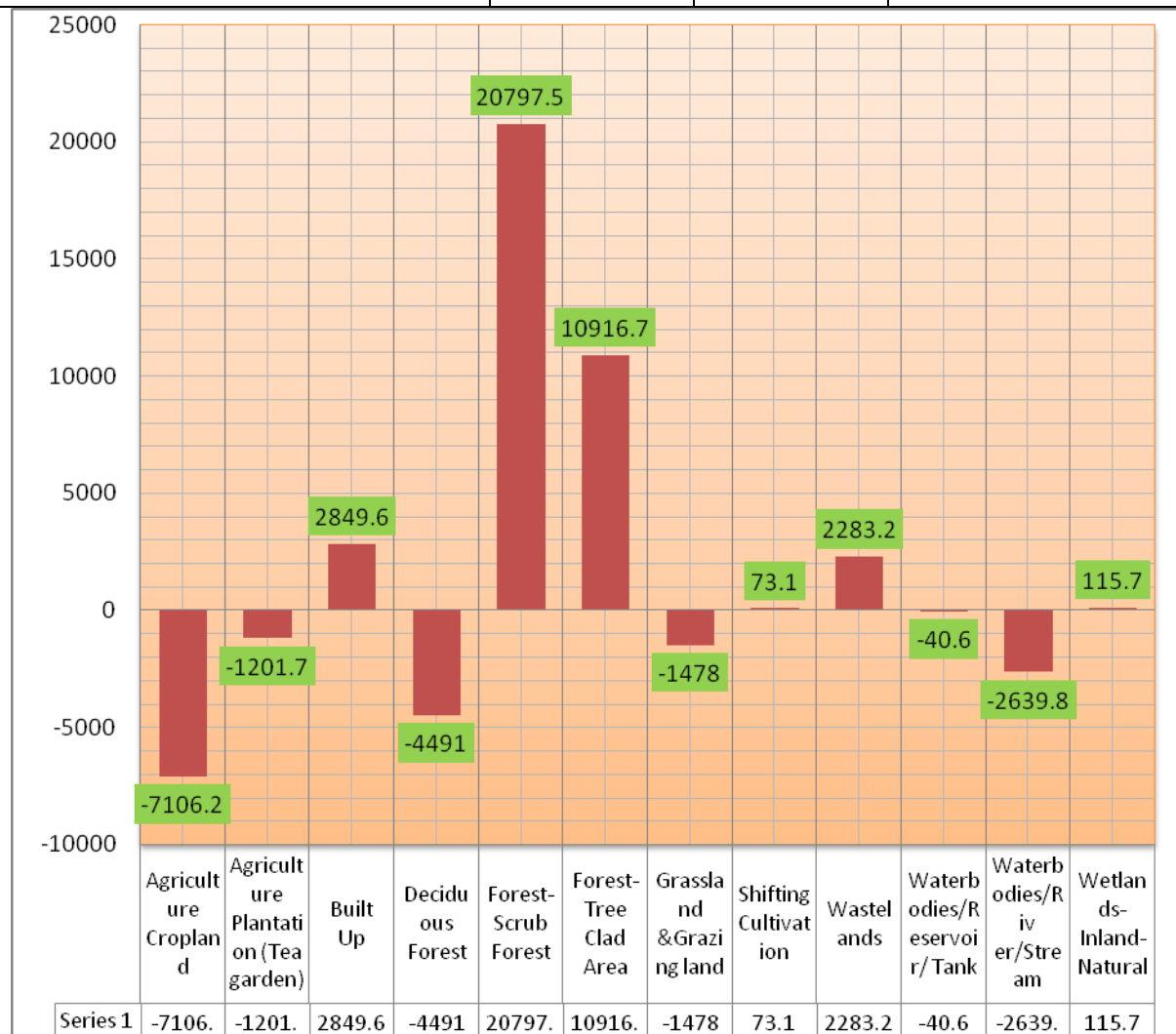
**Figure 2.4.a: Graph showing extent of changes (hectares) in LULUCF detected between 2005-2006 and 2015- 2016 at Kamrup West Division.**

Table 2.4: LULC matrix of Kamrup West Division for two time points 2005-06 and 2015-16

LULC 2005-06 to 2015-16	Agriculture Crop land	Agriculture Plantation/Tea Garden	Built-Up	Deciduous Forest	Forest-Scrub Forest	Forest-Tree Clad Area	Grassland & Grazing land	Shifting Cultivation	Waste land	Water bodies/Reservoir/Tank	Water bodies/River/Stream	Wetlands-Inland Natural	Grand Total
Agriculture Cropland	52372.9	11.5	2039.2	1332.1	775.0	7730.2	242.3		2049.7	16.8	1319.2	1995.9	69884.8
Agriculture Plantation (Tea garden)	138.6	551.3		22.5	76.4	1059.6				1.0	3.4	0.8	1853.5
Built Up	0.5		1.8	1.1		0.4							3.8
Deciduous Forest	671.3	7.6	6.2	46719.3	3305.0	2721.2	1.1	191.2	5.0	9.3	32.0	96.2	53765.3
Forest-Scrub Forest	601.2			830.3	6279.5	2220.3	0.8	5.4	0.0	3.2	76.5	22.0	10039.1
Forest-Tree Clad Area	2197.6	64.3	691.7	158.8	205.5	17756.2	28.6		100.2	6.3	72.2	89.0	21370.5
Grassland & Grazing land	1426.0		2.5	1.9	0.7	23.3	319.5			0.2	2000.1	132.6	3906.7
Shifting Cultivation				78.2	13.6	31.7		966.8					1090.3
Wastelands	34.9		0.3			56.7			206.9		8.2	6.9	313.9
Waterbodies/Reservoir / Tank	83.4	0.0	0.1	5.4	3.8	10.3				246.4	0.2	12.0	361.7
Waterbodies/River/ Stream	3564.9	15.8	46.0	101.4	56.4	396.5	1835.1		84.1	0.3	19103.5	82.2	25286.1
Wetlands-Inland-Natural	1687.3	1.3	65.7	23.1	42.6	280.8	1.2		151.2	37.6	31.1	1331.8	3653.8
Grand Total	62778.6	651.8	2853.4	49274.3	10758.4	32287.2	2428.7	1163.4	2597.1	321.1	22646.3	3769.5	191529.6

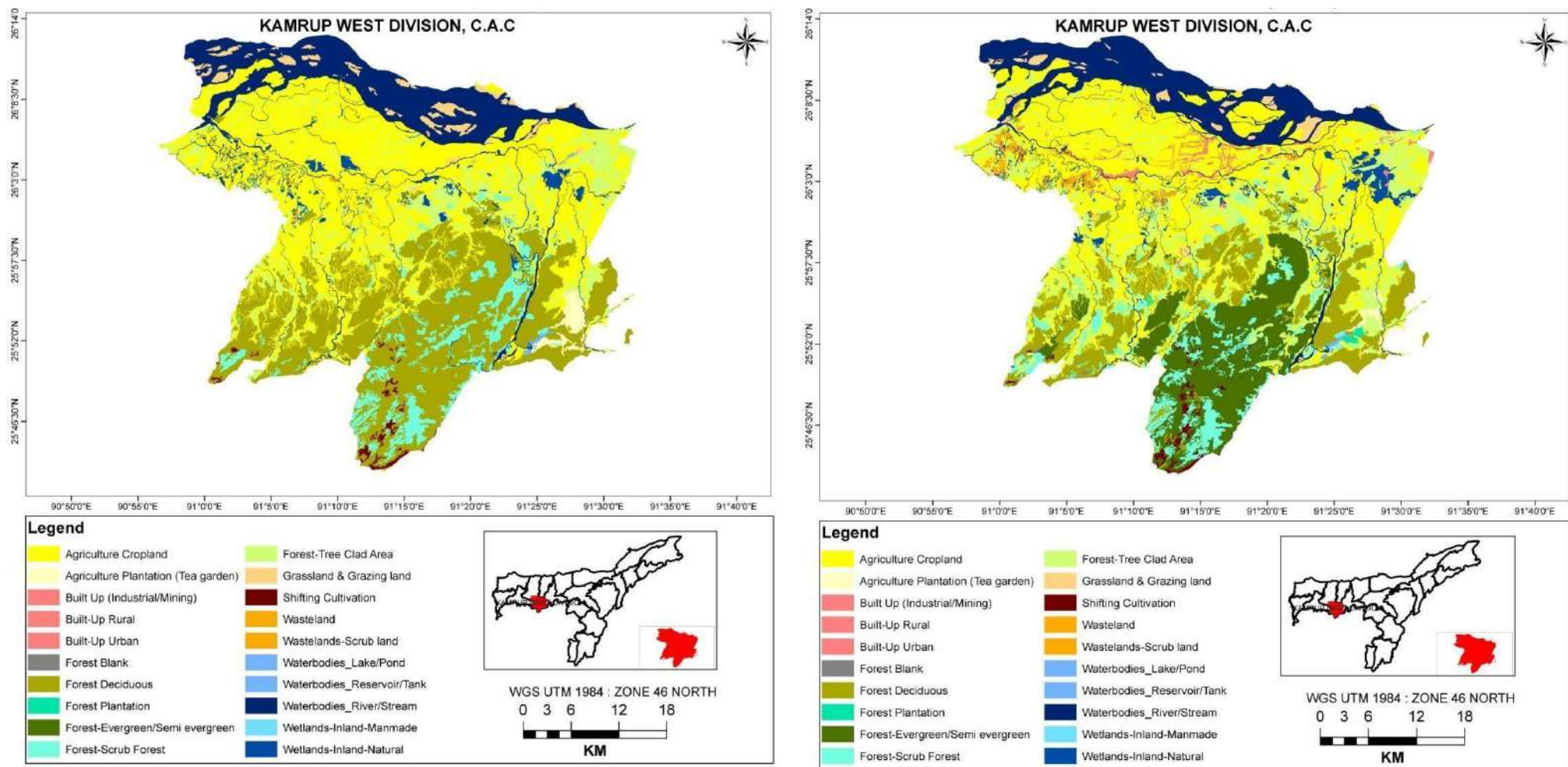


Figure 2.4b: Land Use Land Cover Map of Kamrup West division in 2005-2006 and 2015-2016.

2.5 Threat to the forest: The threats to the forest of Kamrup West division are briefly outlined in the succeeding paragraphs:

Human activity: The degree of injury and damage to the forests on account of human activities is the greatest and in fact it is greater than all other factors (listed earlier) put together. Humans cause damage to the forests in various ways.

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. However, incident of illicit felling has been reduced during last 5/6 years. Sporadic incidents of illegal felling takes place. The scenario of forest destruction can be imagined from the writings of the then Protection Range officer, Sri Yunush Salim quotation of which are given below.

1. Saw pits:- Reconnaissance in the char villages like Nagarbari, Malibari, Sammaria, Kalatoli, Balimari, Jambari, Andheritari, Jharpara, Goroimari, Charaibahi, Gumi, Poshgumi, Puthimari, Mazgumi, Sontali, Chinna, Futuri etc. as well as the villages in and around Reserve Forests produce that there are more than One Thousand number of saw pits running illegally and consuming 500-1000 cubic Meter of timbers a day.

3. Firewood:- Illegal collection of Fire wood in the Reserve Forests including felling of big sal trees to convert into firewood desperately by the illegal doers is causing Forest denudation.

Quoted from letter No.PS/KW/Illegality/95 dated 15/07/1999

illegalities there. A huge quantity of valuable trees have been felled in the Reserves namely Dimali R.F., Dampara R.F., Simlahill R.F., Khaksi Sikrabura R.F. and Ghraputa R.F. The unabated illegal felling at the time, while P.P. land operations are going on indicates that no other but the P.P. land Contractors are involved in these forest destruction. At the same time connivance by certain officials cannot be denied. Acquiring timbers from Reserve Forests under pretext of C.O. (P.P. land operation) and by compounding offences, a recent trend of the ill motivated businessmen has been evolved as the most detrimental deforestation work. I have seen some depots (authorised?) and found huge abnormalities there.

I. At Nam-Santipur in a depot 171 numbers of Sal and 16 numbers of N/Sal logs are lying, where, in most of the logs hammer impression has been defaced, end of the logs bearing hammer impression & figure (by serial) is cutted away to put passing hammer and the rest are bearing no hammer impression.

Quoted from letter No.PS/KW/Illegality/16 dated 12/02/1999

It is already been indicated earlier that part of the wet miscellaneous formations i.e. the 'Julis' have been drastically opened up for cultivation (the quantum being server during the sixties) and that is the type of forest which is important from the point of view of maintaining a judicious ecological balance as well as for acting as natural reservoirs reducing the peak flow of floods in the inhabitant areas, may be eliminated altogether. Even lands in the higher taris are being attempted for cultivation by way for encroachments. The cultivations in the "Julis" often tries to expand his of land by gradual widening of his area, and in the process trees in the neighbouring "taris" are adversely effected. Girdling of trees in the neighbouring "taris ostensibly for the purpose of removal of the cause of shade on the cultivated plots, are frequently result of such girdling is a common sight in some area. Destructive felling for the purpose of "Jhumming" (Shifting cultivation) are prevalent in some of the reserved forests (Ex-Gizang, Moman) of the division.

Whenever there is some enthusiasm for a public cause (opening of a school, a market etc.) in the villages in the vicinity of the forests, very often the latter are the first victim of such enthusiasm in the shape of demand for land and frequently such demand are acceded to.

Cattle: Cattle from the villages located near the periphery of the RFs cause damage to forest by way of grazing in the Reserved forests. These domestic animals often found to destroy the saplings, besides it causes soil compactness. Intensive grazing affects the regenerative capacity of forests. Grazing increases erosion in hilly areas thus affecting water retention potential.

Climatic causes: The pre-monsoon showers in April and the advent of monsoon proper later on are marked by a few heavy storms, which cause considerable damage in different years. These gale-force wind break the seed bearing branches of Sal and blow away the immature seeds. Quite a few Sal trees become wind thrown annually, and in same years such windfalls not only nullify the work of the Division but also upset all attempts at control of yield by these natural occurring in the month of May. Seasonal floods affect trees occasionally, at the periphery of low lying areas. Frosts are non-existent in this division.

Fire: This is a regular annual feature in all the compartments, particularly in the accessible area. Except for area under young regeneration or plantations, no appreciable harm is done by such annual fires. Early controlled burning and allied fire protection measures are adequate to safeguard the former areas.

Climbers, Epiphytes, Parasites, Fungus etc: In the plain Sal area, infestation of climber is rather light. In the moist deciduous forests, and hills, climber infestations is moderate to heavy. Climbers cause considerable damage in the form of producing weed, crooked or forked trees, wind throwing on a number of trees at a time when these are heavily infested by inter twining climbers and occasional complete suppression of killings off a tree altogether. The epiphytic behaviour of trees of Ficus spp.in early stage to gain a foothold on a host tree and then out growing and completely enveloping the host tree results in the death of the later. Such instances are sporadic at present. Loranthus spp. invades Sal and other trees as a partial stem parasite, but the instances are not alarming. There are sporadic instances of Sal trees being infested by the fungus polyporus spores resulting in occasional death.

Insects: Felled trees, particularly wind-fallen Sal trees are attacked by the borer namely, *Hoplocerambyx spinicornis*. The damage can be checked by timely debarking of felled trees. Standing dead or sick Sal trees are also attacked by this borer. Certain amount of damage is also done by leaf defoliators of both Sal and Teak. The canker grub is seen to infest occasional young trees in teak plantations.

Animals: The number of wild animals having been drastically reduced due to human interference in these forests, the quantum of damage from this source is not significant. However, small animals in big number cause damage to the forests. Rats and rodents damage Sal seedlings by growing of the roots while burrowing under ground. Monkeys do a certain amount of mischief by breaking inflorescence of Sal and by pulling up young seedlings.

Wild elephants (even domestic ones working or grazing in the forests) debarks standing Sal trees leading to the death of the trees.

Due to heavy pressure on land almost all the areas outside the Reserved Forests in the Division have been opened up for cultivation and therefore the reserved forests are the only place left for grazing of domestic animals, the incidence of grazing in areas adjacent to Villages is rather heavy but the effect is localized and not irreversible for regeneration and plantation areas fencing become compulsory on account of this factor in certain locations, bare sports denuded of all undergrowths at the edge of the Forests, where cattle are tendered during the rains and where the soil become compacted are readily noticeable.

2.6 Distribution of different forest types: The different types of forest in the Division are classified as envisaged by Champion and Seth (Revised Survey of Forest Types of India), The following table shows the forest types along with their classification codes. The forest types in the Division have however changed during the course of time. Area under different forest type is shown in table 2.6.a. Pie diagram showing area under various forest type of Kamrup West Division is in figure 2.6.b. The distribution of different forest types is illustrated in the map (fig: 2.6.c).

Table: 2.6.a Area under different forest type

Forest type	Area in hectare
1.Eastern Hill Sal, Khasi Hill Sal	4872
2.Moist Plains Sal Kamrup Sal	8264
3. Moist mixed deciduous forest including pockets of evergreen patches	18484
4. Miscellaneous formation including open beel, Mulla, Stream beds etc.	2933
5.Jhummed over areas part under secondary euphorbiaceous shrub	1262
6. Moist Sal Savannah	414
7.Areas under Plantations	1093
8. Area under cultivation, Forest Village,.	5449
9. Encroachment	10733

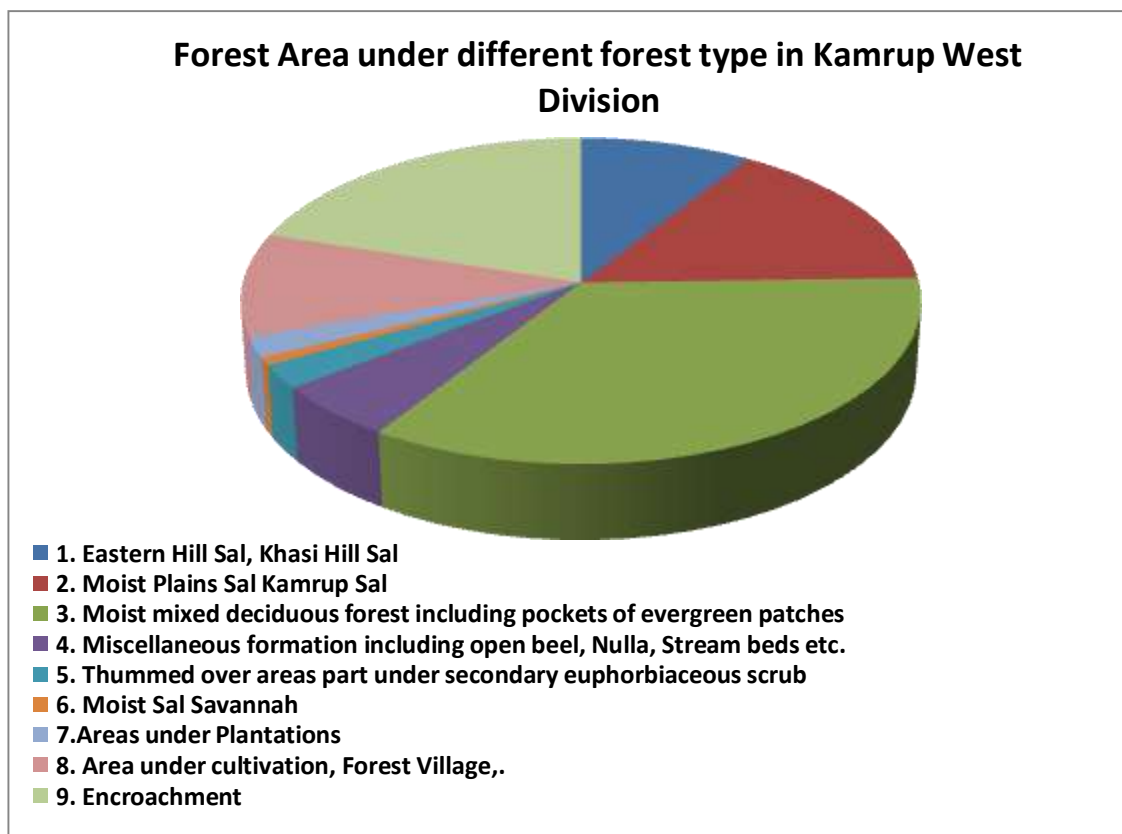


Fig: 2.6.b Pie diagram showing area under various forest type of Kamrup West Division

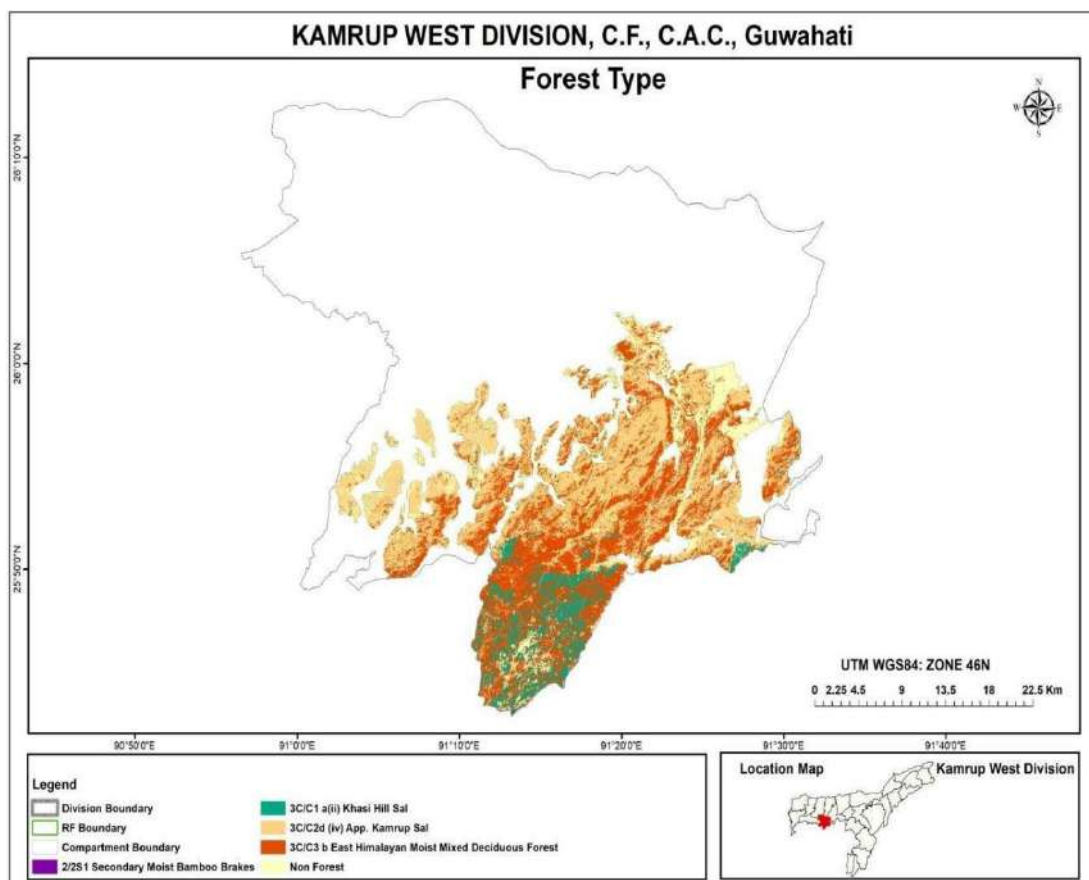


Fig.2.6.c. Forest type map of Kamrup West Division

*Source : A revised survey of the forest types of India By Champion and Seth (1968)

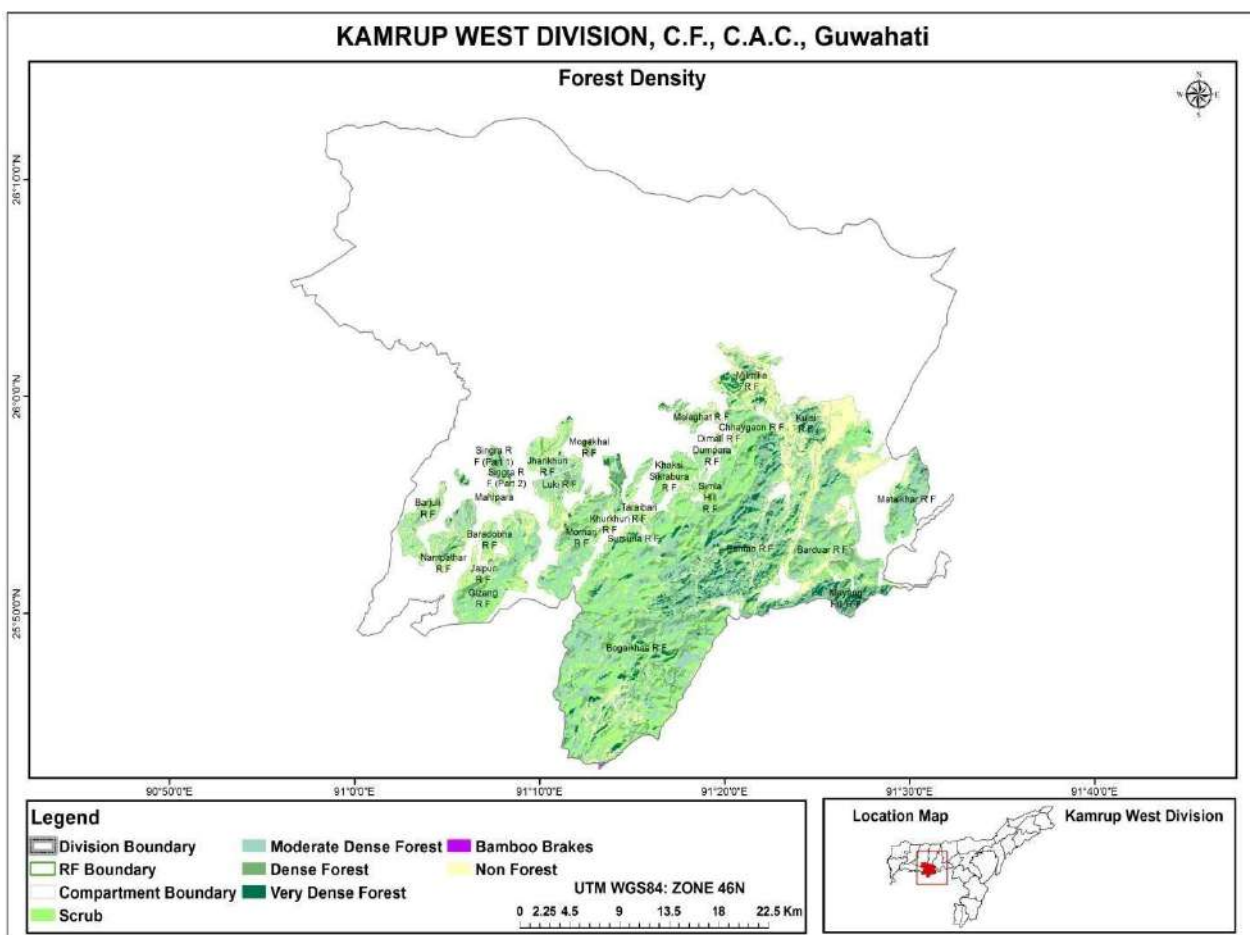


Fig. 2.6.d. Forest density map of Kamrup West Division

2.7 Tree cover outside forest areas: Trees outside forests (TOFs) are important natural resources that contribute substantially to national biomass and carbon stocks and to the livelihood of people. Trees outside the forest (TOF) comprise a heterogeneous and locally very different natural resource, also referred to as tree resource outside the forest (TROF). Over the last decades, decision makers have become increasingly aware of the importance of TOF, and as a consequence, this tree resource is, now-a-days, often considered in forest monitoring systems. Despite the important role of TOF in subsistence and market-based rural livelihood diversification, and the consequent reduction in pressure on national forests from on-farm trees, current government policies and practices fail to recognize the value of these trees. A responsive service mechanism centered on tree growing households would help the management of tree resources on the farmland. Numerous studies have been conducted on assessment of carbon, biodiversity and livelihood. However, a knowledge gap exists regarding TOF resources at the rural level related to policy in particular. TOF have good potential for sequestering atmospheric carbon and enhancing plant biodiversity. The private sector has a significant role in promoting TOF in the form of on-farm trees, agroforestry and others non-wooded land management. The government's role has not been satisfactory for enhancing TOF. Therefore, TOF and its management should be given high priority for bio-diversity conservation, carbon sequestration and promoting rural livelihood.

Trees outside forest (TOF) are the trees growing outside the recorded forest area in the Division. A large part of the demand of the people in terms of timber, fuelwood, and resources is being met from

outside forest areas and therefore assessment of TOF becomes imperative in this Working Plan. There is large number of home grown species found in the revenue areas of this District. These are grown by people in rural areas over their land as habitual socio-cultural practices by planting fruit bearing trees like Mango (*Mangifera indica*), Jamun (*Syzygium cumini*), Jackfruit (*Artocarpus spp*), Jalpai (*Elaeocarpus serratus*), Amlakhi (*Phyllanthus emblica*), Silikha (*Terminalia chebula*) etc. along with patches of Bamboos. Further, trees exist on road-sides, planted by the Forest department. The tree outside forest cover is shown in the Map 2.7.a

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. IRS P-6 LISS IV (5.8m) satellite images were geometrically rectified with the help of Survey of India toposheets on 1:50,000 scale. Mapping of TOF areas was carried out by digitizing the green-wash area by taking them as proxy forest areas and masking them out. Map showing the tree outside forest areas in Kamrup West Division is shown in the figure 2.7.a. The total area of tree outside forest in the Division is 15,337.12 ha. Details of TOF areas with the coordinates is provided in ANNEXURE VI.

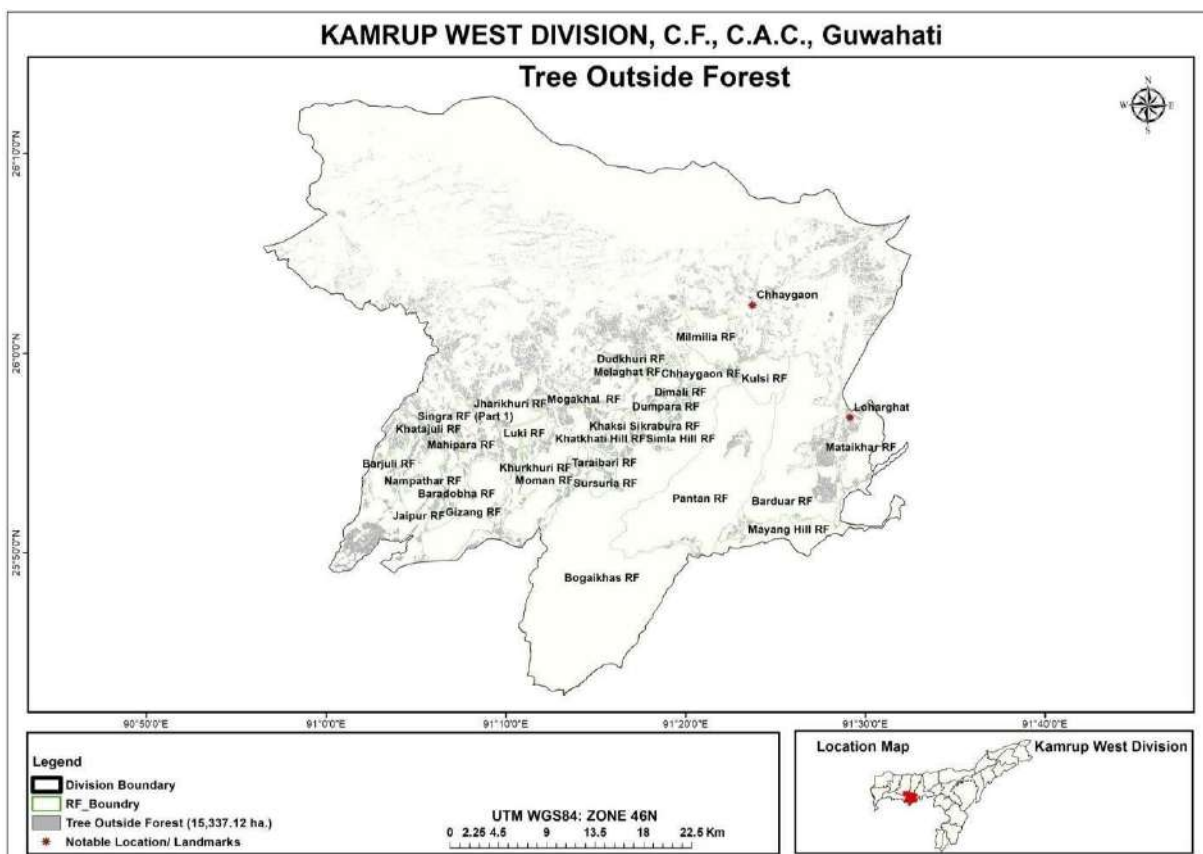


Fig. 2.7.a Map showing tree outside forest in Kamrup West Division.

2.7.1 Unclassified State Forest (USF): USF areas are those patches in the jurisdiction of the forest Divisions, outside the Reserved forests that are above 10 hectares in area. These were delineated and mapped (see Figure 2.7.1a). Detail area of each USF patch and coordinates is shown in ANNEXURE. Please refer Fig. 2.7.1a.

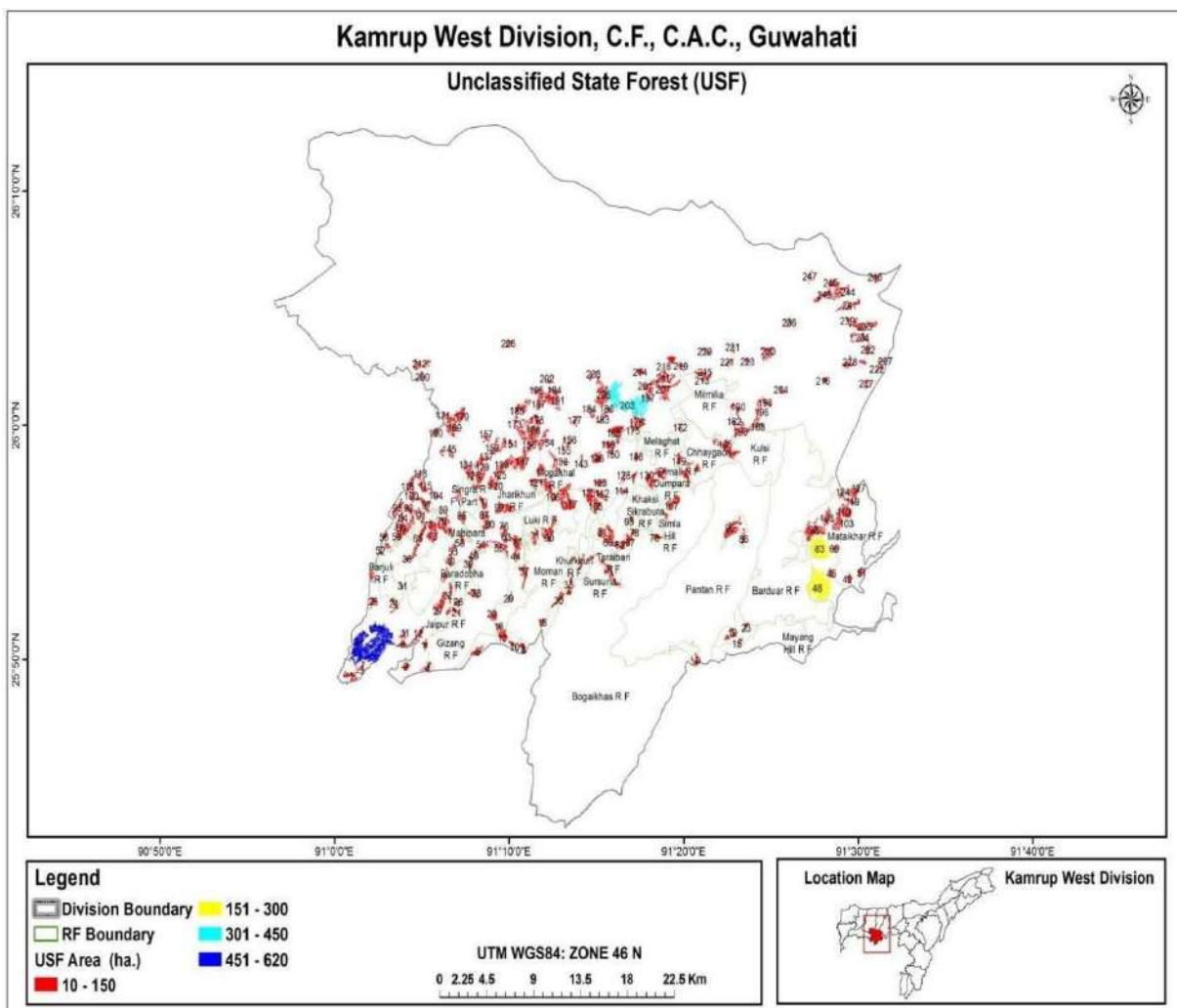


Fig. 2.7.1a. Map showing Unclassified state of forest in Kamrup West Division

2.8 Shifting cultivation: Before constitution of Reserved Forests in the Division, there were considerable extent of Jhumming (Shifting Cultivation) in the hilly areas as has been observed by Copeland and Milroy, the pioneers in Forestry in these Divisions. The first Reserved Forest in this Division was formed in 1772-73 and the process of constitution of Reserved Forests is still continuing.

A considerable population of Garos formerly lived by Jhum cultivation 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. After the formation of the first Reserved Forest, demarcation of the areas were taken in hand, Jhum cultivation was prohibited in the hills and fire protection was introduced for the first time in these forests. Presently, there is no official record or information of shifting cultivation in the Division. However, negligible amount of shifting cultivation has been found in the areas adjoining the Assam-Meghalaya borders, specifically in the Lumpi areas.



Chandubi Road, Rajapara under Loharghat Range



CHAPTER 3

MAINTENANCE, CONSERVATION AND ENHANCEMENT OF BIODIVERSITY

3.1 Forest composition and distribution

Brief descriptions of the different types of Forests as per (or approximating to) classifications given in the Revised survey of Forest types of India by Champion and Seth; to which the Forest Reserve dealt with this working plan belong are furnished in the succeeding paragraph.

Eastern Hill Sal Forests-Khasi Hills Sal (Types 3C/Cla (ii):

As the name implies, this type occurs in the hilly areas of the Reserved Forests of the Division and Sal forms pure patched and groups along the ridge and spurs, the valleys and the middle slopes being occupied by miscellaneous species and Bamboos. In areas subject to frequent biotic interference, pure Sal patches may extend to the valleys and mid-slopes, also particularly on the southern and western aspects. The Sal trees occurring along the ridges are rather of poor quality, with poorly developed crown and low branches, whippy Sal is frequently found in these Sal patches where there are slight openings, with occasional poles and saplings.

Makri Sal and Haldu are the common associates of Sal in the spurs and ridges, Titasopa also occur on the top of Hills along less accessible areas. Other associates in the top canopy are Oksi, Sida, Bhomora, Tia, Ahoi and an occasional Gamari, Hatikerepa, Paroli, Kaunla, Hingori etc.

The light middle storey is made up of Garokhuta or Garogine, Gainali, Amlakhi, Kum, Kanchan, Kathalua, Bhela, Bhadia, Garcinia sp. etc. and occasional bamboos (Kako).

The most common ground cover in locations having closed canopies is Sau-grass (*Microstegium ciliatum*). In open areas *Imperata cylindrica* replace it. Other spp. commonly found as ground cover are *Carex stroementitia*, *Thysanoloena maxima*, *Alpinia mallughas*, *Coffea bengalensis*, *Eupatorium odoratum*, *Holmskioldia sanguinea*, *Zizyphus* sp. *Aspergus* sp. *Pouzalzia uiminea*, *Desmodium* sp. *Indigofera* sp. etc.

Climbers frequently met within this type are *Butea parviflora*, *Entada phaseoloides* with occasional *Millettia auriculata*, *Dalbergia tamarindiflora*, *Dalbergia arimosa*, *Caesalpinia crista*, *Cissus repanda*, *Ficus scandens*, *Bauhinia anguin*, *Acacia concinna*, *Jasminum* sp, *Embelia nutans*, *Embelia negushia* etc.

Most plains Sal forests-Kamrup Sal (type 3C/c 2d (ii)

The lower slopes of the foothills and the 'Taris' in the alluvial plains are occupied by this type of forests in the Division. Sal forms pure stands and amongst the trees of 30 cm DBH and up, it occurs to the extent of 73% to 95%. The general quality Ic I/II except for Sal occurring in "Khorkari" soil and in areas with high water table (of along the banks of Chandubi beel) or inadequate drainage, where the trees are stag-headed and of poor quality. Whips and established Sal accrue in adequate numbers where

the openings in the canopy are sufficiently large. Groups and patches of advance growth are commonly found in the areas, probably as a result of group fellings carried out during Dr. Bor's Plan. The associate of Sal in the top storey in this type in the order of their occurrence (amongst trees of 30 cm and up in DBH in some typical compartments) are: Makri Sal (4.8%), Oaks (2%), Ahoi (2.3%), Jia (1.1%), Sida (0.9%), Salkali (0.9%), Paruli (0.7%), Jam (0.5%), Bhomora (0.3%), Gohora (0.2%), Ajhar (0.15%), Hatikerpa (0.14%), Hingori (0.11%), Ghora neem (2%).

In areas subject to heavy burning, the middle storey is practically absent and is made up of a few fire resistant species like Kum, Gamari, Ahoi, Malosi, Bhela etc. In other areas besides the above species Dhudkhuri, Khukhuru, Tekburuki, Garogaine, Gohora, Bhadia, Bhatghilla, Tarath, Harubandha etc. form the middle storey. In comparatively moist locations, not subjected to annual burning, the middle storey is made up of species like Khukra (*Tricalysia singularis*), Narasingha, *Achronychia laurifolia*, *Garcinia xanthochymus*, *Garcinia anomala*, *Pavetta indica*, *Litsea* sp. *Persea bombycina* etc.

There are great variations in the ground cover. In comparatively young Sal areas, areas subjected to annual burning and having a more open canopy, thatch (*Imperata cylindrica*) forms the main ground cover along with *Curcuma aromatica*, *Flemingia* sp. *Leea* sp. *Sida carpinifolia*, *Carex stramentitia*, *Grewiasapida*, *G. Sclerophylla*, *Desmodium triquetrum*, *Premna herbacca*, *Clerodendron* sp. *Urena lobata* etc. Occasional patches of *Microstegium ciliata* may occur in areas not subjected to annual burning. *Eupatorium odoratum* occurs along the edges of compartments near open areas (Villages), and also in larger openings in the forests, but it replaces by thatch with annual burning. In closer canopied areas *Coffea bengalensis* predominates. In more moist locations *Alpinia allughus*, Ferns, *Phloganthus thyrsoiflorus* etc. occur with occasional cane. Some of the other species occurring as ground cover are *Aspergus* spp, *Pouzolzia viminea*, *Sida cordifolia*, *Desmodium cephalotes*, *D.laburnifolium*, *D.latifolium*, *Indigofera* sp. *Justicia gendarussa*, *Clerodendron serratum*, *Achyra* sp., *Physsanthus simplex*, *Cannabis sativa* etc.

Climber infestation in this type, particularly in areas subjected to steady accessibility is not heavy. *Butea parviflora* and *Cissus repanda* are the common species with occasional *Dalbergia stipulacca*, *Bauhinia vahlii*, *Accacia pinnatea*, *Unceria sessilifructus*, *Stenochleana pakustre*, *Milletia accriculata*, *Delima sarmentosa*, *Merremia Umbellata*, *Embelia* sp. etc.

Most mixed deciduous forest: Approximates to types 3c/c, (b) and Type 3c/c3 (2SI). (Type apparently not covered in the revised survey of survey of forest of India).

The middle slopes of the hills excluding spurs and ridges are occupied by this type of forests and this also forms occasional patches in the plains Sal areas. Scattered Sal trees occur in this type but it does not dominate by forming large, pure patches, as in the proceeding two types. The top storey species in order of a frequency of occurrence (% amongst of 30 cm & up in DBH) area: Sal (10%), Ahoi (10%), Makari Sal (10%), Oxi (9.5%), Jia (4.6%), Parali (4.4%), Bhelu (3.2%), Sida (3.05%), Udal (2.8%), Jam (2.7%), Bahera (2.4%), Gamari (2.2%), Kanchan (1.9%), Amari (1.9%), Kum (1.7%), Garodine (1%), Uingori (1.5%), Seleng (1.2%), Khokhen (1.2%), Dudhi (1.1%), Salkali (4%), Kuhir (0.9%), Cham (0.9%), Sopa (0.8%), Sirish (1%), Amara (0.7%), Phoko (0.8%), Koro (0.6%), Thutmela (0.6%), Sanoru (0.5%), Diamru (0.5%), Hilkha (0.5%).

In large parts of this type of forests, particularly on the cooler aspects and the valleys, the middle storey as occupied by bamboo (*Dendracolamus hamiltonii*) and along streams by another type of bamboo (*Neouhouzeaua Dullooa*). In the rest of the area the middle storey is not distinct, as it is often swamped by tall shrubs and climbers. Species occurring here are Kum, Bhela, Dudhkuri, Dudhi, Amlokhi, Godhajam, Dol-Poduli, Gorogain, Telbhuruki, Khukhru, Jarath, Larubandha Bhatghila, Bhadix, Ilex, sp. *Serries robusta*, *Randia* sp. *Canthium glabrum*, *Vanguiera spinosa*, *Cordial* sp. *Vitex canesceas*, *Bridlia tomentosa*, *Endospermum chinese*, *Sapium* sp-*Macaranga* sp. *Trema* sp. etc.

Along the lower slopes of the foothills as well as the plains, where this type of forests occur, in open locations thatch predominates as ground cover. In the hill slopes, with closed canopies sau grass occur as grubbed cover, *coffea bengalensis* occurs in patches with closed canopies in the lower slopes. Some of the other species met with as ground cover are *Eupatorium odoratum*, *Holmskioldia sanguine*, *Pouzolzia viminea*, *Antidesma diandrum*, *Phyllanthus simplex*, *Reidia hamiltoniana*, *Sida* sp; *Urena lobata*, *Leea* sp; *Desmodium* sp. *Flemingia* sp. *Monosa himalayana*, *Sambusus javanica*, *Viburnum colebroohianum*, *Morinda aungustifolia*, *Indigofera* sp., *Xanthuim stumarium*, *Ardisia* sp; *Buddleia asiatica*, *Salamen* sp; *Buddelia asiatica*, sp;.

Climbers are rather abundant in the mixed deciduous forests and some of the species found are *Entada phaeseoloides*. *Butes parviflora*, *Milletia auriculata*, *Smiles Macrophylla*, *Accacia pennata*, *A. Concina*, *Dioscotea* sp; *Derris cuneifolia*, *Umbellia natans*, *E nagushia*, *Uncari sessilifructus*, *Dalbergis stipulacea*, *Dalbergia rimosa*, *caesalpinia crista*, *Ficus scandens*, *Cissus repanda*, *Dalhouse bracteates*, *Naravelia*, *zeylanica*, *Dysolobium grande*, *Baubinia anguina*, *Heptapleurum vennlosum*, *thonbergia grandiflora* etc.

Evergreen patches:

Approximates to type 2B/C.I.a forests in the West Kamrup Division is very limited locations being away from habitation and not subject to any biotic interference in the form of grazing, fire etc. These patches occur mainly in the hills along banks of perennial streams and in shady moist pockets along nullas. The climax formation is represented by pure pockets of Nahar (*Mesua ferea*) in other locations some of the species found are cham, Amari, *Gacinia* sp. *Paroli*, *Carrallia brachiata*, *Dysoxylum* sp. *Castonopsis* sp. *Beilschmeida* sp; *Cinamomum* sp. *Phoebe lanceolata*, *Actinodaphne* sp. *Litsea* sp. *Dryptos assamica*, *Engelhardia spicata*, *Ficus* sp. etc.

The middle storey is usually occupies by bamboos (Kako and Dalu) in the hill slopes and otherwise it is sparse and made up of *Garcinia* sp. *Premna* sp; *Talauma* sp; *Mitrephora tomenyosa*; *Flacourtia cataphratta*, *Micromelum pubescens*, *Chisocheton paniculata*, *Turpinia pomifera*, *Aesculug panduana*, *Meliosma* sp; *Heteropanax fragrans*, *Triculysia singularis*, *Pavetta indica*, *Saprosma ternatum*, *Symplocos* sp; *Styrax serrulatum*, *Chinnamomum* sp; *Cinnamomum* *Litsea* sp; *Aporosa aurea*, *Sarchochlamys pulcherrima*, *Oreocnide ibtogrifolia* etc.

Species occurring as ground cover in this type are *Alpinia allughas*, *A. Bracteata*, *Phlogacanthus* sp; occasional canes, *Phrynium* sp; *Hedychium* sp; *Ammomum linguiforme*, *Ferus* (*Cycathea*, *Angiopteris* etc.) *San-Grass*, *Unona longiflora*, *Sida cordifolia*, *Glycosmis pentaphylla*, *Paramignya griffithii*,

Rhammus nepalensis, *Aphania rebra*, *Desmodium labournifolium*, *Vigurnum colebroobianum*, *Maesa indica*, *Myxopyrum smilacifolium*, *Litsea salicifolia*, *Elaeoganus* sp. Etc.

Climbers are not abundant in this type and besides the species mentioned in the preceeding types, *Cnesmone janvanica*, *Conocephalus suaveolens*, *Hodgsonia hiteroelita* etc. also occur in such areas.

Secondary Moist Bamboo Brakes (Type 2/2 S.I):

In the hilly area, along with the moist mixed deciduous forests large tracts are occupied by bamboo-brakes. The bamboos even extend to the evergreen patches in the hills. The principal species of bamboo is the Kako (*Dendrocalamus hamiltonii*) and Dalu (*Neehouzeaua dullooa*) bamboos occupy limited areas in the shape of bets in damp locations along streams and nullas. Dalu bamboo do not form compact clumps.

Secondary Eupherbiaceous serul (Type 3C/C3/2.S.2):

Jhumming (shifting cultivation) is prevalent in some of the hilly reserved forests (ex. Gizang, Moman etc.) of the Divisions and in area abandoned (after clear felling and raising 2 or 3 crops) after jhumming, this type of formation comes up initially. The species composing the only storey are *Macaranga denticulate*, *M. Indica*, *Treema orientalis*, *Grewia* sp; *callicarpa arborea*, *Albizia chinensis* etc, with occasional Kadam and hakan. The extent of area under this type is rather limited.

The undergrowth is composed of *Flemingia* sp; *Solamen* sp; *Abroma augusta*, *Ricinus communis*, *Minesa himalayana*, *Litsea citrate* etc. Climbers like *Dioscovea* sp; *Smiles* sp; *Naravelia zeylanica*, *Tapiria hirsute*, *Accacia concinna* etc. also occur.

Moist Sal Savannah (Type 3C/C2/DSI):

As the name implies, these occur as pockets or patches of grass-lands, in the “Taris” in the plains Sal areas, usually adjacent to villages or cultivation. These areas are subject to fierce annual fire and hence only stunted fire resistant trees occur in a very scattered way over the grass, species usually found being Kum, Bhela, Amlokhi, Dudhi, Bagari etc. and scorched saplings of Sal.

In the vicinity of the Sal trees, abundant whips of Sal exist which are burnt back annually, in the process the root stock growing stronger every year and with a little favourable condition, these get established quickly.

The principal grass occurring in such area are *Imperata cylindrical* and *Narenga porphyrocoma*. Associated with those are isolated individuals or small colonies of the grasses, e.g. *Apluda mutica*, *Themeda arundinacea*, *Cytopogon mardus* etc. Some of the other herbs and shrubs are found in association with grasses are *Grewia sapida*, *Premna herbacea*, *Leea* sp; *Flemingia* sp; *Plectranthes ternifolius*, *Anisochilus polystachyus*, *Anisomeles ovate*, *Argemone Mexicana*, *Sida carinifolia*, *Desmodium* sp; etc. Climbers in such area are conspicuous by their absence.

Wet-miscellaneous formations (Approximates to type 4D/SSA/and 4E/RST):

These formations can be divided into various subtypes but for the sake of convenience (as the extent under each is limited) have been lumped together under the above heading. These occur in the form of a belt along the banks of streams and edges of depressions, “Khorkani” Soils in the nullah beds as well as the marshy/swampy depressions (known as “Juli”) originating as a valley between two spurs in

the hills and extending far into the plains between the highland taris. The natural vegetation in the julis are being annually annihilated by very rapid expansion of paddy cultivation and are likely to be extinct if this trend continues.

The belt occurring along the edges of the streams and depressions are dominated by Ajhar, Bhelker etc. Along with these there are occasional Koroï, Uriam, Simalu & Khokon, *Turpinia pomifera*, *Syzygium ablatum* etc. The middle storey when present is formed by the trees of *Garcinia* sp. *Glochidion* sp; *Myristica* sp; *Pavetta indica* etc. The shrubs and herbs in such areas are represent by *Melastoma malabathricum*, *Sida cordifolia*, *Glycosmis pentaphylla*, *Paramignya griffithii*, *Osbeckia rostrata*, *Ardisia* sp; *Hedyotis* sp; *Forrestia mellissima*, *Colocasia antiquortuj*, *Homalomena aromatic*, *Alpinia bracteata*, *Ferus* and occasional canes. In “Khorkani” ormations occussional stunted Sal may exist on the top of the mounds. *Clinogyne dichotoma* form large associations in such areas.

In the marshy/swampy depressions on the slightly raised locations individual stems of *Dillenia indica* thrives along with occasional *Anthocephalus cadamba*. In clayey soils *Sacharum spontaneum* covers large. In wet soils likely to dry up during winter *Saccharum procerum* occurs with the made Aarundinacea, *Erianthus ravennae* etc. Marchy areas are occuppies by associations of *Phragmites karka*, *Arundodonax*, *Leersia hexandra*, *Contus speciosus*, *Polygenum* sp; and areas etc.

Besides some of the species of climbers already enumerated in previous types other sp; occurring in such formations are *Clematis cadmia*, *Conocephalus suavelons*, *Cnesmone javanica*, *Merremia umbellate*, *Wttakilo volubilis* etc.

Based on the vegetation survey and forest inventory and compartment descriptions, a summary of important trees and other species found in the area is given in Annexure-I.

3.2 Plant species diversity: The majority of the Reserved forests are covered by plantations only. The major species of the plantations are either Teak or Sal. Hence not much diversity of species are seen in the Reserved forests of these Division. The IVI shows that *Tectona grandis*, *Shorea robusta* are the important species in the division.

Table 3.2. IVI of different species growing in Kamrup West Division

Sl.no	Species	Density	Frequency	Total basal area	Doiminance	IVI
1	<i>Acacia catechu</i> (L.f.) Willd.	0.01	0.56	0.42	0.00	0.20
2	<i>Aegle marmelos</i> (L.) Correa	0.00	0.28	0.11	0.00	0.08
3	<i>Aglaia hiernii</i> King	0.31	6.72	10.20	0.03	3.22
4	<i>Aglaia spectabilis</i>	0.03	0.56	1.28	0.00	0.32
5	<i>Albizia lebbeck</i> (L.) Benth.	0.13	3.36	2.14	0.01	1.25
6	<i>Albizia odoratissima</i> (L.f.) Benth.	0.04	0.84	0.45	0.00	0.32
7	<i>Albizia procera</i> (Roxb.) Benth.	0.69	12.89	13.12	0.04	5.66
8	<i>Alstonia scholaris</i> (L.) R. Br.	0.16	3.36	2.43	0.01	1.33
9	<i>Altingia excelsa</i> Noronha	0.01	0.28	0.14	0.00	0.11
10	<i>Artocarpus chaplasha</i> Roxb.	0.26	6.72	16.50	0.05	3.81
11	<i>Artocarpus lacucha</i>	0.01	0.28	0.09	0.00	0.09
12	<i>Averrhoa carambola</i> L.	0.22	5.04	5.20	0.01	2.13
13	<i>Baccaurea ramiflora</i> Lour.	0.03	1.68	0.46	0.00	0.51

14	<i>Bauhinia purpurea</i> L.	0.36	8.68	6.25	0.02	3.36
15	<i>Bombax ceiba</i> L.	0.03	1.96	3.64	0.01	0.91
16	<i>Bridelia retusa</i> (L.) A.Juss.	0.00	0.28	0.01	0.00	0.07
17	<i>Camelia sinensis</i>	0.00	0.28	0.02	0.00	0.07
18	<i>Canarium bengalense</i> Roxb.	0.01	0.28	0.14	0.00	0.09
19	<i>Careya arborea</i> Roxb.	0.70	7.56	9.46	0.03	4.02
20	<i>Cassia fistula</i> L.	0.17	7.00	1.98	0.01	2.18
21	<i>Chukrasia tabularis</i> A. Juss.	0.15	2.80	3.25	0.01	1.27
22	<i>Cinnamomum glaucescens</i>	0.01	0.28	0.18	0.00	0.11
23	<i>Colona floribunda</i> (Kurz) Craib	0.01	0.84	0.25	0.00	0.25
24	<i>Croton persimilis</i> Müll.Arg.	0.05	1.96	1.38	0.00	0.70
25	<i>Cryptocarya amygdalina</i> Nees	0.01	0.28	0.00	0.00	0.08
26	<i>Delonix regia</i> (Hook.)Raf.	0.01	0.28	0.03	0.00	0.08
27	<i>Dillenia pentagyna</i> Roxb.	1.09	24.93	27.03	0.08	10.70
28	<i>Diospyros variegata</i> Kurz	0.17	3.92	5.77	0.02	1.84
29	<i>Dipterocarpus indicus</i> Beddome	0.01	0.84	0.30	0.00	0.25
30	<i>Duabanga grandiflora</i> (DC.)Walp.	0.47	9.80	19.04	0.05	5.18
31	<i>Engelhardtia spicata</i> Lechanex Blume	0.00	0.28	0.04	0.00	0.08
32	<i>Erythrina stricta</i> Roxb.	0.10	3.36	2.35	0.01	1.23
33	<i>Ficus benghalensis</i> L.	0.00	0.28	0.82	0.00	0.16
34	<i>Ficus racemosa</i> L.	0.03	1.68	0.48	0.00	0.50
35	<i>Ficus religiosa</i> L.	0.01	0.56	4.39	0.01	0.62
36	<i>Garcinia kydia</i> Roxb.	0.01	0.56	0.08	0.00	0.15
37	<i>Garuga pinnata</i> Roxb.	0.00	0.28	0.08	0.00	0.08
38	<i>Gmelina arborea</i> Roxb.	0.38	8.40	8.52	0.02	3.56
39	<i>Holarrhena pubescens</i> Wall.	0.13	3.92	2.39	0.01	1.41
40	<i>Khasiaclunea oligocephala</i>	0.02	0.56	6.65	0.02	0.88
41	<i>Knema linifolia</i> (Roxb.) Warb	0.00	0.28	0.02	0.00	0.07
42	<i>Lagerstroemia parviflora</i> Roxb.	0.78	14.01	11.64	0.03	5.93
43	<i>Lagerstroemia speciosa</i> (L.)Pers.	0.08	1.96	0.86	0.00	0.70
44	<i>Lannea coromandelica</i> (Houtt.) Merr.	0.49	11.48	12.73	0.04	4.94
45	<i>Lithocarpus fenestratus</i>	0.09	2.52	0.94	0.00	0.85
46	<i>Litsea glutinosa</i> (Lour.) C. B.Rob.	0.00	0.28	0.04	0.00	0.08
47	<i>Litsea monopetala</i> (Roxb.)Pers.	0.10	0.84	1.83	0.01	0.56
48	<i>Machilus gamblei</i> King exHook. f.	0.15	1.68	2.76	0.01	0.95
49	<i>Magnolia champaca</i>	0.04	0.56	0.94	0.00	0.30
50	<i>Magnolia insignis</i> Wall.	0.01	0.56	0.19	0.00	0.18
51	<i>Magnolia kingii</i> (Dandy) Figlar	0.17	2.80	8.10	0.02	1.82
52	<i>Mallotus nudiflorus</i>	0.04	0.84	6.47	0.02	0.95
53	<i>Mangifera indica</i> L.	0.06	4.20	3.02	0.01	1.43
54	<i>Mangifera sylvatica</i> Roxb.	0.01	0.56	0.00	0.00	0.15
55	<i>Meliosma simplicifolia</i> (Roxb.)Walp.	0.00	0.28	0.16	0.00	0.09
56	<i>Mesua ferrea</i> L.	0.01	0.56	0.37	0.00	0.19
57	<i>Meyna laxiflora</i> Robyns	0.01	0.28	0.05	0.00	0.09
58	<i>Michelia oblonga</i>	0.01	0.84	0.53	0.00	0.28
59	Misc	0.18	5.60	7.78	0.02	2.48
60	<i>Morus macroura</i> Miq.	0.02	0.56	0.18	0.00	0.18
61	<i>Neolamarckia cadamba</i>	0.00	0.28	0.03	0.00	0.08
62	<i>Oroxylum indicum</i> (L.) Kurz	0.03	9.80	0.17	0.00	2.39

63	<i>Phyllanthus emblica</i> L.	0.35	0.28	3.25	0.01	1.02
64	<i>Polygonum plebejum</i> R. Br.	0.01	0.56	0.96	0.00	0.25
65	<i>Premna bengalensis</i> C.B.Clarke	0.01	0.84	0.22	0.00	0.23
66	<i>Premna milleflora</i> C.B.Clarke	0.01	0.28	0.19	0.00	0.11
67	<i>Sansevieria roxburghiana</i>	0.01	36.97	2.15	0.01	9.04
68	<i>Schima wallichii</i>	4.48	0.28	110.42	0.31	19.63
69	<i>Schima wallichii</i> Choisy	0.00	3.64	0.01	0.00	0.87
70	<i>Sesbania cannabina</i> (Retz.)Pers.	0.19	70.87	1.47	0.00	17.35
71	<i>Shorea robusta</i> Gaertn.	38.65	1.68	415.91	1.17	111.95
72	<i>Spondias pinnata</i> (L. f.) Kurz	0.04	13.45	0.87	0.00	3.37
73	<i>Sterculia villosa</i> Roxb.	0.60	14.29	15.53	0.04	6.09
74	<i>Stereospermum chelonoides</i> (L.f.) DC	0.50	14.29	24.72	0.07	6.91
75	<i>Syzygium cumini</i> (L.) Skeels	0.32	8.40	5.26	0.01	3.12
76	<i>Syzygium jambos</i> (L.) Alston	0.01	0.28	0.15	0.00	0.09
77	<i>Syzygium nervosum</i> A.Cunn.ex DC.	0.01	0.28	0.04	0.00	0.09
78	<i>Tectona grandis</i> L.f.	2.18	11.48	28.06	0.08	9.52
79	<i>Terminalia bellirica</i> (Gaertn.)Roxb.	0.37	10.08	8.43	0.02	3.94
80	<i>Terminalia chebula</i> Retz.	0.08	2.80	2.03	0.01	1.03
81	<i>Terminalia myriocarpa</i>	0.01	0.28	0.64	0.00	0.14
82	<i>Tetrameles nudiflora</i> R. Br.	0.72	11.76	81.32	0.23	12.71
83	<i>Toona ciliata</i> M.Roem.	0.28	7.84	7.21	0.02	3.13
84	<i>Vitex altissima</i> L.f.	0.51	13.17	13.03	0.04	5.41
85	<i>Zanthoxylum rhetsa</i> (Roxb.)DC.	0.01	0.84	0.49	0.00	0.28
86	<i>Ziziphus funiculosa</i>	0.01	0.56	0.05	0.00	0.16
	Total	57.47	420.45	938.31	2.63	300

3.3 Status of biodiversity conservation in forests: The biodiversity of forests is declining rapidly due to land use change, climate change, invasive species, over exploitation, and pollution. These are due to the adverse affects from various drivers. Encroachment, illegal felling for cultivation land has posed threat to the forest flora as well as faunal biodiversity. The State has several rules and regulations such as Biological Diversity Act 2002, Assam Biodiversity Rules 2010, State Forest Policy 2004, National Forest Policy 1988, Draft Assam Bamboo and Rattan Policy 2003, National Biodiversity Action Plan 2008, Assam State Action Plan on Climate Change 2015-30, etc. for conservation of biodiversity. The strategies include protection and making efforts to restore original ecosystem and halt habitat fragmentation, degradation and loss and shrinking of genetic diversity, promotion of indigenous tree species, improving canopy density in the existing forests, promotion of natural regeneration, promotion, protection and preservation of bamboo and rattan, preparation of comprehensive flora and fauna species lists, management of funds for biodiversity conservation and enhancement related work, involvement of local communities and their livelihood development, etc. Forests of entire State are suffering from biodiversity loss. Biodiversity is declining gradually in the forests. The prime and prominent cause of such biodiversity loss is antropogenic activity. Forests are surrounded by human habitation.

Illegal logging, 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 are often 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 they substantiate that if our forest could be protected from biotic interference, we can have good forests with diverse flora and fauna.

3.4 Status of species prone to over exploitation:

In Kamrup West Division, mostly all the reserved forests are having trees which are below the commercially exploitable girth. So the commercial exploitation of these trees is not very much prominent. However, the local villagers most often cut the trees to meet their domestic needs as fire wood. In this situation all the tree species under the Divisions are very much prone to over exploitation. Matured Sal and Teak trees of exploitable girth class had already been exploited illegally by timber smugglers long back. Under the present system, Khokhan, Bola, Bonsom etc. are prone to over exploitation due to high demand for timber. Rudraksa, bhatghila, etc. are heavily exploited for medicinal purposes.

Table 3.4: Status of plant species diversity prone to over exploitationin

Sl. No.	Common Name	Scientific name	Use
1	Khukan	<i>Duabanga grandiflora</i>	Timber
2	Bola	<i>Morus laevigata</i>	Timber
3	Bonsom	<i>Phoeba goalparensis</i>	Timber
4	Titasopa	<i>Michelia champaca</i>	Timber
5	Sida	<i>Lagaestromia parviflora</i>	Timber
6	Asan	<i>Terminalia tomentosa</i>	Timber
7	Koroi	<i>Albizia procera</i>	Timber
8	Kuhir	<i>Bridelia retusa</i>	Timber
9	Sam Kothal	<i>Artocarpus chaplasi</i>	Timber
10	Rudraksha	<i>Elseocarpus ganitrus</i>	Medicinal
11	Palash	<i>Butea monosperma</i>	for NTFP purpose
12	Mahogany	<i>Chukrasia tabularis</i>	Timber
13	Thekera	<i>Garcinia sp.</i>	Medicinal
14	Bhatghila	<i>Oroxylum indicum</i>	Medicinal
15	Haldu	<i>Adina cordifolia</i>	Timber

3.5 Conservation of genetic resources:

Preservation plots were laid out in different forest types of Assam as one of the important means for conserving and protecting the existing biodiversity for conservation of genetic resources of important

floral species as well as for assessing ecological changes occurring in such areas over a period of time. In Kulsi such a preservation plot was laid in 1969 comprising an area of 4.00 hectare details of the plot is as under-

Name of preservation plot: Kulsi

Situation: Kulsi Reserved Forest

Division: Kamrup West division

Area: 4.0 ha

Forest type : Khasi hill Sal forestType: 3C/C1/(a)(ii)

Date of formation –1969

The dominant species are Tectona grandis (Segun) and Shorea robusta (Sal).

Table 3.5a shows some preservation plots laid in Western Assam Genetic Range, Rani by Genetic Cell (Research) Division.

Table 3.5a showing some preservation plots laid by Genetic Cell (Research) Division

Sl. No.	Name / Plot No.	GPS Coordinates		Tree species	Description of the Plot	Remarks
1	WAG/12	A. N: 25°58'15.1" E: 91°25'01.2"	B. N: 25°58'17.5" E: 91°24'57.1"	Simul (Bombax Malaberica)	Area: 2Hect. Location/RF: Kulshi, Year of selection: 1991-92	Total Nos. of Simul (Bombax Malaberica) trees found in the plot is 200 Nos. out of which 18 Nos. of trees are selected as "Plus Tree".
		C. N: 25°58'16.8" E: 91°24'57.6"	D. N: 25°58'11.0" E: 91°25'01.0"			
2	WAG/13	A. N: 25°58'16.2" E: 91°24'13.0"	B. N: 25°58'16.0" E: 91°24'12.1"	Simul (Bombax Malaberica)	Area: 10 Hect. Location/RF: Kulshi, Yr of selection: 1991-92 Forest Type: 3C/C1 a (ii)	Total Nos. of Simul (Bombax Malaberica) trees found in the plot is 165 Nos. out of which 13 Nos. of trees are selected as "Plus Tree".
		C. N: 25°58'01.4" E: 91°58'13.1"	D. N: 25°58'16.2" E: 91°58'13.2"			
3	WAG/14	A. N: 25°58'30.6" E: 91°24'35.1"	B. N: 25°58'32.1" E: 91°24'29.0"	Teak (Tectona grandis)	Area:1 Hect. Location/RF: Kulshi, Yr of selection: 1991-92 Forest Type: 3C/C1 a (ii)	Total Nos. of Teak (Tectona grandis) trees found in the plot is 50 Nos. out of which 10 Nos. of trees are selected "Plus Tree".
		C. N: 25°58'28.0" E: 91°24'25.0"	D. N: 25°58'27.0" E: 91°24'30.4"			
4	WAG/15	A. N: 25°58'30.6" E: 91°24'35.1"	B. N: 25°58'27.0" E: 91°24'35.1"	Teak (Tectona grandis)	Area: 9 Hect. Location/RF: Kulshi, Yr of selection: 1991-92 Forest Type: Northern Tropical Moist Deciduous Khasi Hill Sal 3C/C1 a (ii)	Total Nos. of Teak (Tectona grandis) trees found in the plot is 95 Nos. out of which 14 Nos. of trees are selected "Plus Tree".

3.6 Fauna and their habitats: Because of human disturbances in the form of over exploitation of resources, illegal felling, encroachments, grazing etc. wildlife habitat is degraded to a great extent causing depletion of wildlife population and reduction of diversity. Elephant may be recognized as flagship species in the forests of Kamrup West Division. No other big animal can be seen in RFs. However, Avi fauna including migratory birds find the basic elements i.e., food, water and shelter in the forests. Reptiles and amphibians are abundant.

Statement showing some important fauna and their habitats/microhabitats in Kamrup West Division is shown in Table 3.6a.

Table 3.6a: Statement showing some important fauna and their habitats in Kamrup West Division, Assam

Sl. No.	Range	Name of the Species	Habitat / Microhabitat	Area	Remarks
1	Singra	Elephant	Deep Jungle area	Jarikhuri RF Bogaikhas RF, Taraibari RF Gorubaldha RF Khurkhuri RF Moman RF Luki RF	Herds of elephant move from place to place, covering various Reserved forests in search of food. During winter, the herds move to Meghalaya borders and are spotted back in the Reserved Forests during rains
2	Loharghat	Elephant	Deep Jungle area		Available in 3 R.F.s
3	Loharghat	Rhesus Monkey	Arboreal	Mayang R.F.	
4	Loharghat	Civet	woodlands and grasslands	Mataikhar R.F.	Nocturnally visible in the Reserved forests as well as in the forest vilages, climb roof of houses, may be vulnerable to man- animal conflict.
5	Loharghat	Langurs	Arboreal	Barduar R.F.	
6	Loharghat	Deer	grasslands	Mainly Jimpota and Gutipathar area in 3 Nos.R.F.	very rarely seen as very shy animals
7	Loharghat	Variety of Reptiles	holes, burrows and crevices		not much threat in the area. However, a number of Cobras are also reported
8	Kulsi	Elephant	Deep Jungle area	all the Reserved Forests	
9	Kulsi	Monkey	Arboreal		
10	Kulsi	Deer	Doars and grasslands		even seen in flocks
11	Kulsi	Wild pig	grasslands, make nest in the grassland areas		shy animals
12	Kulsi	River dolphin			
12	Bondapara	Snake	Both Land and water		both venomous and non-venomous snakes reported
13	Bondapara	Eel	Found in swampy areas		edible species need immediate attention
14	Bondapara	Pond Heron/ Paddy Bird	Found in bushes in and around water bodies, can swim in the periphery of water bodies		
15	Bondapara	Egret	Builds nests, found on grazing grounds as well as perched along river side.		
16	Bondapara	Crab	Burrowing habit along side water bodies as well as in the crevices of rocks.		
17	Bondapara	Kingfisher	Builds nests in trees.		
18	Bondapara	Mongoose	Burrowing animal.		
19	Bondapara	Fox	Found in deep forest.		
20	Bamunigaon	Elephant		Pantan RF	
21	Bamunigaon	Monkey		Pantan RF	
22	Bamunigaon	Deer		Bogaikhas RF	
23	Bamunigaon	Wild-Pig		Bogaikhas RF	

3.7 Threats and Challenges to wildlife: Most of the Reserved Forests of Kamrup West Division are surrounded by human habitations/cultivations and due to the constant disturbance larger animals have practically been wiped out or have moved else-where from all such areas.

Some of the animals existing in the accessible areas are the Rhesus macaque and Assamese Macaque, Jungle Cat, Civets, Mongoose, Jackal, Grey Musk-Shrew, three- striped squirrel, Mole rat, Field mouse and leopards (occasional). Monitor lizards are also seen occasionally. Only in the comparatively remote or less accessible locations (e.g. interiors of Barduar, Mayang and Pantan Reserves) some signs of existence of larger wild animals have been recorded. The animals found are: Sambhars, Barking Deer, Wild Boar, Goat antelope, Gaur (occasional), Elephants, porcupine, Malayan Giant Squirrel, Sloth Bear, Wild Dog, Tiger (occasional), Common and Capped langur, leopard cat etc. The most important species which gathers much attention in this Division is the Gangetic river dolphin- *Platanista gangetica*, which is found in large numbers in the Kulshi River.

The avifauna of the Division is rather rich. Some of the birds observed are jungle crow, tree pie, Grey Tit, Nut-thatej, several varieties of Babbler, different types of Bulbul, Busched, Robin Thrush, Flycatcher, Shirke, Cuckoo, Drongo, Warbler, Myna, Sparrow, Swallow, Wagtail, Sun bird, Flower-pecker, Wood-peaker, Barbet, Hawk, Cuckoo, Parakeet, Bee catcher, Kingfisher, Owl, Vulture, Kites, Quail, Tern, Plover, Moor-hen, Storks, Heron, Teal and Pochard, Shoveller, Spot-Bill, Pintail Barheaded Geese, Darter, Pelican, Cormorant, Sand-piper, Red-jungle-fowl, Red twille-dove, blue Rock-pigeon, Bronze-winged dove, Common Green Pigeon, Fishing Eagle, Hawk Eagle, Night Jar, Blue Jay, Kool, Weaver bird, Pheasant, Crow pheasant, Parrot, Hornbill etc.

The greatest adverse factor operating on the wild life now is the shrinkage of habitat due to rapid expansion of human habitation and subsequently cultivation land. In this respect, the large scale opening up of the 'Juli' lands in the Forest for cultivation, particularly during the sixties, was one of the most harmful instances as far as wild-life is concerned. These areas not only used to harbor a large variety of birds and smaller animals but also provided sustenance of the herbivores animals. The repercussion of such shrinkage of habitat has been felt in recent years in the shape of depredations by Wild Elephants (which roam about in herds in some of the Reserved Forests and migrate to the adjacent State of Meghalaya, by wanderings) in the cultivated areas. Sometimes even thickly populated locations face the serious consequences of such depredations. Similarly, the loss of the erstwhile swampy or marshy ground and the silting up of open water stocks i.e., beels have an adverse impact particularly on the avifauna diversity. Other major threats of wild animals are hunting for bush meat. Wild boar, deer, and aquatic birds are very much prone to hunting. Killing of snakes and other small animal by villagers due to ignorance and lack of awareness are sometimes recorded.

In the light of the above, conservation of the remnants of the "Wet Miscellaneous Formation" exclusively for the purpose of wild life preservation has become extremely essential and further opening up of such areas for cultivation and other purposes should not be allowed under any circumstances. As for the rest of the areas of the forest, in consistence with the demand of Forestry, least disturbance to the habitat as far as practicable should be aimed at.

3.8 Protection and management of fauna: There was no specific management plan for wildlife in the Division. However, wild animals are being treated as natural capital of the Division. All protection measures are being taken to prevent hunting and killing. Awareness campaigns are organized time to time especially during Vana Mohotsava, Wildlife Week etc.

3.8.1 Elephant Census: Elephant population estimation was done during the year 2011 and 2017 under this division. Abstract of block count and water hole/salt lick/open area observation count of Elephant census 2017 is as follows:

Table 3.8.1a Abstract of block count and water hole/salt lick/open area observation count

Block count abstract (Direct sighting)		Water hole/salt lick/open area observation count	
Adult female	3	Adult female	13
Sub-adult female	5	Sub-adult female	13
Juvenile female	2	Juvenile female	6
Adult male	1	Adult male	4
Sub-adult male	2	Sub-adult male	6
Juvenile male	1	Juvenile male	6
Calf	0	Calf	7
Unidentified	2	Unidentified	7
Total	16	Total	62

Table 3.8.1b Elephant census of 2011 : Abstract of block count

Adult female	59
Sub-adult female	3
Juvenile female	5
Adult male	43
Sub-adult male	28
Juvenile male	0
Calf	19
Unidentified	28
Total	185
Unidentified	28
Total	185

Compensation for human killed and property damaged by wild elephant are borne by the Project Elephant. Table 3.8.1d shows detail of persons killed, crop damaged, Household damaged etc. by Wild elephants under Kamrup West Division.

Tiger Census: Tiger Census has been done during the year 2010, 2014 & 2018, but there is no record of presence of tiger under the jurisdiction of Kamrup West Division.

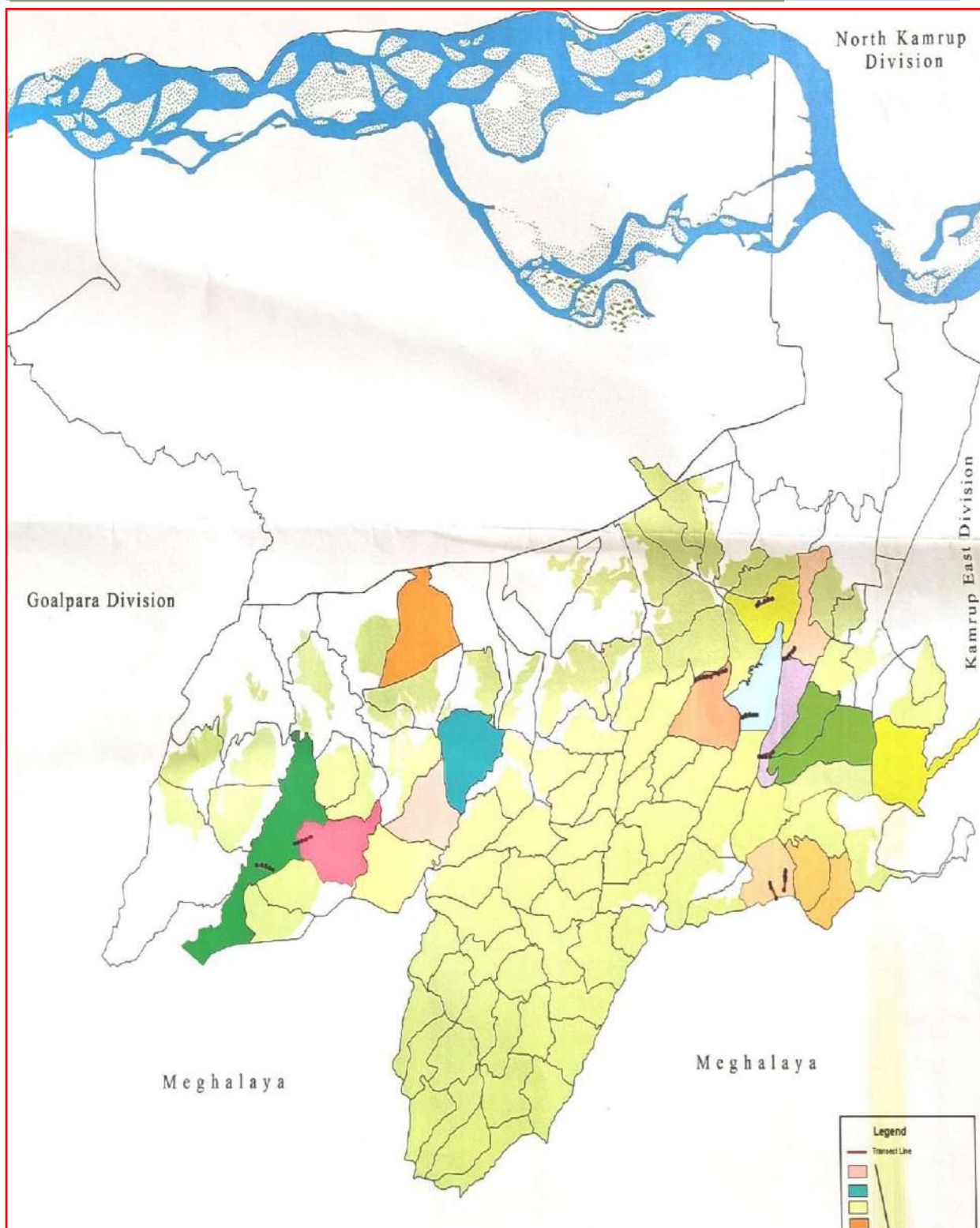


Figure 3.8.1c Map showing block for elephant population estimation

Table 3.8.1d Detail statement of persons killed, Crop damaged, Household damaged etc. by Wild elephants under Kamrup West Division:

Year	Human Death				Crop Damaged				House Damaged(Property)				Human Injury			
	Persons killed by Wild Elephant (Nos)	Ex. Gratia amount to be paid (in Rs)	Ex-Gratia amount paid (in Rs)	Outstanding amount to be paid (in Rs)	Crop Damage (In Bigha)	Ex-Gratia to be paid (in Rs)	Ex-Gratia amount paid (in Rs)	Outstanding amount to be paid (in Rs)	House hold damage (Nos)	Ex-Gratia to be paid (in Rs)	Ex-Gratia amount paid (in Rs)	Outstanding amount to be paid (in Rs)	Humans Injured (Nos)	Ex-Gratia to be paid (in Rs)	Ex-Gratia amount paid (in Rs)	Outstanding amount to be paid (in Rs)
2008-09	1	100000	100000	0	0	0	0	0	0	0	0	0	0	0	0	0
2009-10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2010-11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2011-12	2	200000	200000	0	0	0	0	0	0	0	0	0	0	0	0	0
2012-13	3	300000	300000	0	0	0	0	0	0	0	0	0	0	0	0	0
2013-14	4	300000	300000	0	0	0	0	0	0	0	0	0	1	40000	40000	0
2014-15	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
2015-16	3	300000	300000	0	0	0	0	0	5	30000	0	30000	2	40000	8000	32000
2016-17	3	1200000	1200000	0	25	190000	190000	0	9	563000	563000	0	1	30000	4000	26000
2017-18	3	800000	800000	0	2.5	20000	0	20000	10	440000	320000	120000	0	0	0	0
2018-19	2	800000	0	800000	1	7500	0	7500	15	282800	0	282800	0	0	0	0
2019-20	2	800000	0	800000	0	0	0	0	1	43500	0	43500	0	0	0	0
Total	23	4800000	3200000	1600000	28.5	217500	190000	27500	40	1359300	883000	476300	4	110000	52000	58000

CHAPTER 4

MAINTENANCE AND ENHANCEMENT OF FOREST HEALTH AND VITALITY

4.1 Status of Regeneration: Past record on regeneration was not maintained properly. During the tenure of this Working Plan it is proposed to initiate regeneration assessment studies. Sal and Teak coppices are coming up in areas infested by illegal felling. 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 natural regeneration of other species exists, survival of saplings is poor due to biotic interferences. To supplement natural regeneration of trees through plantation 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 table 4.1.b.

The natural bamboo regeneration exists in substantial areas due to non-working of bamboos in the bamboo brakes. In order to increase area under bamboo, bamboo plantations shall be carried out in JFMC and NTFP working Circle.

4.2 Area affected by forest fire: Incidences of major Forest fire, either man-made or natural incidences is not a major issue in the Kamrup West Division. However, MODIS data will be used to give the details of minor fire related incidents.

4.3 Area damaged by natural calamities: The area affected by natural calamities mostly flood has been given in table 4.3a and mitigation strategy plan for such areas susceptible to these calamities is highlighted.

4.4 Area protected from grazing: Grazing activities are not allowed inside forest areas however, the local people living along the forest fringe areas leave their cattle open for grazing. Only those areas where plantations are created are given protection from grazing.

Table 4.1.a: Number of saplings/Ha. recorded in different compartments

Name of the RF	Compartment No	Saplings/Ha.
Baradobha R.F.	1	163
Barduar R.F.	1	400
	2	360
	3	90
	5	340
	4A	755
	C2	337
	C3	1533
	H1	300
	H2	950
	H4	580
	H5	748
	H6	350
	KG10	20
	KG2	235
	KG4	555
	KG5	560
	KG6	895
KG7	90	
KG8	250	
Barjuli R.F.	2	200
	3A	83
Bogaikhas R.F.	1	505
	2	497
	3	452
	4	380
	6	453
	9	155
	12	243
	13	790
	16	593
	17	170
	18	50
	20	380
	21	305
	22	325
	23	95
	24	40
	26	245
Chhaygaon R.F.	2	325
	3	103
	4	100
	5	160
Dimali R.F.	1	1620
Dumpara R.F.	1	80
Ghoraputa R.F.	1	480
Gizang R.F.	H1	110
	H2	157
	P1A	20
Gohain Gurung	1	2587
Jaipur R.F.	1	30
Jharikhuri R.F.	1	260

Khaksi Sikrabura	2	350
	6	245
	7	470
Khatajuli R.F.	1	15
Khurkhuri R.F.	1	20
Kulsi R.F.	4	600
	5	45
	7	260
	8	10
	9	60
Luki R.F.	1	50
	2	500
	3	350
Mahipara R.F.	1	43
Mataikhar R.F.	1	277
	2	87
	3	195
Mayang Hill R.F.	1	246
	2	383
	3	482
	4	370
Melaghat R.F.	1	686
Milmilia R.F.	1	140
	2	1050
	7	590
	8	690
	9	255
	10	385
	45	
Mogakhal R.F.	1	45
Moman R.F.	H3	70
	H4	45
	P4	235
	P5	45
Nampathar	D4	80
	U2	428
	U3	270
Pantan R.F.	2	440
	3	380
	4	490
	5	774
	C5	170
	H10	375
	H11	1080
	H2	315
	H4	1065
	H5	110
	H6	572
	H7	225
	H8	340
Simla Hill R.F.	1	1540
Singra (Part 1)	1	203
Singra (Part 2)	1	1436

Table 4.1.b Statement showing Regeneration status of important plant species in Kamrup West Division, Assam

I.No.	Range	Plot No./ Compartment	Latitude	Longitude	Species	Number of seedlings	Number of saplings	Number of poles
1	Singra	15 Number	25°56'54.7" N	91°10'09.0" E	Sal	55%	45%	
2	Kulsi	Plot No. 1 Balijuri Kulsi R.F.	25°59'40.9" N	91°25'03.5" E	Sal	2000	500	1500
3	Kulsi	Plot No. 2 Bakalipara Kulsi R.F.	25°59'41.1" N	91°24'41.6" E	Sal	1500	400	1200
4	Kulsi	Plot No.3 Bakalipara Kulsi R.F.	25°59'50.3" N	91°24'50.1" E	Sal	1000	400	2000
5	Kulsi	Plot No. 4 Andheri Kulsi R.F.	26°00'05.0" N	91°24'48.6" E	Sal	800	500	1800
6	Kulsi	Plot No. 5 Anehri Kulsi R.F.	26°00'07.2" N	91°24'31.9" E	Sal, Teak	500	300	2000
7	Kulsi	Plot No. 6 Tiwamari Barduar R.F.	25°58'55.0" N	91°26'19.7" E	Sal, Teak, Makari Sal	1000	800	1200
8	Kulsi	Plot No. 7 Dhanipara Barduar R.F.	25°59'27.9" N	91°27'31.7" E	Sal, Teak	1500	800	2500
9	Kulsi	Plot No. 8 Dhanipara Barduar R.F.	25°59'24.9" N	91°27'32.8" E	Sal	2000	1500	3000
10	Kulsi	Plot No. 9 Dolong Molong Barudar R.F.	25°58'21.2" N	91°25'49.1" E	Sal	1000	800	1500
11	Loharghat	Jimpota under Barduar R.F.	25°58'05.7" N	91°27'14.2" E	Sal	2500	3300	2000
12	Loharghat	20 No. (Degarpara area)	25°53'2.06" N	91°26'57.6" E	Sal	3000	3500	2500
13	Loharghat	Kahua area under Mayang R.F.	25°52'17.16" N	91°27'08.8" E	Sal	2000		
14	Loharghat	Nisila Dolong	25°52'39.7"N	91°27'13.0"E	Sal	300	500	1800
15	Loharghat	Mataikhar	25°54'15.0" N	91°23'43.4" E	Sal	350	700	2000
16	Loharghat	Deopani	25°57'09.9"N	91°29'46.2"E	Sal	450	500	2000
17	Bondapara	1A	N: 25°54'18.3"	E: 91°06'11.0"	Agar	22 Nos.		
18	Bondapara				Sal	20 Nos.		
19	Bondapara		N: 25°54'17.4"	E: 91°06'10.3"	Simalu	4 Nos.		
20	Bondapara				Kuhi	15 Nos.		
21	Bondapara		N: 25°54'18.8"	E: 91°06'09.8"	Poma	7 Nos.		
22	Bondapara				Arjun	Arjun		
23	Bondapara		N: 25°54'19.3"	E: 91°06'11.2"	Sidhai	30 Nos.		
24	Bondapara				Makari Sal	20 Nos.		
25	Bondapara				Jam	15 Nos.		
26	Bondapara				Amlokhi	12 Nos.		
27	Bondapara				Bhamora	30 Nos.		

28	Bondapara	1B	N: 25 ⁰ 54'18.8"	E: 91 ⁰ 06'09.8"	Sal	10 Nos.		
29	Bondapara				Agar	15 Nos.		
30	Bondapara		N: 25 ⁰ 54'19.3"	E: 91 ⁰ 06'11.2"	Simalu	3 Nos.		
31	Bondapara				Kuhi	25 Nos.		
32	Bondapara		N: 25 ⁰ 54'18.1"	E: 91 ⁰ 06'10.8"	Poma	5 Nos.		
33	Bondapara				Arjun	10 Nos.		
34	Bondapara		N: 25 ⁰ 54'19.5"	E: 91 ⁰ 06'11.0"	Makari Sal	15 Nos.		
35	Bondapara				Jam	7 Nos.		
36	Bondapara				Amlokhi	7 Nos.		
37	Bondapara				Bhamor a	10 No		
38	Bondapara	1C	N: 25 ⁰ 54'18.1"	E: 91 ⁰ 06'10.8"	Sal	10 Nos.		
39	Bondapara				Agar	10 N		
40	Bondapara		N: 25 ⁰ 54'19.0"	E: 91 ⁰ 06'11.0"	Kuhi	7 Nos.		
41	Bondapara				Simalu	2 Nos.		
42	Bondapara		N: 25 ⁰ 54'21.3"	E: 91 ⁰ 06'10.8"	Poma	6 No.s		
43	Bondapara				Arjun	12 Nos.		
44	Bondapara		N: 25 ⁰ 54'21.1"	E: 91 ⁰ 06'11.9"	Sidhai	15 Nos.		
45	Bondapara				Makari Sal	20 Nos.		
46	Bondapara				Jam	5 Nos.		
47	Bondapara				Amlokhi	3 Nos.		
48	Bondapara	Bhamor a			15 Nos.			
49	Bondapara	1 (D)	N: 25 ⁰ 54'21.1"	E: 91 ⁰ 06'11.9"	Tal	5 Nos.		
50	Bondapara				Azar	7 Nos.		
51	Bondapara		N: 25 ⁰ 54'21.3"	E: 91 ⁰ 06'10.8"	Kuhi	12 Nos.		
52	Bondapara				Simalu	5 Nos.		
53	Bondapara		N: 25 ⁰ 54'22.0"	E: 91 ⁰ 06'12.5"	Poma	5 Nos.		
54	Bondapara				Arjun	10 Nos.		
55	Bondapara		N: 25 ⁰ 54'22.4"	E: 91 ⁰ 06'11.2"	Dudhkari	7 Nos.		
56	Bondapara				Sidhai	5 Nos.		
57	Bondapara				Jam	4 Nos.		
58	Bondapara				Amlokhi	2 Nos.		
59	Bondapara				Bhamora	8 Nos.		

60	Bond apara	1 (E)	N: 25 ⁰ 54'22.4"	E: 91 ⁰ 06'11.2"	Sal	10 Nos.		
61	Bondapara				Azar	5 Nos.		
62	Bond apara		N: 25 ⁰ 54'23.2"	E: 91 ⁰ 06'11.5"	Kuhi	12 Nos.		
63	Bondapara				Simalu	5 Nos.		
64	Bondapara		N: 25 ⁰ 54'23.0"	E: 91 ⁰ 06'12.7"	Poma	6 Nos.		
65	Bondapara				Arjun	15 Nos.		
66	Bondapara		N: 25 ⁰ 54'22.0"	E: 91 ⁰ 06'12.5"	Dudhka ri	12 Nos.		
67	Bondapara				Sidhai	15 Nos.		
68	Bondapara				Jam	10 Nos.		
69	Bondapara				Amlokhi	3 Nos.		
70	Bondapara				Bhamora	8 Nos.		
71	Bondapara	Katajuli R.F.	N:25 ⁰ 56'30.5"	E:91 ⁰ 05'23.5"	Sal (Copies)	70%		
72	Bondapara		N: 5 ⁰ 56'18.4"	E: 1 ⁰ 05'27.8"				
73	Bondapara		N:25 ⁰ 56'41.7"	E:91 ⁰ 05'48.3"				
74	Bond apara		N: 5 ⁰ 56'12.0"	E: 1 ⁰ 06'03.9"				
75	Bondapara	Mahipara R.F.	N:25 ⁰ 55'50.5"	E:91 ⁰ 09'25.9"	Sal (Copies)	70%		
76	Bondapara		N: 25 ⁰ 55'37.8"	E: 91 ⁰ 07'31.2"				
77	Bondapara		N:25 ⁰ 56'06.6"	E:91 ⁰ 07'48.6"				
78	Bondapara		N: 25 ⁰ 55'27.0"	E: 91 ⁰ 08'13.4"				
79	Bondapara		N:25 ⁰ 54'22.4"	E:91 ⁰ 06'20.1"	Arjun, Sidhai, Makari Sal, Jam, Amlokhi, Bhomor a, Gamari, Azar	60% to 70%		
80	Bondapara		N: 25 ⁰ 54'14.4"	E: 91 ⁰ 06'15.9"				
81	Bondapara		N:25 ⁰ 54'17.7"	E:91 ⁰ 06'09.6"				
82	Bondapara		N: 25 ⁰ 54'25.7"	E: 91 ⁰ 06'11.8"				
83	Bamunigaon	120	N: 26 ⁰ 02'61.1"	E: 091 ⁰ 21'49.9"	Sal	3000	800	1500
84	Bamunigaon	105	N: 25 ⁰ 58'39.4"	E: 091 ⁰ 19'29.9"	Sal	2500	500	1200
85	Bamunigaon	119	N: 26 ⁰ 02'13.1"	E: 091 ⁰ 20'26.2"	Sal	1800	400	800
86	Bamunigaon	114	N: 25 ⁰ 59'9.12"	E: 091 ⁰ 17'40.1"	Sal	600	500	800
87	Bamunigaon	117	N: 26 ⁰ 00'35.6"	E: 091 ⁰ 21'59.7"	Sal, M/Sal, O xy, B/Bagan	2000	700	500
88	Bamunigaon	113	N: 25 ⁰ 59'41.3"	E: 091 ⁰ 19'22.2"	Sal, Jam, Ameri	20000	400	600
89	Bamunigaon	112	N: 25 ⁰ 59'33.4"	E: 091 ⁰ 18'0.1"	Sal, M/Sal, Sidh, Oxy	1200	500	700
90	Bamunigaon	103	N: 25 ⁰ 58'38.9"	E: 091 ⁰ 21'07.7"	Sal, M/Sal	1000	500	800
91	Bamunigaon	107	N: 25 ⁰ 58'79.8"	E: 091 ⁰ 21'23.5"	Sal, N/Sal, Sidha, Poma & Bhumura	2000	900	1500

Table 4.3a: Statement showing area damaged by natural calamities in Kamrup West Division, Assam

Sl. No.	Year	Natural Calamity	Range	Location	GPS coordinates	Mitigation measures
1	2014	Flood	Bondapara	Entire Bondapara Range including the Range Office and the Beats	N 25°56'53.7" E: 91°06'12.4"	measures were taken to recover the immediate resources within the vicinity of the Range and Beat offices.
2	Sept' 2014	Flood	Bamunigaon	Chhaygaon area severely affected	Nil Nil	
3	2014	Flood	Singra	Entire Singra Range including the Range Office and the Beats	Nil Nil	

4.5 Lopping practices: Similar to grazing, lopping is also not permitted in the Reserved forests of this Division. However, rights and concessions were also provided in some of the Reserved forests for collection of fodder, firewood, housepost, bamboos and canes. The status of existence of lopping practices during fodder/NTFPs collection and extent of damage to the fodder/ NTFP species, has been mentioned in the Table 4.5 below:

Table 4.5: Statement showing status of lopping practices (if any)

Sl. No.	Range	Forest Village	Beat	Pasture land (ha)	Palatable species name(s)	Indicative removals (kg/day)
1	Singra	Palahpara (Singra Range)		3	Grass, Mow, Dimaru, Kopalphota etc.	As per Supreme Court Order No. 202/ 95, any non-forest activities including removal of fodder,
2	Singra	Rowmari (Singra Range)		7	Grass, Mow Dimaru, Kopalphota etc.	
3	Bondapara	Namborjuli Village, Boripar Village			Ahot	
4	Bondapara	Baniapara Village			Am	fuelwood etc. has been banned from the Division
5	Bondapara	Garajani Village			Gomari	
6	Bondapara	Charaibaha Village			Kathal	
7	Bondapara	Pachia Village			Dimaru	
8	Loharghat		Rajapara & Muduki		Kathal, Mango, Amlokhi, Leteku, Panial, Amora, Jam, Vadailata, Narasingha	

4.6 Area infested by invasives 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 4.6a shows areas affected due to the invasive weed species.

Table 4.6a Statement showing status of area infested by invasive weed

Sl. No.	Range	Beat	Compartment	Weed Species	Area invaded	Mitigation measures
1	Singra	Lumpi	nil	Jharmani and Kapalphota, Rifujilata, Nagalata	4500 H Bogaikhas	Slash and burn technique used to clear the invasive species from
2	Singra	Jungakhuli			97 H. Sursuria are	
3	Singra	Hahim			1132 Ha Moman area	
4	Singra	Singra			7.45 Ha	

					Jarikhuri area	forest areas. In case of severe infestation, mass slash and burn operations are taken up.
5	Singra	Singra			225 Ha Luki area	
6	Bondapara		1	Nagalata, Marulata	Singra Part-II RF	
7	Bondapara		U2, D5, D3B, D3A, U3, D4, D2, D1	Jharmoni, Madhulia, Nagalata, Rifujilata, Bandar Kekuwalata	Nampathar R.F	
8	Bondapara		1	Jharmoni, Refujilata,	Barduar R.F.	
9	Bondapara		1	Jharmoni, Nagalata, Madhulia Lata	Mahipara R.F.	
10	Bondapara		3B, 1 3A,	Nagalata, Jharmoni, Madhulia Lata	Barjuli R.F.	
11	Bondapara		1	Shamronga Bone, Nagalata, Bandar Kekuwa lata	Jaipur R.F.	
12	Bondapara		1	Jharmoni, Nagalata, Rifuzilata	Khatajuli R.F.	
13	Bondapara		H1, H2, P3, P2, P1B, P1A	Shamronga Bone, madhulia Lata, Bandar Kekuwa lata, MaruliLata	Gizang R.F.	
14	Loharghat	Rajapara		Michenia	3%	
15	Loharghat	Muduki		Panilota	2%	
16	Loharghat	& Mataik har				
17	Loharghat			Mallota	1%	
18	Loharghat			Bandar Kekoa	1%	
19	Loharghat			Hati Bandha Lata	1%	
20	Loharghat			Lajukilata	1%	
21	Loharghat			Jarmoni Ban	3%	
22	Kulsi Range	Kulsi I.B. Beat		Hatibandha Lata	Partially	Cutting, clearing etc.
23	Kulsi Range			Jarmoni		
24	Kulsi Range			Phutuki		
25	Kulsi Range			Tokmah		
26	Kulsi Range			Amarlata		
27	Bamunigaon	Ratanpur,		Jarmoni, Reguji	Partly	Cutting

4.7 Incidents of pests and diseases: Pests and diseases have been recorded in the forest stands of Sal, Teak and Gamari. Sal borers (*Hoplocerambyx spinicornis*) are occasionally found on wounded Sal trees. Occasional die-back of Sal seedlings is observed in artificially raised seedlings, especially during hot days followed by heavy rains. Teak leaf defoliator (*Hyblaea purera*), Gamari leaf defoliator (*Calopepla leayana*) have 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 (<i>Hyblaea purera</i>) Gamari leaf defoliator (<i>Calopepla leayana</i>)	Teak and Gamari	Garbhanga C ₁ C ₂ Rani C ₁ C ₂ Nalapara C ₁ C ₂ Jalukbari RF	Nil

4.8 Forest degradation and its drivers: Forest degradation in Kamrup West Division is mainly due to anthropogenic pressure e.g., Encroachments and illegal felling are the main drivers of forest degradation. Most of the RFs had encroachments. Details of drivers of forest degradation like unregulated removal of forest produce, encroachment, over grazing, mining, etc. along with the area description under different levels of degradation have been provided in the table 4.8

Table 4.8: Drivers of Forest Degradation in the Kamrup West Division

Sl. No.	Range	Degradation drivers	Name of area where visible	Severity (High/Medium/Low)	Area (indicative)
1	Singra	Grazing	Singra Palahpara, Rowmari- Luki RF, Jarikhuri RF	Medium	3 Ha & 7 Ha respectively
2	Singra	Illegal felling	Lumpi area, Ranibasti, Bagaikhas RF	Medium	
3	Singra	Encroachment	Moman, Luki, Jarikhuri, Bogaikhas RF	Medium	
4	Singra	Weed infestation	Bagaikhas, Sursuria, Moman, Jarikhuri, Luki RF	Medium	6,699 Ha
5	Singra	Boundary conflict	Assam- Meghalaya Boundary, Lumpi area	High	3 (sq kms)
6	Singra	Clear felling	Bagaikhas RF, lumpi area	Medium	
7	Singra	Man animal Conflict	Dilinga No.2 (Jarikhuri RF), Dhanhati (Moman RF), Jabepara, Pakharapara	Low	
8	Loharghat	Fuelwood extraction		Medium	
9	Loharghat	Grazing		Medium	
10	Loharghat	Illegal felling	Borduar R.F, Pohupota and Majortari area	low	Irregular in nature
11	Loharghat	Encroachment	Borduar R.F and Mayang R.F	medium	14.3 Hct. (Post 2006)
12	Loharghat	Agriculture expansion		Low	
13	Loharghat	Man animal Conflict	Rajapara area	Low	
14	Kulsi	Deforestation	Pantan R.F. Doledonga	Low	Aprox. 10 Ha
15	Kulsi	Illegal felling	Barduar R.F. Bargurung	Low	
16	Kulsi	Encroachment	Plain and Hill	Low	
17	Bondapara	Fire wodd extraction	Place to place Range area	Medium	
18	Bondapara	Grazing	Place to place Range area	Medium	
19	Bondapara	Forest Fire	All over Range area place to place	Medium	
20	Bondapa ra	Illegal felling	All over Range area	Medium	
21	Bondapara	Encroachment	All over Range area place to place	Medium	
22	Bondapara	Man animal conflicts	Elephant man conflicts at Nampathar, Mahipara, Upper Bamunigaon, Rajapara area	Medium	
23	Bamunigaon	Deforestation	Pantan RF	Low	Approx 13 Hect.
24	Bamunig aon	Illegal felling	Mainapara	Low	
25	Bamunig aon	Encroachment	Plam & Hill	Low	

4.9 Pollution control and protection of environment: Incidences, extent of forest land degradation due to pollution (soil, water, in some cases air) is quite rare and thus no measures have been taken by the Kamrup West Division to mitigate them.

CHAPTER 5

CONSERVATION AND MAINTENANCE OF SOIL AND WATER RESOURCES

5.1 Area treated under soil and water conservation measures:

The catchments areas of the rivers and streams in the Division lie only partly in the Reserved Forest covered by this plan. All the major tributaries have their source in the adjacent areas of Meghalaya and hence for proper watershed management an integrated plan could be necessary. All the streams and rivers carry a considerable amount of silt load particularly during the rainy season. Some of the low lying swamps and depressions which served the purpose of reservoirs and reduced the intensity of floods in the past, is silted up and was brought under the plough quickly.

From the view point of soil-conservation, the practice of 'Shifting cultivation' or Jhumming prevalent in the hilly areas in some of the Reserved Forests (Gizang, Moman etc. of the Division) is definitely to be discouraged. The extent of jhumming prevalent in the neighbouring areas of Meghalaya is of course much damaging. Fortunately the climate conditions are rather favourable, in the locality, and an abandoned 'Jhum' is quickly covered up by shrubs and other secondary growth. This results in the quantum of soil run-off being much less, than what it would have been in areas with less favourable conditions for natural regrowth.

The ridges and spurs particularly in the Mataikhar, Mayang Hill, Barduar, Pantan Hill, Chhaygaon Hill, Moman, Gizang, Sursuria etc. reserved forests in this Division serve as watersheds of numerous streams and nullas and these will have to be subjected to the least disturbance as far as forestry operations are concerned. There are also signs of greater degrees of erosion and run off from the bare ground under concreted and unthinned Teak plantations in the Hills. This can of course be rectified by proper thinning to encourage suitable ground cover, in the areas covered by this plan is of course obligatory under the Forestry practices, and nothing else can serve the purpose of watershed management and soil conservation better than a forest cover.

Also, restricted felling and least disturbance can result in the development of good watershed catchment areas. Microwatershed map of the Division is shown in Figure 5.1.

5.2 Duration of water flows in the selected seasonal streams: The total area covered by the river/stream in the Division is 24333.10ha. River stream map of the Division is shown in Figure 5.2.b. The rivers carry maximum silt and sand during the rainy season as a result siltation is a major problem in the district. Almost all the rivers flowing in the Division are perennial in nature. The water table rises maximum during April to September.

During tenure of this Working Plan periodic monitoring of river flow pattern with reference to annual rainfall/duration of flow will be carried out and data will be provided to show the status of

improvements, if any. The following graph shows the status of stream flow due to rainfall in the streams of Kamrup West Division.

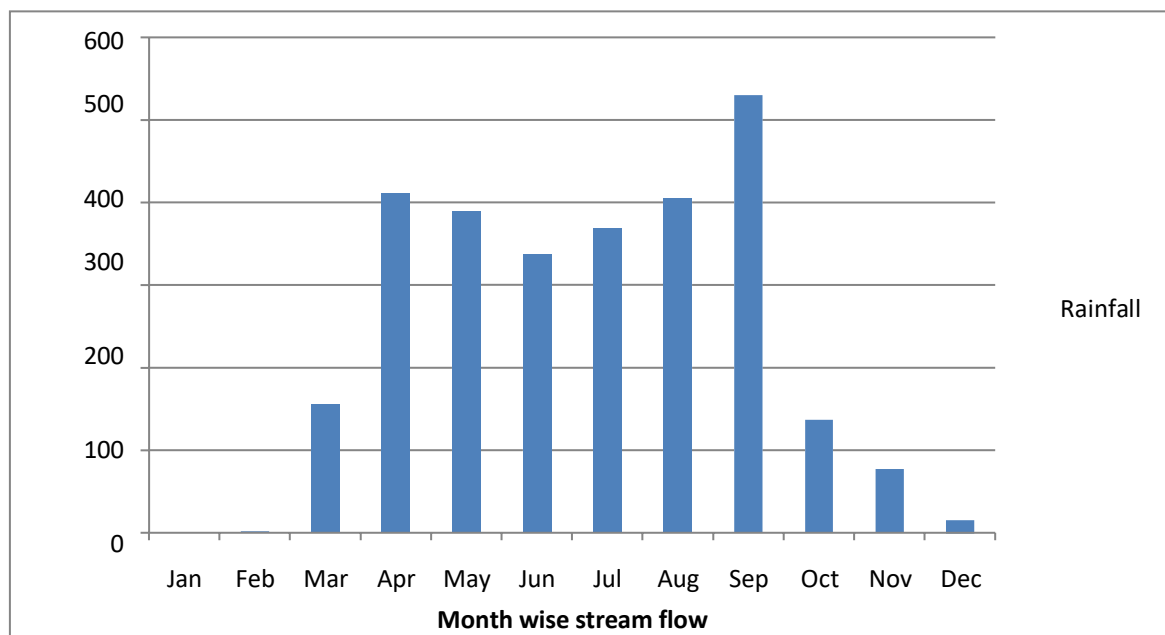
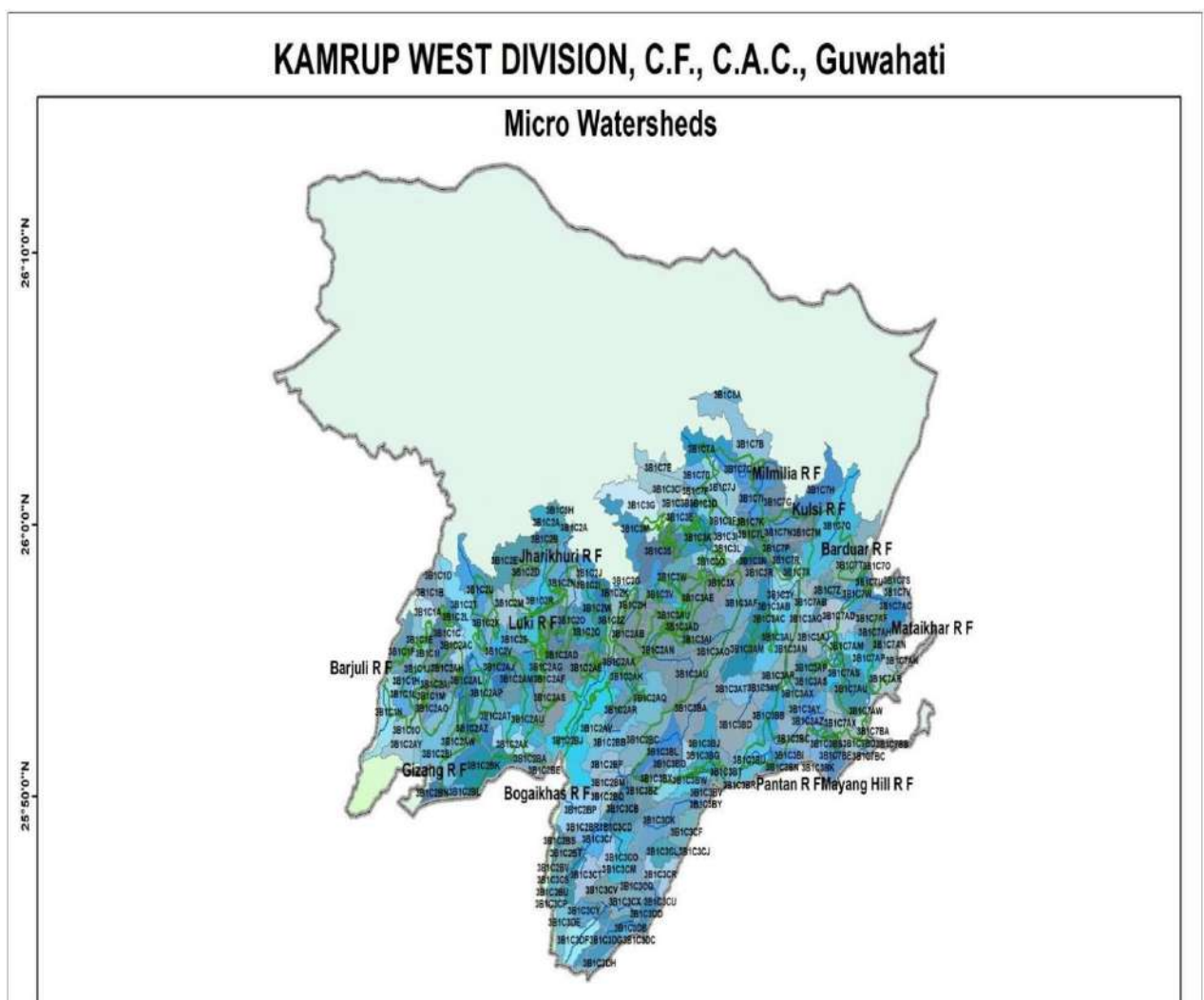


Fig. 5.2. a. Status of stream flow in litres per minute due to rainfall in Kamrup West division



SOIL REGIONS

EASTERN INDIA PLATE 202

NATIONAL ATLAS OF INDIA

LEGEND:

- I. Tropical**
 - 1. Tropical Alluvial Soil
 - 2. Tropical Black Soil
 - 3. Tropical Red Soil
 - 4. Tropical Brown Soil
 - 5. Tropical Yellow Soil
 - 6. Tropical Grey Soil
 - 7. Tropical Dark Grey Soil
 - 8. Tropical Very Dark Grey Soil
 - 9. Tropical Dark Brown Soil
 - 10. Tropical Very Dark Brown Soil
- II. Subtropical**
 - 11. Subtropical Black Soil
 - 12. Subtropical Red Soil
 - 13. Subtropical Brown Soil
 - 14. Subtropical Yellow Soil
 - 15. Subtropical Grey Soil
 - 16. Subtropical Dark Grey Soil
 - 17. Subtropical Dark Brown Soil
 - 18. Subtropical Very Dark Brown Soil
- III. Temperate**
 - 19. Temperate Black Soil
 - 20. Temperate Red Soil
 - 21. Temperate Brown Soil
 - 22. Temperate Yellow Soil
 - 23. Temperate Grey Soil
 - 24. Temperate Dark Grey Soil
 - 25. Temperate Dark Brown Soil
 - 26. Temperate Very Dark Brown Soil
- IV. Arid/Desert**
 - 27. Arid/Desert Black Soil
 - 28. Arid/Desert Red Soil
 - 29. Arid/Desert Brown Soil
 - 30. Arid/Desert Yellow Soil
 - 31. Arid/Desert Grey Soil
 - 32. Arid/Desert Dark Grey Soil
 - 33. Arid/Desert Dark Brown Soil
 - 34. Arid/Desert Very Dark Brown Soil
- V. Mountain**
 - 35. Mountain Black Soil
 - 36. Mountain Red Soil
 - 37. Mountain Brown Soil
 - 38. Mountain Yellow Soil
 - 39. Mountain Grey Soil
 - 40. Mountain Dark Grey Soil
 - 41. Mountain Dark Brown Soil
 - 42. Mountain Very Dark Brown Soil
- VI. Alpine**
 - 43. Alpine Black Soil
 - 44. Alpine Red Soil
 - 45. Alpine Brown Soil
 - 46. Alpine Yellow Soil
 - 47. Alpine Grey Soil
 - 48. Alpine Dark Grey Soil
 - 49. Alpine Dark Brown Soil
 - 50. Alpine Very Dark Brown Soil
- VII. Desert**
 - 51. Desert Black Soil
 - 52. Desert Red Soil
 - 53. Desert Brown Soil
 - 54. Desert Yellow Soil
 - 55. Desert Grey Soil
 - 56. Desert Dark Grey Soil
 - 57. Desert Dark Brown Soil
 - 58. Desert Very Dark Brown Soil
- VIII. High-altitude**
 - 59. High-altitude Black Soil
 - 60. High-altitude Red Soil
 - 61. High-altitude Brown Soil
 - 62. High-altitude Yellow Soil
 - 63. High-altitude Grey Soil
 - 64. High-altitude Dark Grey Soil
 - 65. High-altitude Dark Brown Soil
 - 66. High-altitude Very Dark Brown Soil

Scale: 1:1,000,000

Inset Map: Map of India showing the location of Eastern India.

Source: Survey of India, 1961.

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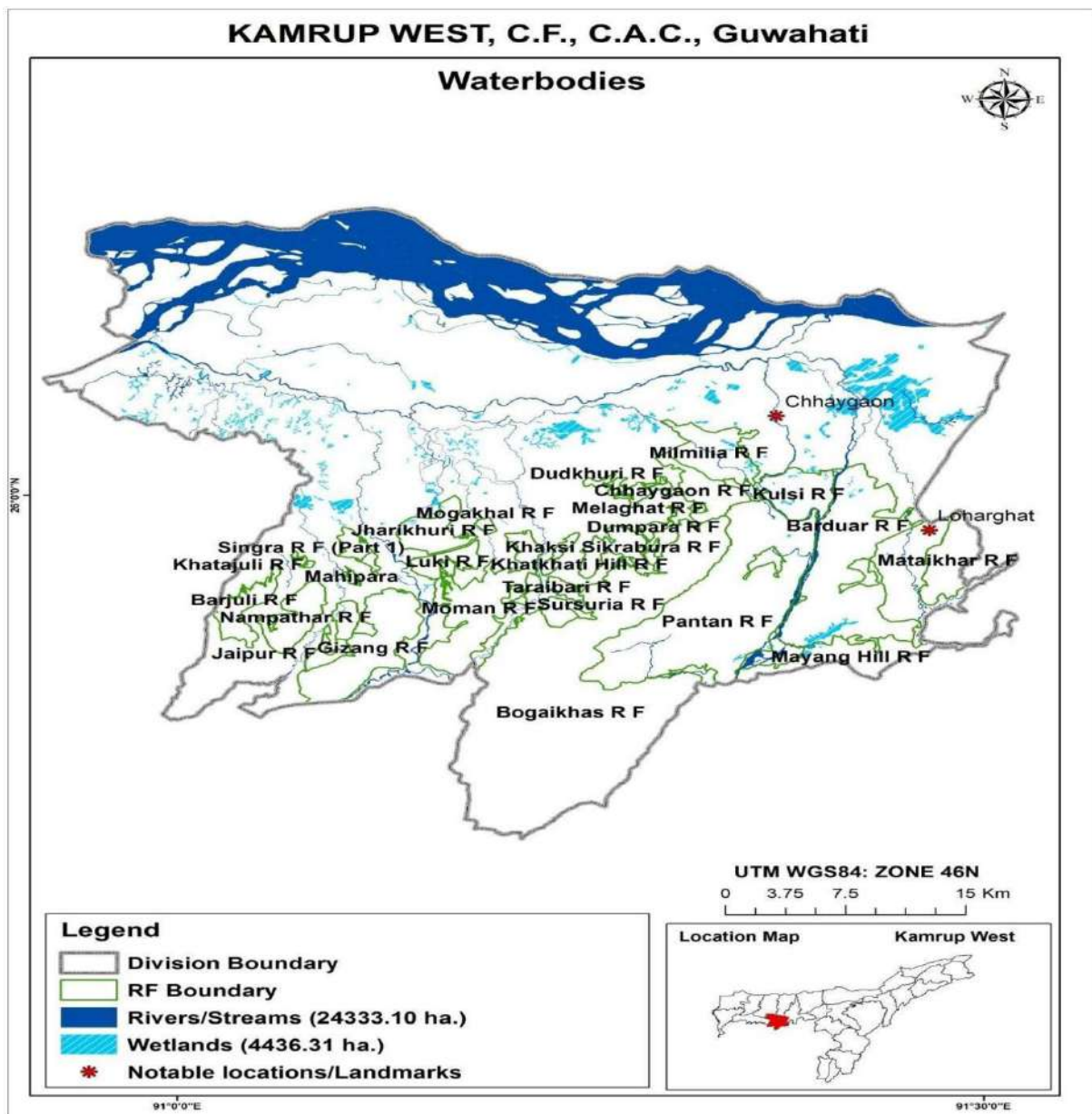


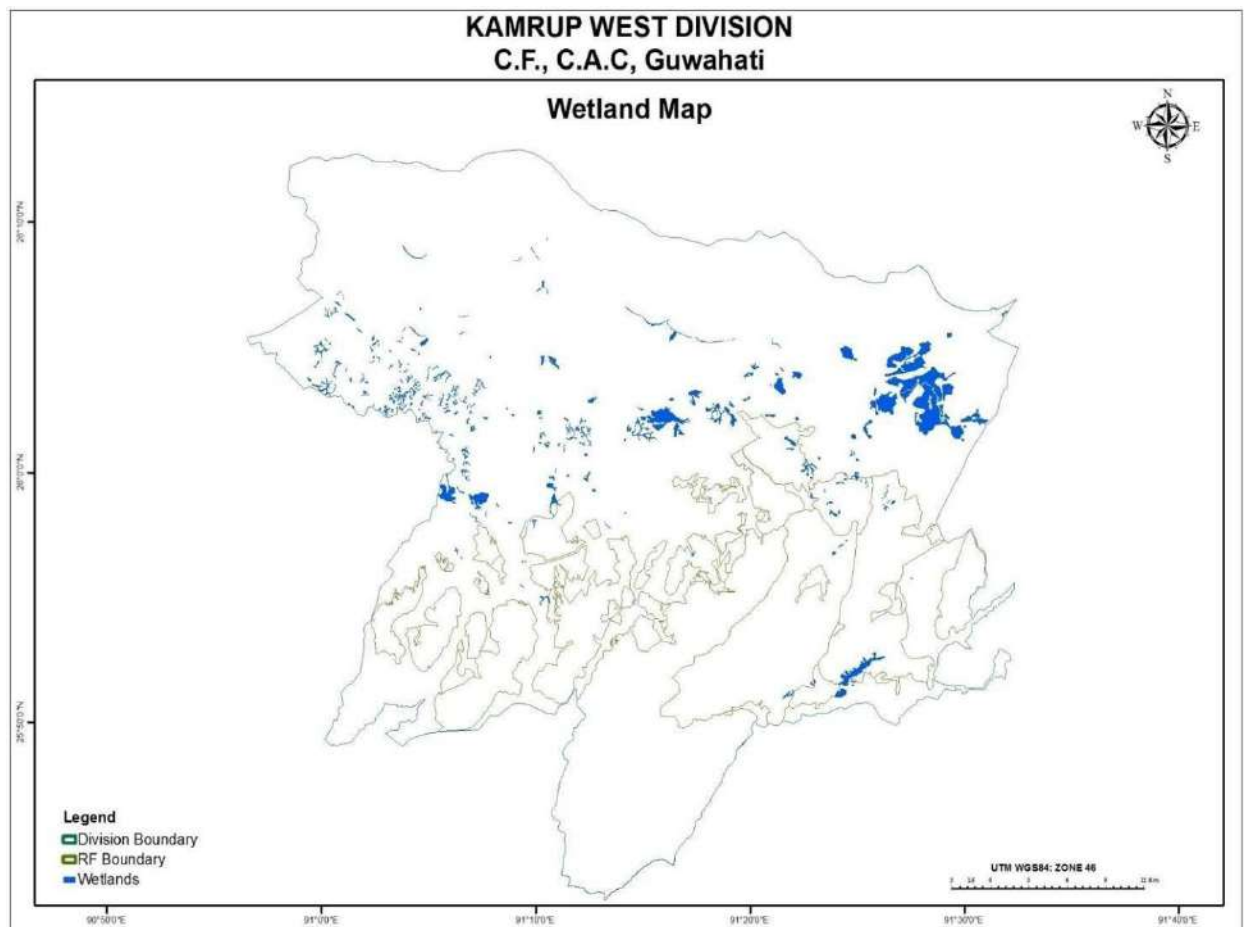
Figure 5.2c: River stream map of the Division

5.3 Wetland in forest areas: The total area covered by the wetlands area of the Division is 18797.71 ha. Table 5.3a shows areas of wetland in the Division. Wetland map of the Division is in Figure 5.3b. The waterbody/wetland of the forest area has been reduced and wetland fauna and flora population of the Division is declining.

Table 5.3.a. Wetland area under different classes

Wetland classes	Area in hectares (ha)
Wetlands-Inland-Manmade	4.24
Waterbodies_Lake/Pond	98.51
Waterbodies_Reservoir/Tank	249.01
Wetlands-Inland-Natural	4084.53

Fig. 5.3 Wetland map of Kamrup West Division



5.4 Water level in the wells in vicinity (5 kms) of the forest area: The average water level as recorded from the wells lying in the vicinity of the forest area during lean months (November to February) as well as during the rainy season is provided here in details:

Table 5.4: Statement showing water level in the wells in vicinity of forest areas

Sl. No.	Range	Village Name	Latitude	Longitude	Water level in meters			
					Aug	Sept	Jan	Feb
1	Singra	Dakuapara No.1	25°57'55.8" N	91°14'01.5" E	0.8	0.75	0.55	0.5
2	Singra	Jongakhuli	25°54'21.7" N	91°13'49.4" E	5.4	5.35	5	4.05
3	Singra	Jogepara	25°57'27.5" N	91°12'01.4" E	1.55	1.4	1	0.9
4	Singra	Singra Palahpara	25°56'56.6" N	91°10'08.3" E	2	1.9	1.4	1.25
1	Bondapara	Shamukha	N: 25°52'38.2"	E: 91°09'25.4"	1.30	1.25	0.95	0.80
2	Bondapara	Tilapara	N: 25°52'19.5"	E: 91°09'08.2"	2.55	2.45	2.00	1.85
3	Bondapara	Salpara	N: 25°51'28.5"	E: 91°08'59.6"	3.30	3.15	2.90	2.85
4	Bondapara	Bamunigaon	N: 25°52'36.7"	E: 91°07'05.6"	0.95	0.85	0.56	0.50
5	Bondapara	Matia	N: 25°54'31.9"	E: 91°03'51.6"	2.30	2.15	1.90	1.85
6	Bondapara	Darang Barjuli	N: 25°53'25.7"	E: 91°03'52.2"	1.80	1.70	1.25	1.10
7	Bondapara	Pachia	N: 25°54'19.5"	E: 91°04'14.8"	2.50	2.35	1.95	1.90
8	Bondapara	Boniapara	N: 25°54'12.7"	E: 91°04'36.3"	4.40	4.15	3.90	3.65

9	Bondapara	Nampathar	N: 25°53'46.5"	E: 91°05'45.6"	1.30	1.10	0.95	0.85
10	Bondapara	Dekapara	N: 25°58'14.0"	E: 91°07'34.1"	1.40	1.20	0.85	0.75
11	Bondapara	Charibaha	N: 25°56'51.11"	E: 91°03'52.0"	4.00	3.90	3.75	3.50
12	Bondapara	Garojani	N: 25°54'06.4"	E: 91°04'52.5"	1.60	1.45	1.25	1.20
13	Loharghat	Jimputa	25°53'12.9" N	91°27'17.1" E	1.20	1.10	0.90	0.78
14	Loharghat	Mataikhar	25°54'10.0" N	91°29'10.0" E	7.50	7.20	6.70	6.30
15	Loharghat	Rajapara	25°52'22.5" N	91°26'12.2" E	4.40	4.10	3.60	3.20
16	Kulsi	Golia	26°57'57.1" N	91°25'06.8" E	6.00	5.80	3.50	3.00
17	Kulsi	Nagaon	26°58'10.3" N	91°25'20.9" E	4.00	3.80	3.50	3.00
18	Kulsi	Dolong Molong	26°58'25.8" N	91°25'53.7" E	4.50	4.00	3.10	3.00
19	Kulsi	Balijuri	26°59'43.0" N	91°24'43.7" E	3.00	2.50	2.50	2.00
20	Kulsi	Andheri	26°51'32.0" N	91°24'02.8" E	6.50	6.00	4.00	3.50
21	Kulsi	Nathpara Balijuri	26°00'57.3" N	91°25'15.5" E	18.00	15.00	10.00	8.00
22	Kulsi	Dhangargaon	25°59'01.6" N	91°26'25.7" E	4.00	3.50	2.50	2.00
23	Kulsi	Dhanipara	25°59'28.6" N	91°27'14.5" E	4.20	4.00	3.50	3.00
24	Kulsi	Nalbari	25°59'31.6" N	91°25'42.7" E	4.50	4.00	3.00	2.50
25	Bamunigaon	Lampara village	26°00'17.8//	091°16'85.1//	4.95	4.76	4.10	3.80
26	Bamunigaon	Sikraborah village	25°58'20.8//	091°14'20.6//	4.65	4.00	3.80	3.20
27	Bamunigaon	Ukiam village	25°50'42.9//	091°20'69.4//	4.10	3.80	3.50	3.20
28	Bamunigaon	Koimari village	26°02'33.1//	091°22'000//	3.60	3.20	2.80	2.60

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.

The details of aquifers in record of Kamrup West Division, Assam is shown in Table 5.5

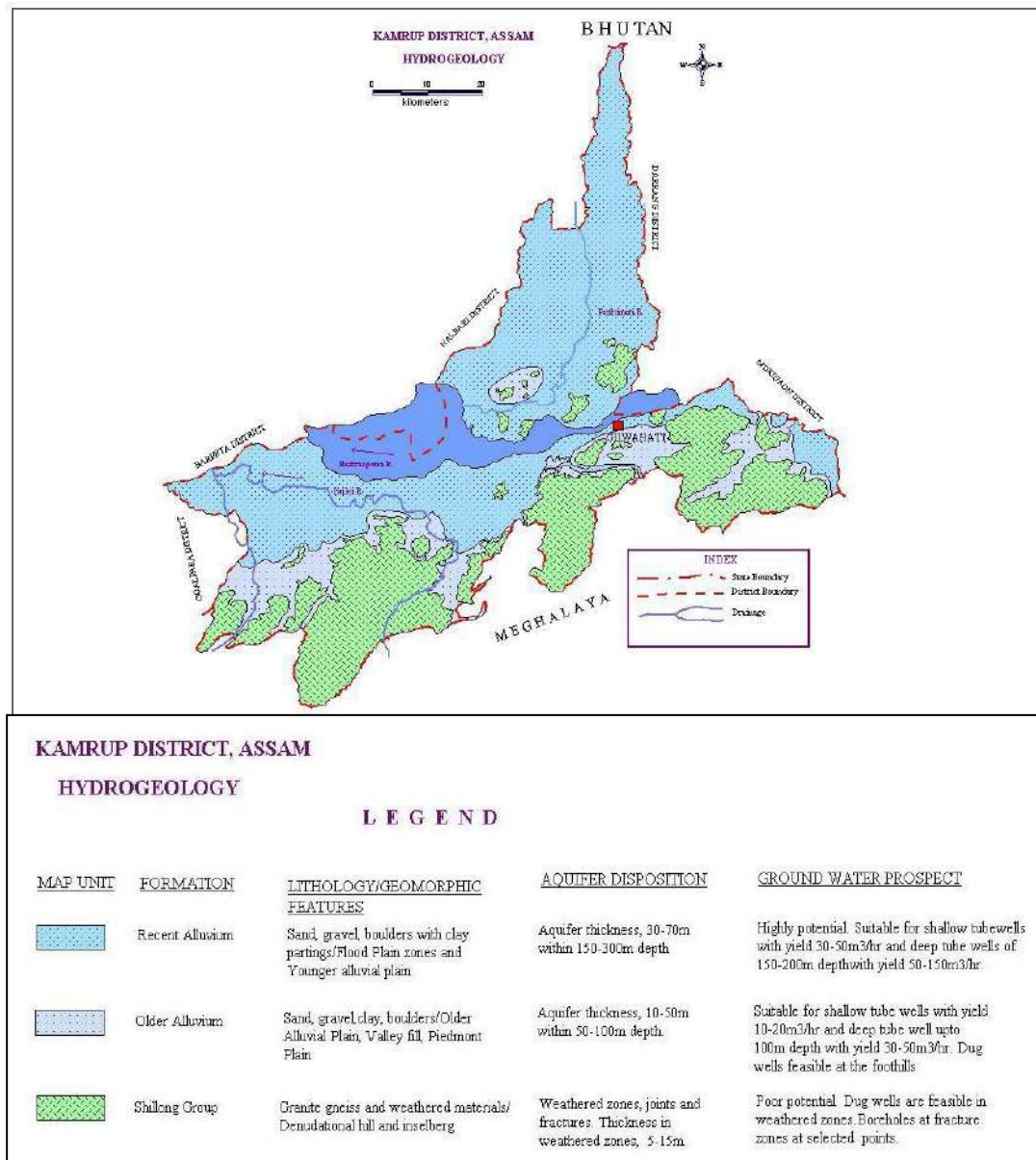


Figure 5.5: Ground water map of Kamrup District (source: Ground Water Information Booklet of Kamrup & Kamrup Metro District, Assam, Central Ground Water Board, North Eastern Region Ministry of Water Resources, Guwahati September 2013)

Table 5.5 Details of aquifers in Kamrup West Division, Assam

Sl.No.	Aquifer	Range	Latitude	Longitude	Water quality	Functional / defunct
1	Mouchowa	Bondapara	N: 25°53'49.5"	E: 91°09'51.5"	Medium	Functional
2	Nowapara (I)	Bondapara	N: 25°53'25.4"	E: 91°09'42.6"	Medium	Functional
3	Nowapara (II)	Bondapara	N: 25°52'45.3"	E: 91°09'21.5"	Medium	Functional
4	Jakuwapara	Bondapara	N: 25°52'34.4"	E: 91°04'29.1"	Medium	Functional
5	Bamunigaon	Bondapara	N: 25°52'33.2"	E: 91°07'10.8"	Medium	Functional
6	Jarikhat	Bondapara	N: 25°54'00.3"	E: 91°03'38.5"	Medium	Functional
7	Darang Barjuli	Bondapara	N: 25°53'37.7"	E: 91°03'44.4"	Medium	Functional
8	Gosanimara	Bondapara	N: 25°50'03.6"	E: 91°04'37.5"	Medium	Functional
9	Christianpara	Bondapara	N: 25°50'54.9"	E: 91°05'11.0"	Medium	Functional

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 harvest-able yield in the working plan. Mean annual increment is an important parameter for sustainable management of forest. Growing stock analysis is necessary to ensure sustain flow of income and ecosystem services to local communities considering conservation and ecological security.

The forest resource assessment methodology prescribed in the National Working Plan Code-2014 was followed to conduct assessment of the total growing stock of trees and biomass. Grid based Systematic Stratified Random Sampling was carried out. Map of the sample plots is provided in Figure 6.1c. Sample plots were laid out and observational assessment of site quality, tree species, composition, its health, density and crop age etc. were recorded in Plot Approach Form I. Blanks, important scattered trees, plantations raised were noted. Information on drivers of forest degradation, NTFP species, intensity of invasive species, faunal sights/ traces, microhabitats of wildlife were recorded.

Sample points were allocated by North East Space Application Center adopting the method as provided in the National Working Plan Code 2014. Plot locations are shown through figure 6.1a. 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 taking the dimensions of the plot, latitude, longitude and altitude were recorded using the handheld GPS device. The main plot was used for recording the trees and bamboo stocking. The enumeration of trees was done by measuring the girth of each tree above 30 cm girth found in the sample plot. In case of bamboo, each clump was enumerated by taking its height, number of first, second and third year old culms, dried, congested culms and overall condition of the culms.

Information on regeneration status of forest species, injury to forest species, grazing incidence, fire incidence, soil type, gradient of slope etc. were gathered through visible evidences and recorded. Data of shrubs, climbers and regeneration status were recorded from all quadrats of 3m×3m laid out at a distance of 30 metres from the centre of the main plot of 0.1ha at SE and NW directions. Data of herbs from all nested quadrats of 1m×1m laid within each quadrat of 3m×3m was collected and recorded in the plot enumeration form. However, it must be admitted that the forest is fairly balanced. Quantification of the number of trees that can be accommodated in the higher diameter classes cannot be reflected by this graph.

A detailed enumeration of trees for the distribution of trees into diameter classes of different species has been limited to the measurement of standing biomass of trees having diameter at breast height above 30 cm. All woody litter below 5 cm diameter is enumerated from the four nested quadrats of

size 3 m x 3 m and from the same plot, all shrubs and climbers are uprooted and weighed for the estimates of biomass and carbon. Estimate for the herbs, grasses and leaf litter and data on humus and soil carbon of the forest floor is obtained from the nested quadrats of 1 m x 1 m plots of NE and SW corners and a pit of size 30 cm x 30 cm x 30 cm is dugged within these plots to collect composite samples of soil for the estimate of soil organic carbon. The schematic diagram of field enumeration plots is shown in Figure 6.1a

Volume of timbers under different diameter classes is shown in Table 6.1.b.

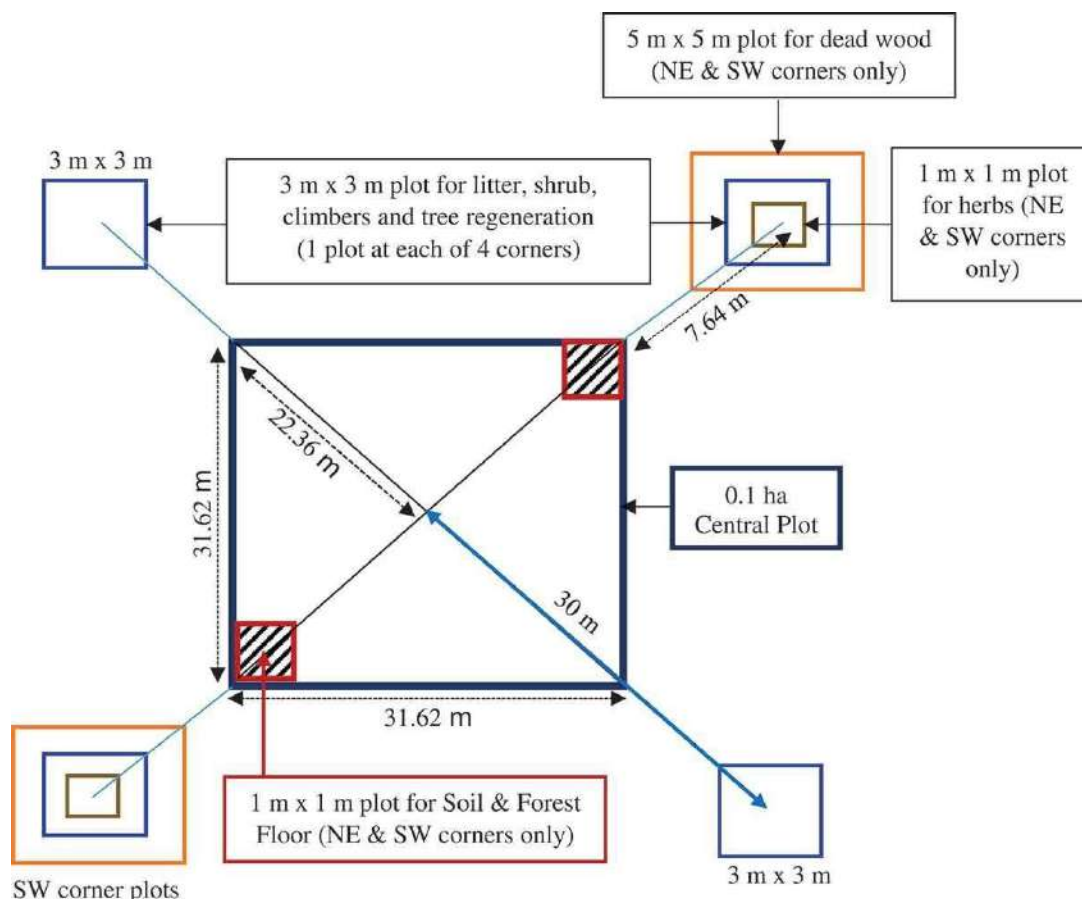


Figure 6.1a Schematic representation of field enumeration plots (NE: North East, SW: South West)

Table 6.1.b. Volume of timber under different diameter classes growing in Kamrup West Division

Species	5 –10	10 –20	20 –30	30 –40	40 –50	50 –60	60 –70	70 –80	80 –90	90 <
Acacia catechu	0.01				0.76	1.03				
Aegle marmelos				1.11						
Aglaia hiernii King		2.12	13.69	26.91	32.57	11.67		11.66		
Aglaia spectabilis			0.18	4.65	2.76	1.71				
Albizia lebbeck	0.09	1.57	4.66	1.70	3.00		1.92			
Albizia odoratissima		1.04	1.40	0.83						
Albizia procera	0.10	8.10	29.01	36.27	9.57	18.72				
Alstonia scholaris		2.63	10.91	4.11	1.34					
Altingia excelsa Noronha		0.52	0.28							
Artocarpus chaplasha		2.38	0.91	6.41	16.86	29.70	15.58	26.30	18.00	11.26
Artocarpus lacucha		0.31	0.31							
Averrhoa carambola	0.17	3.37	8.85	11.65	6.98	7.46				10.89
Baccaurea ramiflora		0.65	1.59	0.45						
Bauhinia purpurea	0.01	8.10	22.54	5.53	3.26		2.43			
Bombax ceiba			0.96	0.96	2.98	4.49			13.70	16.30
Bridelia retusa		0.07								

Camelia sinensis		0.11								
Canarium bengalense		0.13		0.81						
Careya arborea	0.91	88.07	83.90	36.98	12.57	6.59				
Cassia fistula	0.52	6.55	10.37	0.92						
Chukrasia tabularis	0.02	2.64	8.58	11.70	11.30					
Cinnamomum glaucescens		0.24	0.22	0.67						
Colona floribunda		0.18	1.75							
Croton persimilis		0.74	2.43	1.60	1.89	3.08	3.69			
Cryptocarya amygdalina	0.11									
Delonix regia		0.18								
Dillenia pentagyna.	0.27	15.12	47.44	46.21	50.79	33.73	21.36			18.48
Diospyros variegata	0.06	1.73	5.25	9.95	9.37	12.80	4.87	12.76	10.16	
Dipterocarpus indicus		0.47	0.47	0.46	0.46					
Duabanga grandiflora		6.60	22.59	36.09	48.35	43.32	8.14	12.17		44.05
Engelhardtia spicata			4.86							
Erythrina stricta		0.45	6.29	3.92	3.80	6.75				
Ficus benghalensis										10.33
Ficus racemosa	0.03	0.06	1.53	0.85	1.53					
Ficus religiosa				1.05	1.66	2.10				57.61
Garcinia kydia			0.62							
Garuga pinnata				0.52						
Gmelina arborea	0.12	3.44	12.54	15.53	5.28	5.58				9.25
Holarrhena pubescens	0.49	1.93	5.74	4.35						12.77
Khasiaclunea oligocephala				1.66	3.82					54.15
Knema linifolia		0.15								
Lagerstroemia parviflora		18.61	25.61	22.36	7.66	4.26	2.73			
Lagerstroemia speciosa	0.38	1.45	3.83							
Lannea coromandelica		4.34	23.13	36.45	29.34	9.87	3.22			
Lithocarpus fenestratus		1.81	2.47		1.59					
Litsea glutinosa			0.28							
Litsea monopetala		0.23	8.83	5.56						
Machilus gamblei		2.67	7.12	4.10		19.27		38.27		
Magnolia champaca			3.93	2.45		3.07				
Magnolia insignis		0.67		0.80						
Magnolia kingii		0.89	3.44	17.68	25.08	13.61	10.65	6.10	6.66	
Mallotus nudiflorus				0.85				1.29	3.81	
Mangifera indica	0.04	0.59	0.62	5.31	4.63	5.26	3.90	12.20		
Mangifera sylvatica	0.17									
Meliosma simplicifolia					1.61					
Mesua ferrea				1.32	1.36					
Meyna laxiflora		0.26								
Michelia oblonga		0.16	0.26		2.17		5.14			
Misc	0.12	2.04	8.28	12.54	3.24	16.32		16.70	6.66	18.06
Morus macroura		0.92	0.23							
Neolamarckia cadamba			0.33							
Oroxylum indicum	0.17	0.18	0.84							
Phyllanthus emblica	0.13	6.80	8.77	2.24						
Polygonum plebejum							11.09			
Premna bengalensis		0.13	1.43			1.66				
Premna milleflora		0.13								
Sansevieria roxburghiana										27.40
Schima wallichii	0.22	40.40	337.13	234.62	192.54	118.01	58.02	44.66	32.29	49.53
Schima wallichii Choisy		0.04								
Sesbania cannabina		1.26	4.41	6.22						
Shorea robusta Gaertn.	5.86	1086.40	1626.78	422.49	196.44	32.41	49.11	42.75	20.23	41.06
Spondias pinnata		0.29	3.32	1.48	1.31					
Sterculia villosa	0.95	7.05	20.63	25.91	38.02	9.52	14.71	11.30		8.41
Stereospermum chelonoides		3.14	1.04	17.67	36.93	56.18	5.68	15.72	22.91	21.20
Syzygium cumini	0.00	4.52	12.83	8.57	3.88					
Syzygium jambos		0.10			1.32					
Syzygium nervosum		0.26								

Tectona grandis	0.85	43.75	98.49	102.88	23.74					
Terminalia bellirica	0.50	2.36	18.51	18.49	16.95	2.58				
Terminalia chebula		1.93	1.74	1.24	2.22		7.52			
Terminalia myriocarpa							6.28			
Tetrameles nudiflora		1.76	10.29	29.25	84.72	193.66	97.93	153.59	234.32	431.37
Toona ciliata	0.15	2.17	10.81	18.90	22.22	10.45	4.58			
Vitex altissima	0.24	6.43	24.96	33.16	18.98	8.71	7.37	9.64		12.81
Zanthoxylum rhetsa		0.10	0.51	0.62	2.54					
Ziziphus funiculosa	0.15	0.29								

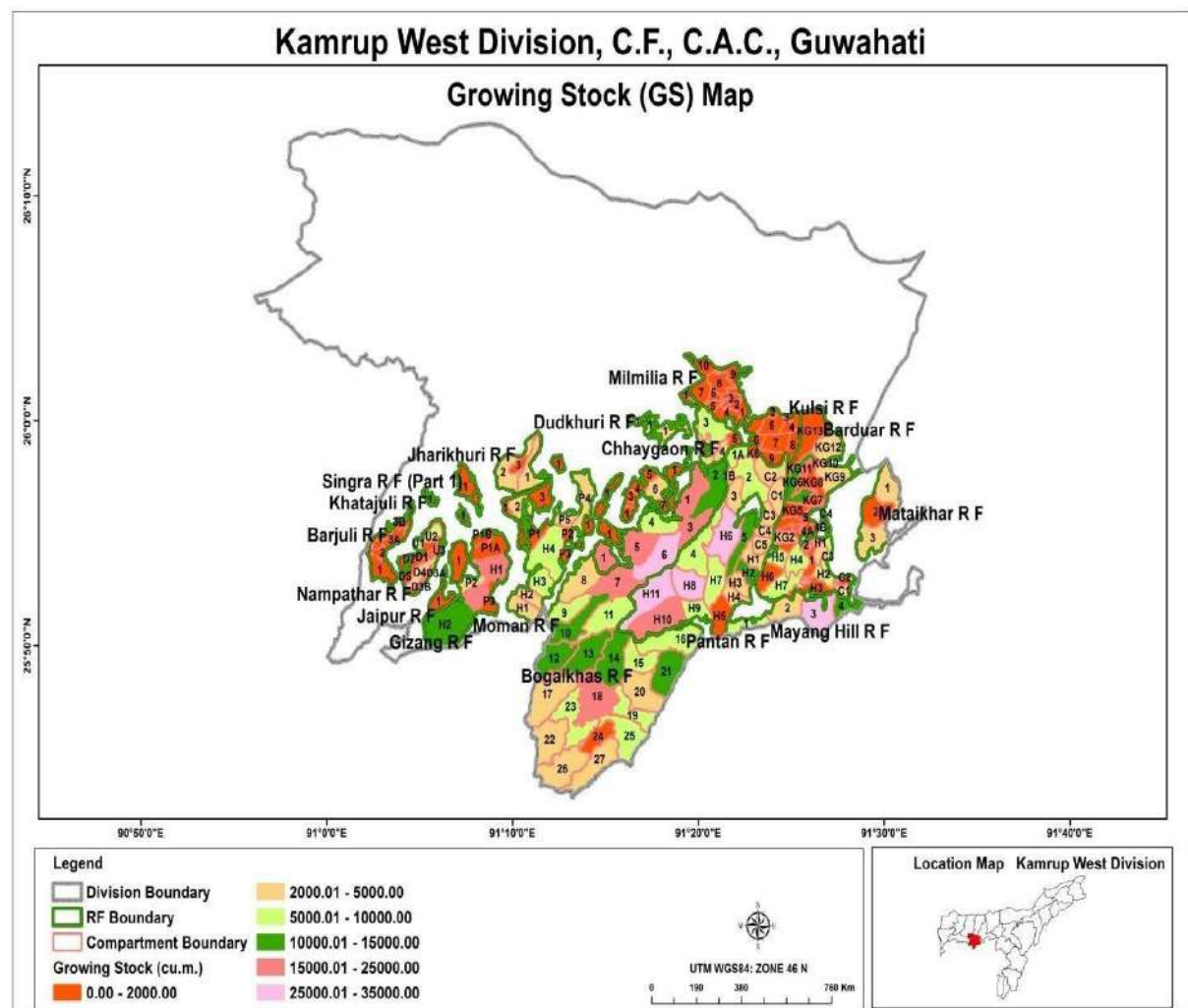


Fig. 6.1.b: Growing stock map of Kamrup West Division



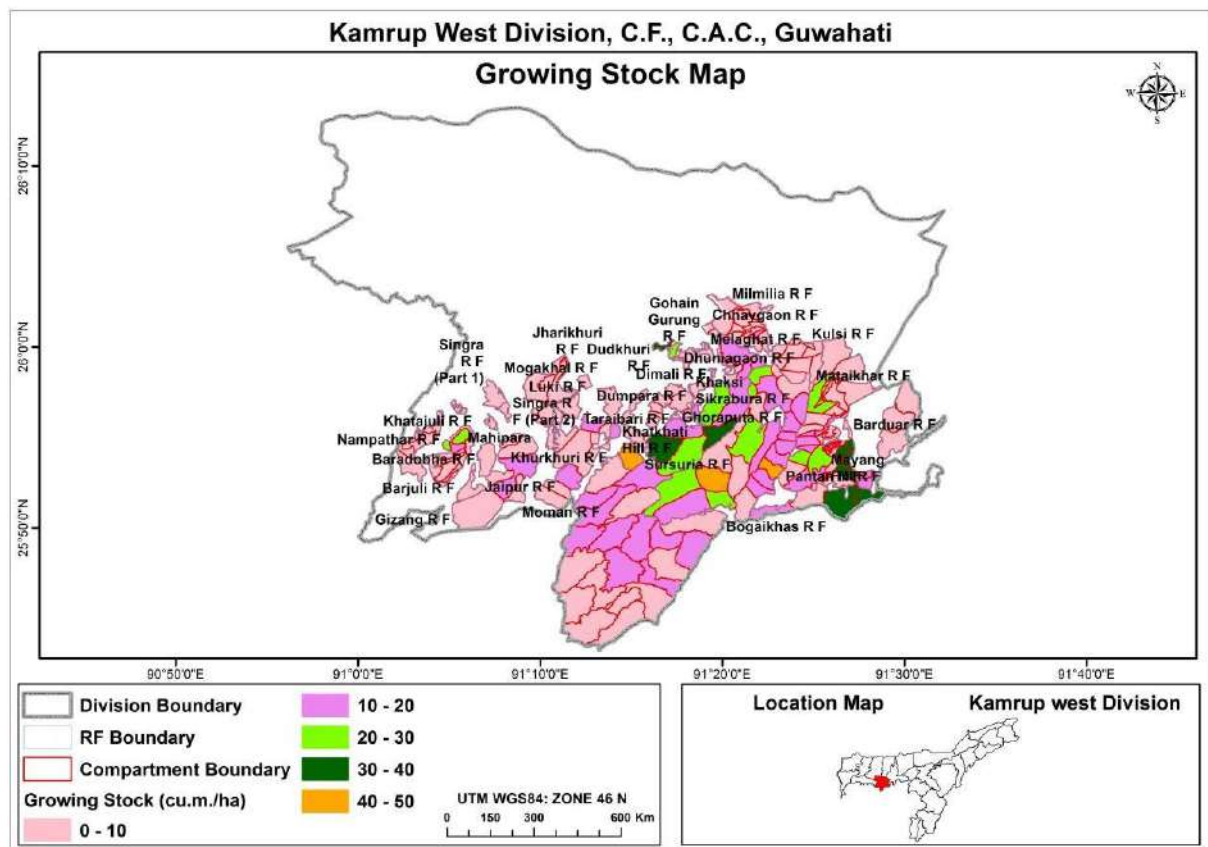


Table: 6.1.c: Compartment wise growing- stock (cu.m./Ha.) of Kamrup West Division

Name of the RF	Compt. No.	(cu.m./Ha.)
Baradobha R F	1	1.39
Barduar R F	1	3.38
	2	13.72
	3	10.55
	5	13.75
	4A	3.00
	4B	5.19
	C1	11.52
	C2	15.43
	C3	38.92
	C4	1.67
	H1	30.79
	H2	37.64
	H3	3.96
	H4	25.06
	H5	28.63
	H6	5.12
	H7	13.97
	KG1	15.94
	KG10	0.88
	KG11	20.38
	KG12	8.38
	KG13	0.16
	KG2	19.36
	KG3	16.38
	KG4	1.19
	KG5	5.34
	KG6	20.36
Barjuli R F	KG7	1.86
	KG8	2.66
	KG9	3.83
Bogaikhas R F	1	1.58
	2	4.40
	3A	1.82
	3B	0.01
	1	23.91
	2	14.11
	3	35.72
	4	13.36
	5	35.57
	6	28.90
	7	19.01
	8	5.25
	9	12.72
	10	12.39
	11	8.01
	12	19.76
	13	11.40
	14	10.35
	15	14.86
	16	8.93
	17	3.76
	18	16.21
	19	12.29
	20	4.74
	21	11.73
	22	3.20
	23	9.24

Chhaygaon R F	24	3.26			4	2.87
	25	9.80			5	2.84
	26	2.88			6	2.96
	27	5.13			7	5.76
	1	6.61			8	2.76
	2	8.13			9	0.34
	3	16.18			10	1.32
	4	14.91				
	5	10.45				
Dhuniagaon R F	1	7.00				
Dimali R F	1	8.48				
Dudkhuri R F	1	37.17				
Dumpara R.F.	1	0.18				
Garubaldha R.F.	1	12.99				
Ghoraputa R.F.	1	2.36				
Gizang R.F.	H1	18.04				
	H2	8.67				
	P1A	0.03				
	P1B	6.50				
	P2	9.67				
	P3	3.29				
Gohain Gurung	1	27.62				
Jaipur R.F.	1	0.05				
Jharikhuri R.F.	1	4.20				
	2	3.20				
	3	3.72				
Khaksi Sikrabura	1	8.19				
	2	4.27				
	3	7.17				
	4	5.94				
	5	5.76				
	6	6.76				
	7	5.83				
Khatajuli R.F.	1	0.09				
Khatkhathi Hill	1	0.41				
Khurkhuri R.F.	1	0.00				
Kulsi R.F.	1	2.00				
	2	1.49				
	3	2.06				
	4	6.07				
	5	0.27				
	6	1.21				
	7	4.52				
	8	0.02				
	9	0.87				
Luki R.F.	1	2.46				
	2	7.89				
	3	2.90				
Mahipara R.F.	1	2.56				
Mataikhar R.F.	1	6.34				
	2	2.67				
	3	7.55				
Mayang Hill R.F.	1	19.48				
	2	6.44				
	3	35.86				
	4	35.11				
Melaghat R.F.	1	6.67				
Milmilia R.F.	1	0.11				
	2	12.64				
	3	1.82				

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6.2 Growing stock of bamboo: The growing stock of bamboo in in Kamrup West Division division, Assam is provided in Table-6.2a below. Bamboo growing stock in table 6.2.b.

Table 6.2.a: Statement showing growing stock of Bamboo in Kamrup West Division, Assam

Sl. No.	Range	Beat	Compartment	Species	Condition	Total area (in Ha)
1	Singra			Jati Bamboo	Sound	200
2	Singra			Kako Bamboo	Sound	15000
3	Singra			Bijuli Bamboo	Sound	50
4	Singra			Teri Bamboo	Sound	2
5	Kusli	Katrobari Camp	1	Kakowa Bamboo	Sound	
6	Kusli	Barbakara	1	Kakowa Bamboo	Sound	
7	Kusli	Barbakara-Doledonga	1	Kakowa Bamboo	Sound	
8	Kusli	Bakalipara	2	Kakowa Bamboo	Sound	
9	Kusli	Bakalipara	1	Kakowa Bamboo	Sound	
10	Kusli	Borgurung	1	Kakowa Bamboo	Sound	
11	Kusli	Kotorabari area	1	Kakowa Bamboo	Sound	
12	Kusli	Pujala Chowthala Beat	1	Kakowa Bamboo	Sound	
13	Kusli	Jalukbari Barbakara	1	Kakowa Bamboo	Sound	
14	Bamunigaon	Ratanpur		Kakowa Bamboo	Sound	20
15	Bamunigaon	Barbakara		Kakowa Bamboo	Sound	90
16	Bamunigaon	Barjhar		Kakowa Bamboo	Sound	80

Table 6.2.b Showing Bamboo growing stock in Kamrup West Division

Range	Beat	Species	und/ Broken	o of clump/ cre	Total Clumps	No of culms	No of culms Dry	No of Current yr culms	Total no of Culms
Loharghat	Rajapara	<i>D.hamiltonii</i>	Sound	12 nos	220	200	20	5	200
			Sound	6 nos	46	40	6	3	40
	Mudukki	<i>D.hamiltonii</i>	Sound	16 nos	250	230	20	9	250
		<i>Neehouzeaua</i>	Sound	10 nos	210	210	10	5	210
	Matiakhari	<i>D.hamiltonii</i>	Sound	18 nos	280	265	15	14	280
		<i>Neehouzeaua dullooa</i>	Sound	12 nos	70	260	10	5	260
Kulshi	Kotraba	<i>D.hamiltonii</i>	Sound	21	21	21	-	21	21
	Barbakra Gohipatar	<i>D.hamiltonii</i>	Sound	95	95	95	-	95	95
	Barbakara Doledonga	<i>D.hamiltonii</i>	Sound	90	90	90	-	90	90
	Bokolipara	<i>D.hamiltonii</i>	Sound	35	35	35	-	35	35
	Bokolipara	<i>D.hamiltonii</i>	Sound	55	55	55	-	55	55
	Borgurung	<i>D.hamiltonii</i>	Sound	46	46	46	-	46	46
	Kotorabari	<i>D.hamiltonii</i>	Sound	63	63	63	-	63	63
	Pujala chowthola	<i>D.hamiltonii</i>	Sound	83	83	83	-	83	83
	Jalukbari Barabakar a	<i>D.hamiltonii</i>	Sound	13	13	13	-	13	13
Singra	Jungakhuli	<i>D.strictus</i>	Sound	112	-	-	-	-	-
	Rowmari	<i>D.hamiltonii</i>	Sound	82	-	-	-	-	-
	Baradoba	<i>Bambusa pallid</i>	Sound	253	-	-	-	-	-
	Lumpi	<i>Gigantochloa Macrotychus</i>	Sound	112	-	-	-	-	-

6.3 Increment in volume of identified timber species: The following table shows the local volume table prepared on the basis of previous data of various species in the division.

Table. 6.3.1. Local volume table of different species in Kamrup West 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

6.4 Efforts towards enhancement of forest productivity: Efforts to enhance forest productivity has been initiated through plantation activities carried out in the Division from time to time. Various local bodies, State as well as National agencies have been involved for carrying out plantations. Table 6.4.a represents details of various plantation activities undertaken in the Division between 2000-01 and 2019-20. Abstract of plantation activity undertaken from 2000-01 and 2019-20 in table Table 6.4.a

Table 6.4.a. Statement showing details of plantation activities, within year 2001- 2018

Year of creation	Name of Scheme	Location	Area (in Ha) Rangewise					Total area Hect.	Survival%
			Lohar hat	Kulsi	Bamuni gaon	Singra	Bonda para		
2000-01	Bamboo Plantation	Nampathar R.F.					6	6	20-25
	Teak Plantation	Nampathar R.F.					10	10	20-25
2002-03	RDF Plantation	Kulsi R.F.		10				10	20-25
	ANR	Kulsi R.F.		3				3	20-25
2003-04	Revolving Fund	Mataikhar R.F. near Mataikhar Beat: 10 Ha Barduar R.F. Khopida under Ghilabari Beat: 10 Ha	20					20	20-25
	ANR	Kulsi: Dhonipara area under Barduar R.F. Bamunigaon: Simla R.F.: 10 Ha Bamunigaon: Ratanpur : 10 Ha		10	20			30	20-25
2004-05	ANR	Bamunigaon: Dumpara R.F. Kulsi: Aliha area under Barduar R.F.: 40 Ha Kulsi: Dhonipara area under Barduar R.F.: 20Ha		60	50			110	20-25
	Compensatory Afforestation	Singra: Mughakhal R.F. Bondapara: Barjuli R.F.				20	43	63	20-25
	Teak Plantation	Joypur R.F.					20	20	20-25
2005-06	ANR	Moman R.F.				20		20	20-25
	Compensatory Afforestation	Kulsi: Dhonipara area under Barduar R.F. Bamunigaon: Melaghat R.F. Bondapara: Nampathar R.F.		100	100		100	300	20-25
	Mixed Plantation	Baradova R.F.					50	50	30

2006-07	ANR	Gohaigurung R.F.:10 Ha Dhudhkuri R.F.: 90Ha			100			100	25-30
	Bamboo Plantation (through JFMC)	Baradova R.F.					40	40	25-30
	Improvement of Degraded Bamboo	Kulsi: Kulsi R.F.: 25 Ha, Pantan R.F.: 25 HaSingra: Bagaikhas R.F.Bondapara: Gizang R.F.		50		75	75	200	25-30
	Forest Village Development Scheme	Kulsi Range: Kulsi, Dhanipara-Dimali, Aliha- Ghograchuk,Jaruagaon-Karikura, Nalbari- Bagapani,Balijuri-Bakalipara, Bherbheri- Andheri, Kahua-Bahatpur,Kordoiguri- Sanyasi, Bogbaha-Garubaldha Loharghat Range: Ouguri, Jaramukhia,Ranikhamar, Rajapara, Manikpur-Sildubi, SaruraniHajorani,Barjhar- Hudupara,Ghilabari-Khirkijuli-Sipahipara Japangbari-Hatibandha-engakhal,Deopani- Bogdoba-Hanapara, Hatigarh BamunigaonRange: Kalabakra-Ratanpur-Rahpur, Akchali-Puthimari-Phulguri-Barjhar, Hatigarh-Ouguri, Paglapara-Moinapara- Khalbakhhal,Alukhunda-Kharkhari- Kadamguri Dighal bil- Noonmati- Makhamdol,Borghu li-Doledonga- Borjha	405	335	110	0	0	850	25-30
	IL	Singra: Samuka JFMC: 105 Ha, Nalapara JFMC: 140 Ha Bamunigaon: Kalabakra JFMC: 132 Ha, Alukhunda JFMC: 120 Ha Bondapara: Dhupguri JFMC: 130 Ha, Dekapara JFMC: 130 Ha			252	245	260	757	25-30
	Rehabilitation of degraded forest nursery	Hatigar, Mayang R.F.	10					10	25-30
	Aided Natural Regeneration Plantation	Bamunigaon: Santipur under Simla R.F. Loharghat: Mayang R.F. (Rajapara Beat) Singra: Bogaikhas Kulsi : Barbakra Beat Pantan R.F. Bondapara: Gizang R.F. (Panipaha) Gamarimura Beat	50	65	50	55	30	250	25-30
	Rehabilitation of degraded forest nursery	Loharghat: Barduar R.F. (Range H.Qtr.) Kulsi: Garubaldha Baruduar R.F. Pantan Bamunigaon: Sannasi Singra: Moman R.F. Gorukata (Hahim) Bondapara: Joypur R.F. Gamrimura Beat	10	34	10	10	8	72	25-30
	Compensatory Afforestation Plantation	Bamunigaon: MilaghatKulsi: Dhanipara Beat Barduar R.F. Bondapara: Nampathar R.F. Singra: Jarikhuri R.F.		100	100	20	143	363	25-30
	Bamboo Plantation (through JFMC)	Kulsi: Barduar R.F.: 30 ha Kulsi: Pantan R.F.: 30 Ha		60				60	30
	Improvement of degraded Bamboo	Kulsi: Kulsi R.F. Singra Range Bamunigaon		40	20	40		100	30
	NAP	Loharghat: Muduki JFMC Kulsi: Kulsi JFMC Bamunigaon: Milaghat & Ratanpur JFMC Singra: Mugakhal, Pakharapara, Pub Palahpara Bondapara: Baradova & Daring JFMC	40	45	90	135	90	400	30
2009-10	Regeneration or Silvi Works	Loharghat: Barduar R.F.	20	20	30	30		100	25-30

		Kulsi: Pantan R.F. Bamunigaon: Milimlia R.F. Singra: Bagaikhas R.F.							
	Rehabilitation degraded forest	Kulsi: Kulsi R.F Bamunigaon: Bagaikhas R.F.		15	15			30	25-30
	Aided Natural Regeneration Plantation)	Loharghat: Deopani, Mataikhar R.F. Kulsi: Barduar R.F. Bamunigaon: Chhaygaon R.F. Singra: Bagaikhas R.F.	20	20	30	30		100	25-30
	Improvement of Degraded Bamboo	Loharghat: Mayang R.F. Kulsi: Kulsi R.F. Singra: Bagaikhas R.F. Bondapara: Baradova R.F. Bamunigaon: Pantan R.F.	20	20	20	20	20	100	25-30
	Bamboo Plantation (through JFMC)	Singra: Bagaikhas R.F. Bamunigaon: Pantan R.F.: 20 Ha Bamunigaon: Bagaikhas R.F. : 30 Ha			50	50		100	25-30
	NAP	Loharghat: Mataikhar JFMC Kulsi: Kahua- Bahatpur Bamunigaon: Koimari, Ukiam, Santipur JFMC Singra: Bhogdabari, Moman, Rajapara, Gohalkona, Sakhati, Jharapara, Palahpara JFMC Bondapara: Langapara- Sukuniapara JFMC	35	34	102	245	34	450	25-30
	State Medicinal Plant Board	Loharghat: Ouguri JFMC Kulsi: Bogbaha-Garubaldha JFMC Bamunigaon: Ukiam JFMC Bondapara: Rabhapara-Christianpara JFMC	40	50	80		0	80	30
	NaRMIL	Singra: Nowapara JFMC, Bondapara: Mirzakhat JFMC					100	180	30
2010-11	Rehabilitation degraded forest	Bamunigaon: Bagaikhas R.F. Singra: Bagaikhas R.F.			30		10		40
	ANR	Bamunigaon: Bagaikhas R.F Kulsi: Barduar R.F. Bamunigaon: Bagaikhas R.F. Singra: Bagaikhas R.F. Bondapara: Jarihat		10	20		10	10	40
	Bamboo Plantation (through JFMC)	Loharghat: Barduar R.F. Kulsi: Barduar R.F. Singra: Moman R.F. Bondapara: Gizang R.F.: 20 ha Bondapara: Nampathar RF: 20 ha Bamunigaon: Pantan R.F.	25	50	55		30	40	50
	Improvement of Degraded Bamboo	Loharghat: Mataikhar, Kulsi: Kordoiguri, Bamunigaon: Ukiam Singra: Nowapara lumpi Road	10	10	20		10		50
	NaRMIL	Loharghat: Pokapam-Bogaline JFMC, Kulsi: Dewanbeel JFMC	36	132					50
2011-12	Rehabilitation of degraded forest	1. Chhaygaon R.F. 2. Bagaikhas R.F			30		30		40-50
	ANR	1. Mayang R.F, 2. Pantan R.F. 3. Milimila R.F, 4. Moman R.F. 5. Nampathar R.F.	15	15		5	5	10	40-50
	NaRMIL (ANR)	Pakapam JFMC Dewanbeel JFMC	90	110					40-50
2013-14	APFBC	Nampathar, Borduar, Mayan, Liki, Pantan Milmila	60	60	70		60	60	40- 70
2014-15		Nampathar, Borjuly, Rowmari, Luki	135	0	0		115	0	40- 70
16-17		Baradova. Joypur, Barduar	190	40	0		22	0	40- 70
17-18		Milmila	0	0	0		0	8	40- 70
15-16	CAMPA		0	0	0		6.5	0	40 -80
17-18	SOPD	Luki, Nampathar, Milmila	0	0	0		5	0	40 -80
17-18			25	0	0		11.76	30	40 -80

Table 6.4.b: Statement showing plantation activities for enhancing forest productivity in Kamrup West Division, Assam

Sl.	Scheme	Year																Total
		2001-02 to 2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	
		Area (inHa)	Area (inHa)	Area (inHa)	Area (inHa)	Area (inHa)	Area (inHa)	Area (inHa)	Area (inHa)	Area (inHa)	Area (inHa)	Area (inHa)	Area (inHa)	Area (inHa)	Area (inHa)	Area (inHa)	Area (inHa)	
1	APFBC	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	310	250	NIL	252.00	8.00	0.00	0.00	820
2	Compensatory Afforestation	NIL	300	63	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	0.00	0.00	0.00	0.00	363
3	CAMPA	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	6.5	0.00	5.00	0.00	0.00	11.5
4	Forest Village	NIL	NIL	NIL	850	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	0.00	0.00	0.00	0.00	850
5	NAP	NIL	400	-	Nil	450	NIL	NIL	NIL	NIL	-	NIL	NIL	0.00	0.00	0.00	6.50	856.5
6	NaRMIL	NIL	NIL	1051	-	-	-	-	368	-	-	NIL	NIL	0.00	0.00	0.00	0.00	1419
7	NBM	NIL	NIL	40	NIL	60	Nil	200	NIL	360	400	Nil	NIL	0.00	0.00	0.00	5.00	1065
8	SMPB	NIL	NIL	NIL	NIL	40	210	NIL	NIL	NIL	NIL	NIL	NIL	0.00	0.00	0.00	0.00	250
9	Aided Natural Regeneration Plantation	NIL	NIL	NIL	NIL	250	NIL	NIL	NIL	55	10	NIL	NIL	0.00	0.00	0.00	0.00	315
10	Rehabilitation of Degraded Forest	NIL	NIL	NIL	NIL	72	30	30	60	12	12	6	NIL	0.00	66.76	0.00	0.00	288.76
11	Mukhya Mantrir Assam Bikash Yojana	NIL	NIL	NIL	NIL	25	NIL	NIL	10	50	10	15	NIL	0.00	0.00	0.00	0.00	110
	Total	Nil	700	1154	850	897	240	230	438	477	742	271	6.5	252	79.76	0	11.5	6348.76



Table 6.5.a: Forest carbon stock under different RFs

Name of the RF	Comptt. No.	Carbon (tons/ha)	Comptt. No.	Carbon (tons/ha)
Baradobha R F	1	1.39		
Barduar R F	1	3.38	H6	5.12
	2	13.72	H7	13.97
	3	10.55	KG1	15.94
	5	13.75	KG10	0.88
	4A	3.00	KG11	20.38
	4B	5.19	KG12	8.38

	C1	11.52	KG13	0.16
	C2	15.43	KG2	19.36
	C3	38.92	KG3	16.38
	C4	1.67	KG4	1.19
	H1	30.79	KG5	5.34
	H2	37.64	KG6	20.36
	H3	3.96	KG7	1.86
	H4	25.06	KG8	2.66
	H5	28.63	KG9	3.83
Barjuli R F	1	1.58	3A	1.82
	2	4.40	3B	0.01
Bogaikhas R F	1	23.91	15	14.86
	2	14.11	16	8.93
	3	35.72	17	3.76
	4	13.36	18	16.21
	5	35.57	19	12.29
	6	28.90	20	4.74
	7	19.01	21	11.73
	8	5.25	22	3.20
	9	12.72	23	9.24
	10	12.39	24	3.26
	11	8.01	25	9.80
	12	19.76	26	2.88
	13	11.40	27	5.13
	14	10.35		
Chhaygaon R F	1	6.61	4	14.91
	2	8.13	5	10.45
	3	16.18		
Dhuniagaon R F	1	7.00		
Dimali R F	1	8.48		
Dudkhuri R F	1	37.17		
Dumpara R F	1	0.18		
Garubaldha R F	1	12.99		
Ghoraputa R F	1	2.36		
Gizang R F	H1	18.04	P1B	6.50
	H2	8.67	P2	9.67
	P1A	0.03	P3	3.29
Gohain Gurung R F	1	27.62		
Jaipur R F	1	0.05		
Jharikhuri R F	1	4.20	3	3.72
	2	3.20		
Khaksi Sikrabura R F	1	8.19	5	5.76
	2	4.27	6	6.76
	3	7.17	7	5.83
	4	5.94		
Khatajuli R F	1	0.09		
Khatkhathi Hill R F	1	0.41		
Khurkhuri R F	1	4.60		
Kulsi R F	1	2.00	6	1.21
	2	1.49	7	4.52
	3	2.06	8	0.02
	4	6.07	9	0.87
	5	0.27		
Luki R F	1	2.46	3	2.90
	2	7.89		
Mahipara	1	2.56		
Mataikhar R F	1	6.34	3	7.55
	2	2.67		
Mayang Hill R F	1	19.48	3	35.86
	2	6.44	4	35.11
Melaghat R F	1	6.67		

Milmilia R F	1	0.11	6	2.96
	2	12.64	7	5.76
	3	1.82	8	2.76
	4	2.87	9	0.34
	5	2.84	10	1.32
Mogakhal R F	1	1.21		
Moman R F	H1	8.07	P2	7.59
	H2	8.83	P3	6.73
	H3	14.98	P4	6.02
	H4	8.98	P5	10.26
	P1	3.31		
Nampathar R F	D1	5.93	D5	6.75
	D2	0.18	U1	10.37
	D3A	4.42	U2	25.62
	D3B	3.67	U3	3.41
	D4	9.68		
Pantan R F	2	13.72	H10	17.00
	3	9.78	H11	26.99
	4	6.03	H2	45.90
	5	18.69	H3	18.26
	1A	26.30	H4	13.56
	1B	25.27	H5	3.90
	C1	11.72	H6	28.07
	C2	9.66	H7	9.42
	C3	13.79	H8	48.80
	C4	14.42	H9	22.19
	C5	14.04	K6	7.86
	H1	17.02	-	-
Simla Hill R F	1	15.43	-	-
		3.00	-	-
Singra R F (Part 1)	1	3.00	-	-
Singra R F (Part 2)	1	9.04	-	-
Sursuria R F	1	42.45	-	-
Taraibari R F	1	2.23	-	-

Table: 6.5.a Reserved forest wise carbon stock in Kamrup West Division

Range	Reserved Forest	No. of Compartment	R.F area (hect)	Carbon Stock (tone)
Bondapara	Gizang	6	3472.237	26736.22
	Nampathar	9	1380.412	10739.61
	Borjuli	4	1129.906	2206.141
	Boradova	1	434.641	604.151
	Singra (part I)	1	379.080	1137.24
	Jaipur	1	326.183	16.30915
	Khatajuli	1	110.160	9.9144
	Singra (part II)	1	95.180	860.4272
	Mahipara	1	93.980	240.5888
	Range Total	25	7421.779	42550.602
Singra Range	Moman	9	3211.250	26685.49
	Jarikhuri	3	1249.251	4634.721
	Luki	3	904.896	3999.64
	Sursuria	1	389.720	16543.61
	Taraibari	1	319.303	712.0457
	Khatkhathi Hill	1	248.482	101.8776
	Mugakhal	1	129.097	156.2074
	Garubaldha .	1	110.076	1429.887
	Khurkhuri	1	66.167	304.3682
	Range Total	21	6628.242	54567.8469
Bamunigaon-Singra	Bagaikhas	27	24668.77	325627.8
Bamunigaon	Milmillia	10	1853.905	6192.043
	Chhaygaon	5	1294.212	14572.83

	Khuxi Sikrabura	7	1019.627	6393.061
	Melaghat	1	362.606	2418.582
	Dumpara	1	193.443	34.81974
	Simla	1	126.264	1164.154
	Gohaingurung	1	125.455	3465.067
	Dudhkhuri	1	98.340	3655.298
	Dimali	1	52.610	446.1328
	Ghoraputa	1	47.753	112.6971
	Dhaniagaon	1	36.422	254.954
	Range Total	30	5210.637	38709.64
Bamunigaon-Kulsi	Pantan	23	11280.857	207116.5
Kulsi	Kulsi	9	1855.119	3821.545
Kulsi-Loharghat	Borduar	30	7235.936	91389.87
Loharghat	Mayang Hill	4	2139.214	51811.76
	Mataikhar	3	1684.338	9297.546
Range Total		7	3823.552	61109.31
Grand total			68124.892	824893.1

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 CO₂ in the atmosphere to sugars through the process of photosynthesis. Melvin Calvin was awarded the Nobel Prize in 1961 in Chemistry for his research on the process of carbon dioxide assimilation in plants using carbon isotopes, which proved that the carbon assimilated in trees, are absorbed from atmospheric CO₂. This way trees and forests act as a major sink of carbon in the natural carbon cycle. Destruction of forests leads to release of CO₂ into atmosphere, which has been calculated to be more than the global vehicular emissions. Harvested wood traps and stores the carbon within it over a long period of time. So promoting carbon sequestration in trees is a practical and cost effective way to capture carbon from atmosphere and store away for a long period of time. Hence the emission reductions are real and long term. Trees are natural sequesters of carbon, they take carbon from atmosphere; utilize it in the process of photosynthesis as well as they store it in the form of biomass or wood. For this process of carbon sequestration to be success it is essential that carbon must not return to the atmosphere from burning. Carbon Sequestration can assist significantly in maintaining the natural carbon cycle. Therefore, requirement is that we need to implement this practice properly. There is a need to go for natural sequestration first, thus conservation of existing forests and more and more reforestation is required. Only then we will be able to reduce carbon emission and corresponding harmful impacts

Greenhouse Gases (GHG) have the capability to reflect back shorter wavelength infrared (IR) radiation. GHGs allow the longer wavelength IR radiation from sun to reach earth through the atmosphere. Earth absorbs the IR radiation, and radiates shorter wavelength IR radiation back into the

atmosphere, which is reflected back into earth by the GHGs. So, the GHGs (such as water vapor, CO₂, CH₄, SF₆, HFCs, PFCs and O₃ (in troposphere)) form a blanket around earth resulting less variation in night and day temperatures, which is critical for life to flourish. This phenomenon is called the greenhouse effect. Moreover, due to the increase in consumption of fossil fuels after the industrial revolution and other sustained life style patterns of humans, the concentration of GHGs in the atmosphere increased, leading to an increase in the average temperatures on land as well as oceans. This increase in temperature caused the air and ocean circulation systems to behave differently, and change course patterns in certain cases, resulting in a change in climatic patterns on the earth. Further, life on earth will have to adapt to this increase in temperatures in a very short period. This phenomenon, which threatens the very existence of life on earth, is termed as Global Climate Change or GCC. Since these changes have been brought about due to human action, these are also called anthropogenic climate change. Mitigation strategies include reduction in emissions of GHGs from sources as well as capture and storage of GHGs over a long period of time (sequestration).

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 agro silvipastoral systems are possibly sources of GHGs. Practices like tillage, controlled burning, manuring, application of chemical fertilizers and frequent soil disturbance can lead to significant emissions of GHGs. The carbon in the above ground and below ground biomass in an forestry system is generally much higher than the equivalent land use without trees (i.e. crop land without any trees). India has a long tradition of agroforestry practices. The agroforestry systems in India include trees on farms, community forestry and a variety of local forest management and ethno-forestry practices. In India, the practice of growing scattered trees on farmlands is quite old and has not changed much over centuries; these trees are multipurpose, used for shade, fodder, fuel wood, fruit, vegetables and medicinal uses.

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

are a large sink of carbon. There is considerable interest to increase the carbon storage capacity of terrestrial vegetation through land-use practices such as afforestation, reforestation, and natural regeneration of forests, silvicultural systems and agroforestry. Agroforestry systems are very important given the area currently under agriculture, the number of people who depend on land for their livelihoods, and the need for integrating food production with environmental services. Globally, climate negotiations have highlighted the importance of land use sectors in mitigating the climate change. Agriculture alone accounts for 10-12% of the total global anthropogenic emissions of GHGs with an estimated non-CO₂ GHG emission of 5120-6116 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.

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

REDD+ is a mechanism being negotiated through the United Nations Framework Convention on Climate Change (UNFCCC) to mitigate climate change by compensating developing countries for demonstrated reduced emissions from deforestation and forest degradation. Since REDD was introduced on to the UNFCCC agenda in 2006 its scope has been expanded through successive negotiations to include not only forest conservation activities, but also forest enhancement and sustainable management of forests. With growing momentum to develop REDD+ systems, there has been increasing focus on the appropriate institutional arrangements for implementing REDD+ at the international, national and project levels. Currently the Assam Forest Department has considered potential revenues from carbon that may arise from the REDD+ carbon projects, and had piloted a

jurisdictional REDD+ project design in Nagaon division (Lowering Emissions, Enhancing Forests (LEEF) in Nagaon). This REDD+ design detailed the prescriptions for various elements and extent of conservation, regeneration and afforestation activities, which can be included in the working plans to account Carbon sequestration by this forest division also. This can eventually help in state-wide reporting of contribution to national NDC goals.



CHAPTER 7

OPTIMIZATION OF FOREST RESOURCES UTILIZATION

7.1 Recorded removal of timber: Due to hon'ble Supreme Court's ban on WP(C) 202 on Godavaran case 1995, harvesting of timber and other forest produces were stopped and prescription of previous Working Plan was not followed in totality. 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 shown below (Table 7.1.a). Major portion of timber had been removed by timber smugglers. The following figure is just a tip of iceberg.

Table: 7.1.a Statement showing quantity of timber (M³) removed during 2001-2002 to 2019-20

Name of Range or Beat	Year	Species		
		Sal	Teak	Non-Sal
Bamunigaon	2001-02	Nil	7.314	Nil
Kulsi		13.068	Nil	Nil
Singra		51.492	Nil	Nil
Bondapara		7.213	15.578	7.096
Loharghat		68.405	Nil	Nil
Bamunigaon	2002-03	607.49	40.583	7.222
Kulsi		290.936	171.32	20.512
Singra		861.305	42.50	Nil
Bondapara		215.573	Nil	Nil
Loharghat		381.392	44.27	7.954
Riverine	2003-04	26.186	0.618	Nil
Bamunigaon		52.474	13.11	Nil
Kulsi		67.841	68.405	3.908
Singra		263.685	24.685	Nil
Bondapara		59.94	1.285	Nil
Loharghat	2004-05	42.292	12.457	0.4
Riverine		68.034	Nil	0.864
Bamunigaon		253.767	13.924	21.374
Kulsi		61.926	88.703	20.276
Singra		1093.148	58.200	8.855
Bondapara	2005-06	83.490	Nil	14.087
Loharghat		407.213	70.867	39.231
Riverine		18.194	Nil	Nil
Bamunigaon		75.208	Nil	Nil
Kulsi		103.291	Nil	Nil
Singra	2006-07	160.056	Nil	Nil
Bondapara		22.816	Nil	Nil
Loharghat		291.374	Nil	Nil
Riverine		Nil	Nil	Nil
Bamunigaon		10.930	8.263	4.274
Kulsi	2007-08	Nil	116.382	5.875
Singra		40.572	14.815	7.618
Bondapara		Nil	Nil	Nil
Loharghat		18.197	24.523	Nil
Riverine		10.474	7.959	10.634
Bamunigaon	2008-09	26.515	5.979	3.170
Kulsi		56.708	39.448	Nil
Singra		28.589	18.499	Nil
Bondapara		24.065	Nil	Nil
Loharghat		263.858	45.929	Nil

Riverine		6.190	Nil	Nil
Bamunigaon	2008-09	46.152	6.157	22.358
Kulsi		14.060	18.169	63.188
Singra		24.822	56.183	39.447
Bondapara		Nil	Nil	Nil
Loharghat		253.812	42.578	11.456
Riverine		12.937	Nil	Nil
Bamunigaon	2009-10	12.140	Nil	33.849
Kulsi		9.001	41.768	3.725
Singra		12.917	49.556	7.822
Bondapara		4.518	Nil	Nil
Loharghat		95.170	11.185	Nil
Riverine		5.868	Nil	Nil
Bamunigaon	2010-11	30.455	Nil	33.646
Kulsi		27.042	42.287	46.751
Singra		17.856	19.924	24.361
Bondapara		Nil	Nil	9.530
Loharghat		27.521	Nil	5.296
Riverine		12.272	Nil	5.116
Bamunigaon	2011-12	118.304	18.902	22.135
Kulsi		56.543	14.576	22.705
Singra		47.871	106.654	3.335
Bondapara		14.821	6.683	13.572
Loharghat		121.378	2.125	51.954
Riverine		Nil	Nil	Nil
Bamunigaon	2012-13	16.738	3.499	41.251
Kulsi		31.771	47.768	33.08
Singra		18.672	41.09	Nil
Bondapara		Nil	Nil	Nil
Loharghat		37.258	2.323	17.015
Riverine		Nil	Nil	Nil
Bamunigaon	2013-14	10.155	9.474	7.831
Kulsi		64.458	6.130	52.564
Singra		36.623	20.553	17.620
Bondapara		Nil	6.771	Nil
Loharghat		144.269	10.884	15.590
Riverine		Nil	Nil	Nil
Bamunigaon	2014-15	Nil	Nil	Nil
Kulsi		1.023	10.109	5.371
Singra		Nil	10.968	Nil
Bondapara		Nil	Nil	Nil
Loharghat		19.990	1.509	17.078
Riverine		Nil	Nil	Nil
Bamunigaon	2015-16	4.409	2.267	Nil
Kulsi		Nil	3.629	7.859
Singra		Nil	6.340	2.184
Bondapara		Nil	Nil	Nil
Loharghat		8.804	10.071	Nil
Riverine		Nil	Nil	Nil
Bamunigaon	2016-17	58.655	29.438	27
Kulsi		38.685	26.249	28
Singra		47.33	26	14.095
Bondapara		6.717	3	2
Loharghat		65.218	26.5	34.201
Riverine		37.979	23.98	46.398
Protection		42.366	23	47.899
Bamunigaon	2017-18	16.161	15	15
Kulsi		Nil	Nil	Nil
Singra		17.782	10	10
Bondapara		1.100	Nil	Nil

Loharghat		6.487	4	2
Riverine		Nil	Nil	Nil
Protection		Nil	Nil	Nil
Bamunigaon	2018-19	40.779	19.5	19.5
Kulsi		10.754	6	4
Singra		27.103	15	15
Bondapara		5.705	3	1
Loharghat		12.813	5	5
Riverine		30.721	16	10
Protection		5.932	Nil	6
Bamunigaon	2019-20	21.25	10	10
Kulsi		4.522	2	Nil
Singra		5.599	3	1
Bondapara		4.563	2	1
Loharghat		30.627	12	8
Riverine		10.557	5	4
Protection		16.46	4	6

7.2 Recorded removal of fuelwood: As removal of fuelwood is not allowed in the Division, so there is no recorded removal of fuelwood from the Division.

7.3 Recorded removal of bamboo/rattan: Removal of bamboo is not allowed from the forest, as such there is no record of removal of bamboo/rattan. However, Harvesting of bamboo is done by villagers for their domestic use.

7.4 Recorded removal of locally important NTFPs including MAPs: Removal of NTFPs except by the village communities is not done from the forest and hence no data is available on the removal of NTFPs from the forest.

7.5 Demand & supply of important timber and important NTFPs: The demand of timber in the Division and its adjoining urban areas is very high, but due to the fact that no harvestable stock exist in the forests, supply from the Division is not possible. The Sal and Teak timber are of high demand.

7.5.1 Markets: With the increase of population and development of small townships in several places of the District there is an increased demand of timbers, mainly Sal and Teak. At present there is only one saw Mill in the Division. Timbers sold from this Division are converted in Saw Mills located in Palashbari too.

7.6 Import and export of wood and non wood products: There are no records of import and export of wood & non wood products

7.7 Import and export of NTFPs: There is no data available on the import and export of NTFPs in the Division.

7.8 Removal of fodder: Removal of fodder is not allowed from the forest hence no data is available on the removal of fodder from the forest.

7.9 Valuation of products: Valuation of products may be done by synergizing past price and current prices of different forest products with with respect to price trend. Past and current prices of timbers in Kamrup West Division is shown in table table 7.9.a

Table: 7.9.a Past and current prices (Rs.) of timber in Kamrup West division, Assam

Items	Past prices (Rs) per Cum (round logs)	Current prices (Rs.) per Cum
Sal	3850.00	8543.00
Teak	4550.00	9358.00
Gamari	3850.00	6000.00
Haldu	2275.00	
Khakan	1225.00	5500.00
Other sps	1750.00	5687.00

Stone Crusher Units: There are 5 (five) Nos. stone crusher units under Kamrup West Division out of which 2 (two) stone crusher units are operative, 2 (two) Nos. have been approved for new installation & 1 (one) No. is in-operative.

Detail statement of Stone Crusher Units under Kamrup West Division:

Sl. No.	Name of Stone Crusher Machine/Unit	Name of Proprietor /Farm	Licence No.	Validity	Remarks
1	M.S. Concrete Private Ltd.	Sri Amit Kr. Jain	CM/1/KW of 2003	31-12-2020	
2	M/S Ritu Stone Crusher	Sri Ritu Das	CM/2/KW of 2003	31-12-2020	
3	M/S A.S. Enterprise	Sri Sabha Rava	CM/7/KW of 2018	Not renewed last year	
4	M/S Siv Sankar Stone Crusher Unit	Sri Bipul Mahanta	--	--	Installation under process
5	M/S Medhicon Stone Industry	Sri Kamal Medhi	--	--	--do--

CHAPTER 8

MAINTENANCE AND ENHANCEMENT OF SOCIAL, ECONOMIC, CULTURAL AND SPIRITUAL BENEFITS

8.1 Number of JFM Committees and area (s) protected by them: As per the National Forest Policy of India 1988, the participation of local community living in and around the forest areas is vital for the conservation and development of forests. In order to implement this policy, the Government of India issued a clear Guideline on 1st. June, 1990 to develop and manage degraded forestland with the help of the local community and voluntary organizations. Communities organize themselves into a Joint Forest Management Committee (JFMC) to protect and manage forests. The benefits to them is direct access and control on the use and sale of most NTFPs and a share in the income from timber as well as other intangible benefits from local ecosystem services – like water recharge, pollination, 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 would form the basis of forest management in the State. This working plan will make all the necessary provision for participation of forest fringe communities aiming to sustainable forest management and benefits of communities. Number of JFM committees and area protected by them are shown in following table (Table: 8.1.a)

Table 8.1.a. The details of JFMCs under Kamrup West Division

Range	Sl. no	Name of JFMC	Year of Estt.	Area Protected (hec)
Loharghat	1	Barjhar-Hudupara	2006-07	45
	2	Deopani-Bogdoba-Hanapara	2006-07	45
	3	Ghilabari	2007-08	20
	4	Ghilabari-Khirkijuli-Sipahipara	2007-08	30
	5	Hatigarh	2007-08	30
	6	Japangbari-Hatibandha-Tengakhal	2007-08	40
	7	Jaramukhia	2006-07	30
	8	Manikpur-Sildubi	2006-07	30
	9	Mataikhar	2006-07	35
	10	Muduki	2008-09	40
	11	Ouguri	2008-09	50
	12	Pokapam-Bogaline	2009-10	126
	13	Rajapara	2006-07	35
	14	Ranikhamar	2006-07	20
	15	Sarurani-Hajorani	2006-07	20
Kulsi	16	Aliha-Ghograchuk	2006-07	20
	17	Balijuri-Bakalipara	2010-11	20
	18	Bherbheri-Andheri	2006-07	30
	19	Bogbaha-Garubaldha	2007-08	30
	20	Dewan Beel	2009-10	180
	21	Dhanipara- Dimali	2006-07	40
	22	Dolong Molong	2006-07	40

	23	Jaruagaon-Karikura	2006-07	20
	24	Kahua-Bahatpur	2006-07	34
	25	Kordoiguri-Sanyasi	2006-07	20
	26	Kulsi	2006-07	30
	27	Nalbari-Bagapani	2006-07	20
	28	Nowgaon	2006-07	20
Bamunigaon	29	Akchalia-Puthimari- Phulguri-Barjhar	2006-07	20
	30	Alukhunda	2006-07	120
	31	Alukhunda-Kharkhari-Kadamguri	2006-07	40
	32	Amringkona	2007-08	20
	33	Borghuli-Doledonga-Borjhar	2006-07	20
	34	Baghmara	2006-07	20
	35	Chakrasilla	2006-07	20
	36	Dighal bil-Noonmati-Makhamdol	2006-07	20
	37	Dudhkuri Anchalik	2006-07	20
	38	Gohai gurung (Lamapra-Kekopara)	2006-07	20
	39	Hatigarh-Ouguri	2006-07	40
	40	Jalukbari	2006-07	20
	41	Kalabakra 1 No. Ratanpur	2006-07	132
	42	Kalabakra-Ratanpur-Rahpur	2006-07	45
	43	Kochpara	2006-07	20
	44	Koimari	2006-07	34
	45	Milaghat	2006-07	45
	46	Mathura Pahar	2006-07	20
	47	Noonmati	2007-08	55
	48	Paglapara-Moinapara-Khalbakhhal	2006-07	45
	49	Ratanpur	2006-07	45
	50	Santipur	2006-07	34
	51	Ukiam	2008-09	74
Singra	52	Pub Palahpara	2006-07	45
	53	Balapara	2006-07	20
	54	Bargaonpara	2006-07	20
	55	Bhalapara	2006-07	20
	56	Bhogdabari	2006-07	45
	57	Chakabaha	2006-07	20
	58	Chakrapani	2006-07	20
	59	Dilinga (Garopara)	2006-07	20
	61	Dilinga (Pragatipur)	2006-07	20
	62	Dilinga (Sonapur)	2006-07	20
	63	Gohalkona	2007-08	45
	64	Halidibari	2006-07	20
	65	Dakuapara-Hazangbasti	2006-07	20
	66	Jarapara	2006-07	45
	67	Jobepara	2008-09	100
	68	Khatkhati	2006-07	20
	69	Moman	2006-07	35
	70	Mugakhhal	2006-07	45
	71	Nalapara	2006-07	140
	72	Nagopara	2006-07	20

	73	Nowapara	2006-07	130
	74	Pakharapara	2006-07	45
	75	Palahpara	2006-07	35
	76	Rajapara	2006-07	35
	77	Sakhati	2006-07	35
	78	Samuka	2006-07	105
	79	Sijubari	2006-07	20
Bondapara	80	Baradova	2006-07	45
	81	Daring	2006-07	20
	82	Dekapara	2006-07	130
	83	Dhupguri	2006-07	130
	84	Dakshin Sakhadani	2006-07	20
	85	Gamurimura-Gangapara	2006-07	20
	86	Langapara-Sakuniapara	2006-07	34
	87	Malchapura	2009-10	20
	88	Mirzakhat	2008-09	180
	89	Rabhapara-Khristianpara	2007-08	40
	90	Salbari	2006-07	20
Riverine	91	Sabhakha	2006-07	20

8.2 Status of empowerment of JFMCs: Joint Forest Management (JFM) involves regeneration and conservation of forests through involvement of village communities in association with the state forest departments. It involves a contract specifying the distribution of authority, responsibility and sharing of benefits between villages and State Forest Departments with respect to land allocated for Joint Management. Under this programme, local communities are involved in the management and restoration of degraded forests. The major purpose of the JFM is to protect the forests from encroachments, grazing, theft and fire and also to improve the forests in accordance with an approved Joint Forest Management Plan. In return, the members of these communities are entitled to intermediary benefits like non-timber forest produces such as firewood, fodder, etc. The policies and objectives of Joint Forest Movement are detailed in the Indian comprehensive National Forest Policy of 1988 and the Joint Forest Management Guidelines of 1990 of the Government of India. Joint forest management is concept of developing relationships between fringe forest groups and forest department on the basis of mutual trust and jointly defined roles and responsibilities for forest protection and development.

With a view to empower the JFMCs various activities need to be taken including organizing meetings to aware the communities about the benefits of forests and biodiversity. Maximum number of women should be inducted in JFMCs. Benefit sharing is the prime instrument to attract and involve the village communities. The following table (Table 8.2.a) shows the details of activities undertaken towards the empowerment of JFMCs. Table 8.2.b shows summery of welfare activities undertaken within the Division.

Table 8.2.a Details of empowerment of JFMCs

JFMC Name	No. of meetings						Members Participated(in each meeting)					
	2007	2008	2009	2010	2011	2012	2007	2008	2009	2010	2011	2012
Alukhunda	8	4	6	4	-	-	15	30	25	10	-	-
Kalabakra	10	6	4	6	-	-	40	40	30	30	-	-
Samuka	4	4	3	2	-	-	15	15	25	15	-	-
Nalapara	4	4	3	2	-	-	30	30	25	30	-	-
Noapara	4	4	2	2	-	-	15	15	20	20	-	-
Mirzakhata	-	4	4	2	4	-	-	30	25	30	30	-
Dekapara	3	4	3	2	-	-	25	30	25	30	-	-
Pakapam	-	-	4	2	2	2	-	-	30	30	25	25
Dewanbeel	-	-	4	2	2	2	-	-	25	30	25	25
Dhupguri	2	3	2	3	-	-	30	25	30	25	-	-

Table. 8.2.b Summary of welfare activities:

SI No	Item	Quantity (Nos /Km)
1	Community Hall	23Nos
2	Drinking Water	300 Nos
3	Sewing Machine	240 Nos
4	Paramedical Training	50 Nos
5	Vocational training	1800 Nos
6	B.Poultry	1800 Nos
7	Piggery	2400 Nos
8	Culvert	153 Nos
9	School	13 Nos
10	Water tank	4 Nos
11	Bridge	13 Nos
12	Road	60.79 km
13	Sanitary Toilet	3 Nos.
14	Deep Tubewell	3 Nos.
15	Street Light	12 Nos.
16	Solar Home light	88 Nos.

8.3 Labour welfare: Labour welfare has become essential because of the very nature of the industrial system and the approaches to this system differ from country to country. Since our country is still going through the process of economic development, it is of great consequence and somewhat easier to counteract the baneful effects of the industrial revolution that has adversely affected the people all over the world.

Labour welfare measures cannot be a substitute for wages, workers have a right to adequate wages, but high rate of wages alone cannot create a healthy environment nor would bring in commitment on the part of the workers. A combination of social welfare, emotional welfare and economic welfare together would achieve good results.

Principles of Efficiency – plays an important role in welfare services and is based on the relationship between welfare and efficiency, though it is difficult to measure this relationship. Whether one accepts

the social responsibility of industry or not, the employer quite often accepts the responsibility for increasing such labour measures as would increase efficiency. For eg. Diet planning in canteens.

Labour welfare in India has a special significance as the constitution provides for the promotion of welfare of the labour for humane condition of work and securing to all workers leisure, social and cultural opportunities. Labour welfare is measure to promote the efficiency of labour. The various welfare measures provided by the employer will have immediate impact on the health, physical and mental efficiency, alertness, morale and overall efficiency of the workers and thereby contributing to the higher productivity. Moreover, the workmen require protection from certain calamities which imperil their efficiency. Social security measure provided by employer will act as a protection to the workers. Social security aims at providing collective measures to protect the members of a community against social risk as their individual resources are seldom adequate to offer protection against hardship. Both assistance and social insurance form integral parts of the system of social security. Labour welfare introduces the extra dimension to industrial relationship which even a satisfactory wage alone cannot provide. Labour welfare expresses the humane interest as an enlightened employer has in the well being and contentment of the people who work for him. Labour welfare means activities designed for the promotion of the economic, social and cultural well being of the employees. The term labour welfare includes any thing done for intellectual, physical, moral and economic betterment of worker by government or by other agencies over and above what laid down by law in various contingencies like illness, unemployment, disability and death which have direct impact on the well being of the worker and the dependent.

Welfare within the precincts of an establishment/organization should include canteens and supply of Drinking water, Latrines and urinals, Washing and bathing facilities, Creches, Rest shelters and Canteens, arrangement for the prevention of fatigue, Health services, etc. Welfare outside the establishment/organization should include provision of indoor and outdoor recreation, housing, education including adult education and visual instructions. Maternity benefits, Social insurance measures, rehabilitation Benevolent fund, cultural activities library and reading room, Holiday Homes etc. may also be included.

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

Various welfare activities were undertaken in fringe villages where the labours are engaged from. Such activities benefit both JFMCs and the labours. Following tables(Table 8.3.a, 8.3.b and 8.3.c) show the activities undertaken in various places as welfare (JFMCs and labours).

Table.8.3.a Details of labour welfare measures taken under forest village development scheme for the year 2007-08 (upto july 2012) under Kamrup West FDA.

Sl. No.	Name of Range	Name of JFMC	Item of the work								Total Finnancial Rs. In Lakh
			Paramedics		Community Hall		Driking Water		Piggery		
			Phy	Fin	Phy	Fin	Phy	Finl	Phy	Finl	
1	2	3	4	5	6	7	8	9	10	11	12
1	Kulsi	Kulsi	1	2	1	2	5	1.5	12	0.12	5.62
2		Dhanipara- Dimali	1	2	0	0	5	1.5	8	0.08	3.58
3		Aliha-Ghograchuk	1	2	0	0	5	1.5	8	0.08	3.58
4		Jaruagaon-Karikura	0	0	1	2	5	1.5	8	0.08	3.58
5		Nalbari-Bagapani	1	2	1	2	5	1.5	8	0.08	5.58
6		Balijuri-Bakalipara	1	2	0	0	5	1.5	8	0.08	3.58
7		Bherbheri-Andheri	1	2	1	2	5	1.5	8	0.08	5.58
8		Kahua- Bahatpur	1	2	0	0	5	1.5	8	0.08	3.58
9		Kordoiguri-Sanyasi	1	2	0	0	5	1.5	8	0.08	3.58
10		Bogbaha-Garubaldha	0	0	0	0	5	1.5	8	0.08	1.58
		Total	8	16	4	8	50	15	84	0.84	39.84
11	Loharghat	Ouguri	1	2	0	0	2	0.6	9	0.09	2.69
12		Jaramukhia	1	2	0	0	4	1.2	9	0.09	3.29
13		Ranikhamar	0	0	0	0	4	1.2	9	0.09	1.29
14		Rajapara	1	2	0	0	5	1.5	9	0.09	3.59
15		Manikpur-Sildubi	0	0	0	0	5	1.5	9	0.09	1.59
16		Sarurani-Hajorani	1	2	1	2	5	1.5	9	0.09	5.59
17		Barjhar-Hudupara	1	2	0	0	5	1.5	9	0.09	3.59
18		Ghilabari-Khirkijuli- Sipahipara	0	0	0	0	0	0.0	10	0.1	0.1
19		Japangbari-Hatibandha- Tengakhal	0	0	0	0	0	0.0	12	0.12	0.12
20		Deopani-Bogdoba- Hanapara	1	2	1	2	4	1.2	12	0.12	5.32
21		Hatigarh	1	2	1	2	0	0.0	8	0.08	4.08
		Total	7	14	3	6	34	10.2	105	1.05	31.25
22	Bamunigaon	Kalabakra-Ratanpur-Rahpur	1	2	1	2	7	2.1	9	0.09	6.19
23		Akchalia-Puthimari-Phulguri-Barjhar	1	2	1	2	4	1.2	8	0.08	5.28
24		Hatigarh-Ouguri	1	2	0	0	0	0.0	8	0.08	2.08
25		Paglapara-Moinapara- Khalbakhal	1	2	1	2	4	1.2	8	0.08	5.28
26		Alukhunda-Kharkhari- Kadamguri	0	0	0	0	0	0.0	8	0.08	0.08
27		Dighalbil-Noonmati- Makhamdol	1	2	0	0	5	1.5	8	0.08	3.58
28		Borghuli-Doledonga-Borjhar	0	0	0	0	6	1.8	8	0.08	1.88
Total			5	10	3	6	26	7.8	57	0.57	24.37

Table.8.3.b Allotment of fund for development activities of Kamrup West FDA for the year 2009-10

Range	Name of Forest Village JFMC	Name of the Forest Village	improvement of Road		Culvert		School		Water Tank		Bridge	
			Phy K.M.)	Fin lakh)	Phy Nos.)	Fin in lakh)	Phy Nos.)	Fin (in lakh)	Phy (Nos.)	Fin (in lakh)	Phy (Nos.)	Fin (in lakh)
Kulsi	Kulsi	Nagoan	0.00	0.00	4	5.00	1	9.2	0	0	0	0
		Dollongmollong	2.60	9.78	4	5.00	0	0	0	0	0	0
		Bechimari	2.93	11.02	4	5.00	0	0	0	0	0	0
	Dhanipara- Dimali	Dhanipara	2.00	7.53	6	7.50	0	0	0	0	0	0
		Dimali	3.98	14.96	0	0.00	0	0	0	0	0	0
	Aliha-Ghograchuk	Aliha	1.50	5.64	0	0.00	1	5.5	0	0	0	0
		Ghograchuk	1.90	7.14	5	6.25	1	5.5	0	0	0	0
	Jaruagaon-Karikura	Jaruagaon	4.00	15.04	0	0.00	0	0	0	0	0	0
		Karikura	2.32	8.70	5	6.25	0	0	0	0	0	0
	Nalbari-Bagapani	Nalbari	3.47	13.05	2	2.50	0	0	0	0	0	0
		Bogapani	2.50	13.16	1	1.25	0	0	0	0	0	0
	Balijuri-Bakalipara	Balijuri	2.30	8.64	5	6.25	0	0	0	0	0	0
		Bakalipara	2.68	10.08	4	5.00	0	0	0	0	0	0
	Bherbheri-Andheri	Bherbheri	4.50	16.92	0	0.00	0	0	0	0	0	0
		Andheri	2.14	8.05	4	5.00	0	0	0	0	0	0
	Kahua- Bahatpur	KahuaBahatpur	3.80	14.29	0	0.00	0	0	0	0	0	0
	Kordoiguri-Sanyasi	Kordoiguri	0.27	1.02	0	0.00	0	0	0	0	1	13.95
		Sanyasi	2.66	10.00	4	5.00	0	0	0	0	0	0
	Bogbaha-Gorubandha	Bogbaha	2.68	10.08	4	5.00	0	0	0	0	0	0
		Gorubandha	2.30	8.64	5	6.25	0	0	0	0	0	0
		Sub total	50.53	193.74	57	71.25	3	20.20	0.00	0.00	1	13.95
Loharghat	Ouguri	Ouguri	3.30	12.40	2	2.50	1	5.0	0	0	0	0
	Jaramukhia	Jaramukhia	0.00	0.00	0	0.00	0	0	0	0	0	0
	Ranikhamar	Ranikhamar	1.63	6.12	0	0.00	0	0	0	0	1	10.50
	Rajapara	Rajapara-1	2.30	8.64	2	2.50	1	7.0	0	0	1	4.55
		Rajapara-2	0.00	0.00	0	0.00	1	6.0	0	0	0	0
	Manikpur-Sildubi	Manikpur	1.50	5.64	3	3.75	1	6.5	1	1.5	0	0
		Sildubi	3.00	11.28	3	3.75	0	0	0	0	0	0
	Sarurani-Hajorani	Sarurani	1.50	5.64	3	3.75	1	6.5	0	0	0	0
		Hajorani	2.50	9.40	3	3.75	0	0	0	0	0	0
	Barjhar-Hudupara	Barjhar	3.00	11.28	3	3.75	0	0	0	0	0	0
		Hudupara	2.40	9.02	3	3.75	0	0	0	0	0	0
	Ghilabari-Khirkijuli- Sipahipara	Ghilabari	1.95	7.33	6	7.50	0	0	0	0	0	0
		Khirkijuli	3.95	14.89	0	0.00	0	0	0	0	0	0

		Sipahipara	3.50	13.16	3	3.75	0	0	0	0	0	0
	Japangbari- Hatibandha- Tengakhali	Japangbari	1.95	7.33	6	7.50	0	0	0	0	0	0
		Hatibandha	2.50	9.40	3	3.75	0	0	0	0	0	0
		Tengakhali	2.40	9.02	5	6.25	0	0	0	0	0	0
	Deopani-Bogdoba- Hanapara	Deopani	0.00	0.00	0	0.00	0	0	0	0	0	0
		Bogdoba	3.30	12.40	2	2.50	0	0	0	0	0	0
		Hanapara	0.00	0.00	0	0.00	0	0	0	0	0	0
	Hatigarh	Hatigarh	2.50	9.40	0	0.00	0	0	0	0	0	0
		Sub total	43.18	162.35	47	58.75	5	31.00	1	1.50	2	15.05
Bamunigaon	Kalabakra-Ratanpur- Rahpur	Kalabakra	0.66	2.50	3	3.75	1	5	0	0	1	8.75
		Ratanpur	1.66	6.25	0	0.00	0	0	0	0	1	8.75
		Rahpur	3.38	12.37	0	0.00	0	0	1	2.63	0	0
	Akchalia-Puthimari- Phulguri- Barjhar	Akchali	3.99	15.00	0	0.00	0	0	0	0	0	0
		Puthimari	1.47	5.52	5	6.25	0	0	1	2.99	0	0
		Phulguri	0.00	0.00	1	1.25	1	7	0	0	1	7
		Barjhar	1.79	6.73	1	1.25	0	0	0	0	1	7
	Hatigarh-Ouguri	Hatigarh	3.33	12.52	2	2.50	0	0	0	0	0	0
		Ouguri	2.26	8.49	1	1.25	0	0	0	0	1	5.25
	Paglapara-Moinapara- Khalbakhali	Paglapara	2.66	10.00	4	5.00	0	0	0	0	0	0
		Moinapara	1.66	6.24	3	3.75	0	0	0	0	0	0
		Khalbakhali	2.65	9.95	4	5.00	0	0	0	0	0	0
	Alukhunda-Kharkhari-Kadamguri	Alukhunda	0.80	3.00	4	5.00	1	7	0	0	0	0
		Kharkhari	0.80	3.00	4	5.00	1	7	0	0	0	0
		Kadamguri	0.86	3.25	1	1.25	0	0	0	0	1	10.50
	Dighalbil-Noonmati-Makhamdol	Dighalbil	1.68	6.31	3	3.75	0	0	0	0	1	4.90
		Noonmati	3.35	12.59	2	2.50	0	0	0	0	0	0
		Makhamdol	1.68	6.31	3	3.75	0	0	0	0	1	4.90
	Borghuli-Doledonga- Borjhar	Borghuli	1.75	6.58	7	8.75	0	0	0	0	0	0
		Doledonga	1.75	6.58	0	0.00	0	0	0	0	2	8.50
		Borjhar (Ukiam)	1.79	6.73	1	1.25	1	5	1	2	0	0
		Sub total	39.97	149.92	49	61.25	5	31.00	3	7.62	10	65.55
	Grand Total		133.68	06.01	153	91.25	13	82.20	4	9.12	13	94.55

Table.8.3.c Progress report under entry point activities upto 2019-20 under part-I of phase-I APFBC :

Name of the Range	Name of the JFMC	Name of the EPA works for which fund sanctioned	Amount approved for release (in lakh) & Total JFMCs	Geo-Reference		Physical Progress	Financial Progress
				Lat	Long		
1	2	3	4	5	6	7	8
Kulsi	Bargorong	Community Hall	844000.00	N-25°-54'-15.6"	E 91°-24-26.8	100	100
		Deep Tube Well	270000.00	N-25°-54'-15.6"	E 91°-24-26.8	100	80%
		Sanitary Toilet	204000.00	N-25°-54'-15.6"	E 91°-24-26.8	100	100
		Sub Total	1318000.00				
Bondapara	Baradova	Community Hall,	844000.00	N-25°-53'-16.6"	E 91°-07'-08.2"	100	100
		Deep Tube Well	270000.00	N-25°-53'-19.2"	E 91°-07'-08.1"	100	80%
		Sanitary Toilet	204000.00	N-25°-53'-18.9"	E 91°-07'-42.7"	100	100
		Sub Total	1318000.00				
	Rabhapara Christianpara	Community Hall,	844000.000	N-25°-51'-42.2"	E 91°-05'-44.5"	100	100
		Deep Tube Well	270000.000	N-25°-51'-42.4"	E 91°-05'-43.8"	100	80%
		Sanitary Toilet	204000.000	N-25°-51'-42.4"	E 91°-05'-43.8"	100	100
		Sub Total	1318000.00				
		Grand Total	3954000.000				

8.4 Use of indigenous knowledge: During older days, when 'Hatimahal' was on the run, there were some famous *Fandis* (capturing elephants) from whom Sri Pratima Pandey learned the know how of capturing wild elephants. It has also been learned that the village Samuka Nalapara (beside Hahim) was the second Mayong in Assam practicing Occult and Mysticism and also in witchcraft. Resin extraction from Sal tree for use as Dhuna was done by the Garo people of this area. Plant parts like seeds, roots having medicinal properties are sold in the weekly markets which are an important component in Ayurvedic medicines and are brought by the people living in the hills.

8.5 Extent of cultural sacred groves: Forest dwelling tribes such as Bodo and Rabha inhabiting the plains and foothills of Western Assam have the tradition of maintaining sacred groves which are locally called "Than". Details of cultural and sacred groves along with ownerships, status of management and interventions to conserve are provided in the table 8.5.a

Table.8.5.a Status of Conserved areas of religious importance and sacred areas with customary conservation practices

Sl. No.	Range	Latitude	Longitude	Name of Sacred area	Salient characteristics about the sacred groove
1	Singra	25°57'-01.8" 25°57'-02.7"	91°14'-16.8" 91°14'-17.4"	Shiva Shankar temple	Temple is located in a Sal forest and locals of the area worship Lord Shiva Shankar. Two huge Sal trees are fully conserved by the locals and the other Sal trees and poles are also conserved from cutting, thinning and even lopping.
2	Singra	25°55'-02.7"	91°13'-55.8"	Shiva Shankar temple	Temple is located at the base of a Singari tree (Vernacular name: Garuhiri) of Jungakhuli forest village.
3	Bondapara	25°57'-22.6"	91°08'-02.9"	Boripara	
4	Bondapara	25°56'-09.8"	91°04'-16.2"	Nam Barjuli	
5	Kulsi			Tiamari Than	
6	Kulsi			Kachaikhaiti Than	
7	Bamunigaon			Manasa Mandir	
8	Bamunigaon			Gabordhan Shiv Mandir	
9	Loharghat	25°52'-21.5"	91°26'-51.2"	Gutipara Buragosain Than	People used to worship God Gutipara Buragosain Than on the basal Gigantic Ficus trees at Rajapara
10	Loharghat	25°52'-21.9"	91°26'-16.8"	Kuyanpani Gohin Mandir	Villagers from Rajapara established a Kuyhnpani Gosain mandir at the basal area of Gigentic Ficus trees.
11	Loharghat	25°54'-46.5"	91°28'-02.3"	Sree Ram Chandra Ashram	People used to worship God Sree Sree Ram Chandra established in the year 1954 at the Hill side area.

8.6 Eco-tourism areas and activities: Ecotourism is a form of tourism involving visits to fragile, pristine, and relatively undisturbed natural areas, intended as a low-impact and often small scale alternative to standard commercial (*mass*) tourism. Eco tourism is directed towards natural environments intended to support conservation efforts and also observe wildlife protection ethics which helps in bringing economic benefits to the local people without involving any middle man. This form of tourism is based further on traditional, cultural and ethnic value of the locality. Therefore, ecotourism is a form of 'Sustainable Tourism' as these values along with natural values are depicted and highlighted to the tourists. Ecotourism provides effective economic incentives for conserving and enhancing biocultural diversity and helps protect the natural and cultural heritage of our beautiful planet.

Chandubi Lake at Loharghat Range

The Chandubi Lake (Beel) is situated within the Borduar Reserved Forest under the jurisdiction of Kamrup West Division, Bamunigaon, at a distance of about 65 km south-west from the Guwahati city. Area of the lake is 350 Hect.

The lake was the result of 1897 great earthquake thus this has immense importance as tectonic lake. The Bombay Natural History Society and International Bird Conservation Network declared this fresh water Beel as an **Important Birds Area** site. The panoramic view and the wintering place of migratory birds attract visitors which gives immense opportunity for development of eco- tourism around the lake.

The Chandubi Lake lays between 25°52' N to 91°24'12" E and 25°53'28" N to 91°26'17" E. The Mayang RF situated on the south of the Beel is undulating hilly tract contiguous with Meghalaya boundary. The highlands lying immediately to the north and south of the Beel are made up of gneisses and schist's of the Achaean age, whereas the Beel and its lowland fringe is underlined by recent alluvium consisting of clay, silt, sand and pebbles. This area is situated on an outlying portion of the Shillong plateau i.e. Khasi Hill range.

Before 1950 the size of the wetland used to be around 448 ha, but due siltation and other biotic interference the wetland has been reduced in size. The depth of the lake varies from 8 m to 3 m only.



Magnificent view of Chandubi Lake

Dewan Beel

Dewan Beel situated in the Dewan Beel JFMC can be promoted as a real destination for Eco-Tourism purposes. The Dewan Beel has its own scenic beauty with its adjoining forest from very ancient time. It is in close proximity of famous Chandubi Lake which is found to have great potential for eco-tourism. Development and promotion Dewan Beel will definitely attract nature lovers and tourists. The Lake is about 550 meter length and 150 meter in width covering an area of 8 hectares (approx). It has been proposed for beautification of the said site. Tall plantation will curve optimum attraction from the outside and will make the place a beautiful one. And it is hoped that, it will be appropriate site for Eco-Tourism, if the proposal is materialized.

Rationale behind the Eco-Tourism Spot:

Dewan Beel is having its unique natural attraction. The area is very much peaceful and it is devoid of any type of hue and cry of human being. Besides, there are several other reasons to select the spot as a destination of Eco-Tourism. These are -

1. It is a unique perennial natural water body.
2. It is submerged during summer.
3. During summer, the Kulsi River is navigable from Brahmaputra via the Project area to Chandubi
4. Lake and Ukiam.
5. Various types of migratory birds used to come to the water body of the Dewan Beel during the winter season.
6. It is very beautiful picnic place.
7. The scenic place, Ukiam is very near from the place which is a centre of union of three rivers i.e. Srinadi, Ghaga and Dron.

Lumpi: Potential eco-tourism site with perennial waterfalls. Located at Inter-State border of Assam and Meghalaya having tremendous natural beauty, it is full of natural vegetation and there is existence of a number of perennial springs. It is a plateau located at 50 kms from the Division headquarters. The place is rich in biodiversity and an ideal bird watching site.

Jongakhuli, Kulsi, Gamarimura are some other places of eco-tourism potential.

8.7 Social customs: Prevalent social customs of the tribals and non tribals are described here.

There are 3 recognised tribal community in Kamrup West Division—Rabha, Garo and Boro. The Rabha community belonged to the Mongolian race and also to the Kirak Janagusti. The Rabhas and the Garos came from Bhutan through Jogighopa and settled in Bhagmela area near Boko. Out of 62 forest villages, only 2 villages belong to the Garo community while the rest is inhabitat by Pati Rabha. The Boro community is scattered all over the area.

1. The Garos previously practised patriarchal system but now transformed to matriarchal system after tying nuotial knots with the Khasis at the interstte borders of Assam and Meghalaya.
2. Around 1862, the Garos adopted Christianity under Baptist mission. So among the Garos impact of western culture also in education system has taken place.
3. In the weekly markets of Boko, Hahim, Bamunigaon etc, the Garo ladies play the leading role.

- Some of the Rabhas and Boros have transformed to vaishnavite religious belief and other than the some Maroi puja (worship of Manasa Devi), Lord Shiva are the main religious icon for them.
4. Other than the above communities inside the Kamrup West Division, there are several communities like Kalita, Koch, Rajbongshi, Komar, Kumar who are in religious sense Hindu. They are mainly cultivators, service holders, businessman etc. Among these communities some are followers of the doctrine of Damodardev and Sankardev.
 5. In the char areas as well as banks of the River Brahmaputra mainly people practising Islam religion is the dominant community.
 7. There are some Nepalese living inside mainly in Bogaikhas RF(Lumpi area) migrated from Tura of Garo hills and now-a –days they are scattered mainly in the area of Boko revenue circle.
 8. There are also Khasi community inside this Division in the Lumpi area of Bogaikhas RF and they practice Christianity.

Agrarian customs

The major component of the population in the division is rural and their main occupation is agriculture. 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. Jute is grown in Chamaria and Chhaygaon areas. 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 varieties 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 herds of cattle (of rather poor breed) are maintained and these are entirely dependent on the forest for grazing.

Fortunately, the number of goats and buffalos are few and damage by browsing is not alarming. There is no professional graziers in the reserved forests areas, but during the winter months a few herd come down from the hills (Meghalaya) and are permitted to graze in the forest of Kulsi Range.

8.8 Status of compliance of forest rights act: Implementation of Forest Right Act was initiated in this Division. Out of 49 FRCs number of total claims received was 7034 and number of accepted claims was 6269. An overview of the status of FRA in the Division is given in table 8.8.b.

Table 8.8.a Claim received, accepted and rejected

Name of Range	Claims received						Claims accepted						Claims rejected					
	No. of Claims			Area(ha) involved			No. of Claims			Area(ha) involved			No. of Claims			Area involved		
	Individual	Community	Total	Individual	Community	Total	Individual	Community	Total	Individual	Community	Total	Individual	Community	Total	Individual	Community	Total
Loharghat	315		1315	824.88	0	824.88	1153	0	1153	627.56	0	627.56	162		162	197.32		197.32
Kulsi	351		3351	3016.26	0	3016.26	3097	0	3097	2869.47	0	2869.47	254		254	146.79		146.79
Bamunigaon	547	21	1668	1908.48	99.33	2007.81	1514	121	1635	1887.88	99.33	1987.21	33		33	20.6		20.6
Singra	30	0	700	664.47	5.07	669.54	364	20	384	100.00	5.07	105.07	316		316	564.47		564.47
Total	393	41	7034	6414.09	104.4	6518.49	6128	141	6269	5484.91	104.4	5589.31	765		765	929.18		929.18

Table 8.8.b. Status Report on implementation of Forest Right act, 2006 (reported as on February'2020)

A.	Total Nos of FRCs	49 Nos
B.	Total Nos of Claims received	7034 Nos.
C.	Total Nos of Claim accepted	6269 Nos.
D.	Total Nos of Claim rejected	765 Nos.
E.	Total number of titles distributed	357 Nos
F.	Total Area of Forest land allotted	119 ha

8.9 Other rights and concession: There are certain rights and concessions granted at the time of constitution of the Reserved forests and these are all revocable at the will of the Govt. The nature of these right and concessions as recorded in the Divisional Reserved Forest Register are reproduced briefly in the statement as follows (Table: 8.9.a).

Table: 8.9. Rights and Concession under Kamrup West Division.

Sl.N o.	Reserved Forest	Abstract of recorded rights & Concessions
1	Uttar Manpathar	Subject to annual clearance of allocated lengths of boundary of the reserve by the villagers of certain specified villages, erection if of pillars by them and rendering help to the department in fire protection works, the villagers allowed the facility of (a) grazing cattle, (b) remove thatch, fire-wood and Akathi for home consumption. (c) cut all trees within specific distances from the edge of cultivation (d) rearing of muga-Silkworm (e) Cultivation of betal leaves. Right of way over specified routes.
2	Dakhin Nampathar	
3	Jharikhuri	Same concessions as for (a), (b), (c) in Nampathar (Uttar & Dakhin R.F's subject to the same conditions. Right of way over specified routes.
4	Singra	Same concessions as for (a), (b), (c) in Nampathar (Uttar & Dakhin R.F's subject to the same conditions.
5	Luki	Same nature of concessions as those for Jharikhuri R.F.
6	Gizang	Same nature of c oncessions as those for Jharikhuri R.F.
7	Moman	Same as for Nampathar (Uttar & Dakhin) R.F's Villagers of certain villages allowed to graze cattle, remove fire-wood, lopping and to ask forest department to fell trees adjoining their cultivation.
8	Khurkhuri	Right of way along specifiers route.

9	Dudhkuri	Right of way along specifies route.
10	Gohaingurung	Right of way along specifies route.
11	Melaghat	Right of way along specifies route.
12	Dimali	Right of way along specifies route.
13	Dhuniagaon	Right of way along specifies route.

- The forest villagers residing within the Reserved Forests are given land at a concessional rate of land revenue and also forest produce free of charge for home consumption. In lieu of these concessions, the adult villagers are required to render 5 (five) days free labour per annum to the department for regeneration and other works. They are also required to render 20 (twenty) days labour on payment of current wages, when called upon to do so.
- Some outsiders who are not resident of forest villages have also been permitted to cultivate land in the Reserved Forests.
- There is also a prevailing practice of permitting removal of forest produce free of charge for home-consumption for residents of villages adjacent to (*and outside*) the Reserved forests, in lieu of their rendering 5 (five) days free labour per annum.
- In the recent years there has been a trend of granting trees/timbers on permit to various institutions at a concessional rate of royalty dues under order from the State Govt.

8.10 Dependency of local people on NTFPs: No record of NTFP storage or transit is available in the division but the following is the list of NTFPs available in the Kamrup West Division which are collected by the villagers for their domestic use.

Table 8.10. List of common NTFPs available in the RFs

	Ranges				
	Bamunigaon	Loharghat	Singra	Bondapara	Kulshi
Name of NTFPs	Bamboo	Kako Bans	Broom stick	Fern(Dhekia)	Sal resin as Dhuna
	Broomstick	Doloi bans	Ferns(Dhekia)	Bahaka Tita	Outenga
	Leteku	Outenga	Bamboo rhizome	Bamboo Rhizome	Thekera
	Dhekia	Thekera	Hilikha	Broomstick	Leteku
	Nalkasu	Broomstick	Amla	Keteru	Japipas
	Banslu	Leteku	Edible Mushrooms	Hilikha	Broomstick
		Poniol	Jati Baah	Bhomora	Bamboo rhizome
		Jamun	Kako Baah	Amara	Ferns(Dhekia)
		Fern(Dhekia)	Cotton	Amlakhi	Poniol
		Gandh Kachu		Gandh Kachu	
		Rattan		Dupor tenga	
		Tokou Paat			
		Honey			

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

CHAPTER 9

ADEQUACY OF POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

9.1 Existing policy and legal framework and their compliance: 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) Act 1972.
- 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) Act 1972 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 plans and their compliance: The previous Working Plan for the period from 1999-2000 to 2008-2009 was compiled by Sri Prabin Kotoky. The general objectives of management was-

- (i) To maintain the existing alluvial plains Sal forests as well as the Hill Sal forests of the lower slopes in accessible locations under intensive system of Management, with the aim of achieving normal distribution of age gradations by specific area, normal increment and normal growing stock.

- (ii) To treat the costs of the hills forests located in the creases, ridges and spurs under a system involving least disturbance to the forest cover, to achieve the best possible results from the point of view of water shed Management and soil conservation.
- (iii) To replace the existing the Moist mixed deciduous forests of comparatively poor value by more valuable species with regular distribution of age classes recognizable by area.
- (iv) To reforest the newly created Reserved Forests areas infested by shifting cultivation heavily under intensive system of Management to cover up the barren lands with indigenous fast growing species.
- (v) To preserve the the existing limited out formations in the present state to serve the purposes of wildlife habitat and flood reservoir etc.
- (vi) To demarcate the Juli land under cultivation and to introduce agro-forestry practice and thus saving the forests from unwanted destruction.
- (vii) To maintain a steady yield to timbers and firewood without diminishing the existing growing stock.

Following are the Working Circles constituted for 1999-2000 to 2008-2009 Working Plan.

i. Working Plan for the Sal shelterwood working circle

All the compartments containing Kamrup Alluvial Plan Sal was placed in this working circle. In addition some of the compartments containing hill Sal, which were readily accessible and mostly at lower elevation with gentle slope were included in this working circle. Teak plantations upto the extent of 10.0 hec raised in this compartment in the past were also included in this WC as further division of compartment in sub-compartment was not found to be feasible.

The special objective of management:

- To obtain the object of normal forest by way of bringing the existing irregular GS under intensive method of treatment augmenting the natural regeneration with Aided natural regeneration to accelerate the rate of regeneration of Sal.
- To conserve the existing GS in areas other than those earmarked for regeneration operations.
- To replenish the depleting GS to its fullest capacity in forms of volume/hac by way of regulating the yield to its barest minimum thereby meeting only the un-avoidable urgent demand of Sal timber.

Compliance: The prescription could not be complied in totality. Because the Hon'ble Supreme Court of India, in the famous case under WP(C) no. 202/95 (T. N. Godavarman Thirumulpad -v- Union Govt. of India) banned tree felling in the entire North East region. Further, there was no approved Working Plan for exercising silviculture practices. The 1999-2000 to 2008-2009 Plan prescribed for Sal shelterwood system with as many as five felling series. No felling either by way of coup or by departmental operation was executed in view of the Supreme Court order. However, plantation drive was undertaken with various schemes in various places. The objective of the Working Plan prescription was thus jeopardized.

ii. Working plan for Teak Alley Plantation working Circle

This working circle was constituted with compartment of various RFs bearing Teak plantations raised in past and the areas deforested for Jhum cultivation in the hill slopes and some areas bearing moist

mixed deciduous forests. The present block of the then newly declared Bogaikhas RF which was brought for the first time under the preview of working plan was also included in this working circle as the block was highly effected by Jhum cultivation. In this type Jhum cultivated areas, Teak showed good result as seen in the Teak plantations raised in this area by the then Guwahati Social Forestry Division. The teak plantations raised by Kamrup West Division during 1985-86 showed good result.

The special objective of management:

- To augment the value of existing forest crop by introducing more valuable species like teak without disturbing the heterogeneity of the forest by adopting alley planting in between narrow strips of natural forest.
- To keep continuity of the legendary teak plantation of Kulshi of 1872.
- To bring the teak plantation of adequate extent to one pattern of management under same set of treatment and even out the irregularity in growing stock.
- To maintain the biodiversity by retaining strips of natural forest cover of hill slope between the belt of plantation of exotic to act as buffer zone against pests and disease as well as for soil and water conservation.

Compliance: The prescription could not be complied in toto. Because the Hon'ble Supreme Court of India, in the famous case under WP(C) no. 202/95 (T. N. Godavarman Thirumulpad -v- Union Govt. of India) banned tree felling in the entire North East region. Further, there was no approved Working Plan for exercising silviculture practices. The 1999-2000 to 2008-2009 Plan prescribed for Teak Alley Plantation working Circle with as many as five felling series, namely Bondapara felling series, Singra felling series, Bamunigaon felling series, Kulsi felling series and Loharghat felling series. But, no felling either by way of coup or by departmental operation was carried out in view of the Supreme Court order. However, plantation drive was undertaken with various schemes in various places. The objective of the Working Plan prescription was thus jeopardized.

iii. Working plan for the Hill protection working circle

This working circle was constituted by including all the hills of Ukiam and Lumpi block of newly created Bogaikhas RF where for the first time, the working plan was going to be introduced. The area forms the main catchment or watershed of all the major river systems of the division. Thus Bogaikhas RF is the source and major water shed of all rivers. So, soil and water conservation in this hill tract is most important to regulate the flow of water in the rivers.

Special objective of management

- To protect and restock the forest covers of the water shed or major drainage system for the conservation of soil and water of the region.
- To provide rest to the forests which was under extensive biotic pressure in the past.
- To study the affect of protection measures on regeneration and succession of various species of the region.
- To develop the degraded forests of hill slopes by artificial regeneration where necessary.

Compliance: The prescription of the 1999-2000 to 2008-2009 Plan could not be complied with because the Hon'ble Supreme Court of India, in the famous case under WP(C) no. 202/95 (T. N.

Godavarman Thirumulpad -v- Union Govt. of India) banned tree felling in the entire North East region. Moreover, there was no approved Working Plan for exercising silviculture practices. The 1999-2000 to 2008-2009 Plan prescribed for Hill protection working circle with two felling series, namely Ukiam felling series, and Lumpi felling series. But, no felling either by way of coup or by departmental operation was carried out in view of the Supreme Court order. However, plantation drive was undertaken with various schemes in various places. The objective of the Working Plan prescription was not absolutely fulfilled.

iv. Peoples participatory Management Working circle

This working circle constituted the area of Dimali block of newly created Bogaikhas RF. A considerable size of Garo population was practicing Jhum cultivation in this area since time of proposing the area for RF. They even raised permanent orchards of Orange and pineapple besides doing shifting cultivation. Sakkomari, Nokodonga, Larubama, Parugaon etc are some of the villages adjoining to this area.

Special objective of management

The National Forest Policy 1988 envisaged people's involvement in the development and protection of forests. The requirements of fuelwood, fodder and small timber as house building material of the tribal and other villager living in and near the forests are to be treated as first charge on forest produce. The forest communities should be motivated to identify themselves with the development and protection of forests from which they derive benefits.

- To convert the Jhumland into productive asset.
- To protect the forests by people's participatory management system and develop forest on non-forest land by promotion of agroforestry.

Compliance: The prescription of the 1999-2000 to 2008-2009 Plan was partially fulfilled in as much as Jhum practice could be minimized by involving communities for forest protection. Under various schemes plantation drives were undertaken in JFMCs. The objective of the Working Plan prescription was partially fulfilled.

V. Working Plans for the Bamboo overlapping working circle: This working circle was constituted with all bamboo bearing areas of the division and overlaps area of other working circles of this plan except for the areas covered by young block, plantation area regeneration of regeneration block formed in different working circle of this plan.

Special objective of management

- Mainly to utilize this scarce NTFP of bamboo resource to meet the demands of cellulose raw material of the paper mill.
- To meet the demand of local people for house construction, agricultural implements, fencing, cottage industry etc.
- To regularize the cutting of bamboo so that the productive capacity of Bamboo clumps are not deteriorated.
- To maintain ecological balance.

Compliance: The prescription of the 1999-2000 to 2008-2009 Plan was not fulfilled to its whole extent. There were as many as five cutting series namely, (1) Pantan cutting series, (2) Ukiam cutting series, (3) Dimali cutting series, (4) Jungakhuli cutting series and (5) Lumpi cutting series. But no commercial harvesting was undertaken. The objective of the Working Plan prescription was not satisfactorily fulfilled.

IV. Misc Regulations

Miscellaneous regulations were also prescribed and suggested with respect to the removal of dead damaged and wind fallen trees, Disposal of Non timber forest produce and settlement of Mahals, Roads and Buildings, Boundary surveys and maintenance, Regulation of Rights and Concessions, Surveys and maps, Research and Experimentations and Wildlife management. Prescribed Miscellaneous Regulations were fulfilled on priority basis and subject to receipt of fund. Sand and stone Mahals were operated which became the prime revenue source of the forest division

9.3 Number of forest offence: Detail list of forest offences in Kamrup West Division is provided in **Appendix**. Most of the offences are drawn under violation of Assam Forest Regulation 1891 (Amendment) Act 1995 and Assam Minor Mineral Concession Rule'2013 (Amended till date). There is no record of wildlife offences under this Division.

9.4 Status of research and development: There is research plot of genetic Cell Division at Rani. But no any research output is there for application in the field. There is no information available with respect to the research activities undertaken in the Kamrup West Division. Lots of scopes are there to pursue research work in Kamrup West Division which can give feedback to silviculturally manage the forest.

9.5 Human resources, capacity building efforts: 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 were deputed to various forestry training Institutes including SFTIs of the State for imparting training.

The capacity building of the existing staff is carried out through a number of trainings, field visits and workshops. The foresters and Forest Guards are imparted training in Assam Forest School, Jalukbari and Assam Forest Guards School, Makum. The effectiveness of the training programmes was also assessed. The capacity building programmes help to build active taskforce.

9.6 Forest resources accounting: Tangible benefits from forests are timber, NTFPs, fuelwood, fodder, minor minerals including sand, stone, gravel etc. while intangible benefits of forests are carbon sequestration, soil erosion control, water recycling, oxygen production, control of air pollution, wildlife habitat, etc. Details of forest resources accounting are furnished in Table 9.6.

Table 9.6: Forest resources accounting in Kamrup West division, Assam

Year	Timber (Vol in m3)		Sand (m3)		Stone (Vol in m3)		Sand Gravel (m3)		Intangible Benefits
	Seized	Wind fallen	(Govt permit)	Mahal	(Govt permit)	Mahal	(Govt permit)	Mahal	
2012-13	161.250	Nil	Nil	Nil	33343.90	Nil	Nil	Nil	NTFPs
2013-14	206.50	77.227	Nil	5875	Nil	Nil	Nil	Nil	Soil Conservation
2014-15	200.360	Nil	Nil	60500	Nil	Nil	Nil	250	Water conservation
2015-16	217.930	84.374	Nil	55875	5500.00	250.00	Nil	Nil	Grazing
2016-17	197.661	13.49	52478	26000	71800	125.00	16322	Nil	Subsistence livelihood
2017-18	270.186	21.616	70010	36750	59321	500.00	110212	Nil	Subsistence livelihood
2018-19	174.65	50.627	36514	42000	15000	500.00	1000	Nil	Subsistence livelihood
2019-20	212.33	19.726	21117.61	15250	37075	500.00	2540	Nil	Subsistence livelihood

9.7 Budgetary allocation to the forestry sector: The total budgetary allocation for planned and non-planned budgets for the years 2012-13 to 2018-19 are presented in Table 9.7.a

Table 9.7. Allocated budget in Kamrup West division, Assam

Year	Allotment (in Rs.)	Expenditure (in Rs.)
2012-13	7885781.00	7885781.00
2013-14	11091061.00	11091061.00
2014-15	2712354.00	2712354.00
2015-16	5000000.00	5000000.00
2016-17	8088000.00	6161000.00
2017-18	11724349.00	8229812.00
2018-19	9437350.00	5417944.00
2019-20	18454297.00	8263540.00

9.8 Existence of monitoring, assessment and reporting mechanism: Physical and financial monitoring are being undertaken from time to time by CCF, CF, DFO and other external agencies. The record reveals that there is transparent monitoring and assessment system for the works executed. Though there is no control for uses but a proper quarterly and annual monitoring system of the various schemes exists. The monitoring and assessment practices done by the Forest Range Officer at 100%, ACF 50 %, DFO 25% and CF 10% along with the seasonal inspection by the CCF, Addl. PCCF and even in some cases the PCCF and HoFF, Assam. Execution takes place through the Range officer of the respective Ranges with guidance by the Divisional Forest Officer.

Monitoring, assessment of the executed work is done by the Divisional Forest Officer himself or through the Assistant Conservator of Forests and report to the Circle Conservator. In their fortnight diaries the Assistant Conservator of Forests and Divisional Forest Officer record their findings of monitoring and assessment and submit to the Circle Conservator of Forests. The Circle Conservator also monitors and assesses the work and reports to the Addl Principal Chief Conservator of Forests who subsequently reports to the Principal Chief Conservator of Forests and finally it reaches to the Government accordingly. The Addl. Principal Chief Conservator of Forests of Upper Assam Zone also time to time monitors and assesses the work and reports to the Principal Chief Conservator of Forests.

9.9 Public awareness and education: The Forest Division is organizing regular public meetings on environment awareness and the topic man-animal conflict to aware and to educate public. Environmental awareness generation and activities have been being taken up by Kamrup West Division during various occasions like World Environment Day and Van Mahotsav etc.

9.10 Adequate manpower in Forest Division: The position of staff of the Division is presented in the following Tables. Table 9.10.a represents sanctioned post and its financial involvement. Table 9.10.b represents man in position and number of vacancies lying against each sanction category.

Table.9.10.a. Sanctioned staff strength

Location	Rank	No.
Kamrup West Division, Bamunigaon	Deputy Conservator of Forests	1
	Asstt. Conservator of Forests	4
	Head Asstt.	1
	Accountant	1
	Sr. Asstt. (UDA)	3
	Jr. Asstt (LDA)	8
	Draft Man	1
	Driver	2
	Dakrunner	1
	Gate Chowkidar	3
	Forest Guard	1
Loharghat Range	Forest Ranger	1
	Dy. Ranger	2
	Forester-I	10
	Forester-II	2
	Forest Guard	19
	Driver	1
	Gate Chowkidar	2
Kulsi Range	Forest Ranger	1
	Dy. Ranger	1
	Forester-I	8
	Forester-II	2
	Forest Guard	12
	Driver	1
	IBC	1
	Boatman	1
Bamunigaon Range	Forest Ranger	1
	Forester-I	9
	Forester-II	3
	Forest Guard	22
	Driver	1
	Gate Chowkidar	1

	Office Peon	1
Singra Range	Forest Ranger	1
	Dy. Ranger	1
	Forester-I	7
	Forest Guard	16
	IBC	1
	Forest Ranger	1
	Forester-I	2
	Forester-II	2
Bondapara Range	Forest Guard	6
	Driver	1
	Forest Ranger	1
	Forester-I	3
Riverine Range, Nagarbera	Forest Guard	3
	Forester-I	1
Protection Range	Forest Guard	1
	Forester-I	1
Headquarter Range	Forest Guard	1
	Chainman	1

Table.9.10.b. Present position of Staff as on 31st March'2020:

Sl.No.	Name of Post	Grade	Sanctioned Post	Man in position			Vacancy
				Male	Female	Total	
1	D.C.F.	I	1	1	0	1	0
2	A.C.F.		4	0	1	1	3
3	Forest Ranger	II	8	5	0	5	3
4	Dy Ranger	III	5	4	0	4	1
1	Forester-I		60	54	0	54	6
2	Forester-II		12	8	0	8	4
3	Forest Guard		93	64	2	66	27
8	Head Asstt.		1	1	0	1	0
9	Accountant		1	1	0	1	0
10	Sr. Assistant		5	3	2	5	0
11	Jr. Assistant		10	9	0	9	1
12	Draft Man		1	0	1	1	0
13	Driver		8	6	0	6	2
14	Surveyor		2	0	0	0	2
15	Office Peon	IV	7	0	0	0	7
16	Dakrunner		3	2	0	2	1
17	I.B.Chowkidar		4	1	0	1	3
18	Chowkidar/G.C		17	3	0	3	14
19	Night Chowkidar		1	0	0	0	1
20	Chain man		1	1	0	1	0
21	Boat man		1	1	0	1	0
22	Sweeper		1	0	0	0	1
23	Grade-IV		4	0	0	0	4
	Total		250	164	6	170	80

CHAPTER 10

FIVE YEARS PLANS

10.1 Environment: 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 important

role of forests in achieving environmental and economic sustainability as well as in maintaining life support systems on earth. The target of Tenth Five Year Plan had stipulated the need to bring 25% of area under forest and tree cover by 2007 and 33% by 2012. It was also proposed to merge all afforestation programmes of National Afforestation and Eco- development Board (NAEB) into a single scheme called National Afforestation Program (NAP). This 100% Centrally Sponsored Scheme (CSS) was started in 2002-03 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.

CHAPTER 11

PAST SYSTEMS AND MANAGEMENT

11.1 General history of the forest: Before constitution of reserved forests in the Division, there were considerable extent of Jhumming (Shifting Cultivation) in the hilly areas as has been observed by Copeland and Milroy, the pioneers in Forestry. The first reserved forest in this division was formed in 1772-73 and the process of constitute on of Reserved Forests is still continuing. Extracts of remarks, which are interesting and revealing made by Milroy in his working plan for these forests are reproduced below:

Most of the Duar was settled with the lower Assam Tea Company, which opened out the present Barduar Tea Estate, but several thousand of acres of valuable sal forests were subsequently relinquished to avoid the necessity of paying land revenue on land that had little apparent value in those days. The relinquished area was to the Barduar Reserve of which it forms the major part.

The creation of Rubber and Teak plantation absorbed the energies of the forest staff till 1885.

The earthquake of 1987 considerably altered the external features of the Kulsi Range forest roads upto the east bank of Kulsi River from Kulsi to Rajapara and through the heart of the Barduar Reserve from Tiymara to Rajapara was destroyed by the formation of the Chandubi Beel. A forest rest house at Ukiam collapsed in the earthquake, and Kulsi River by changing its course obliterated the road to Ukiam.

A considerable population of Garos formerly lived by "Jhumming" 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.

The Garos seem to have been particularly susceptible to "Kala-Azar", a disease that was first noticed in Assam amongst the Garos on the north face of the Garo hills in 1982, and the mortality was extremely heavy in all the villages of the Kamrup border.

The ravages of "Kala-Azar" permitted for additions to be made to the reserves and this combined with the formulation of "Beels" and much treacherous ground by earth quake has turned what was formerly a thickly populated part of the counting into a very sparsely inhabited tract, that is difficult of access.

On the other hand the broad cultivation plain stretching from the north boundary of the Barduar and Kulsi Reserve towards to sought trunk road was a swamp containing very few paddy fields except, near Chhaygaon. There are still eye witnesses of the death of the last wild buffalo in this plain where there is no longer a vestige of jungle. This past history is of interest in that it explains why sings 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.

After the formation of the first reserved forest, demarcation of the areas were taken of the areas were taken in hand, “Jhumings” were prohibited in the hill and fire protection was introduced for the first time in these forests the method of exploitation consisted of unregulated fellings under the ordinary permit system, the purchasers bearing allowed to select the trees for felling, but these were remarked by the Forest staff. There seems to have been no limit as to size or no. of trees to be removed and naturally in those days due to limited demands, the best trees (boles) in easily accessible areas were only worked out. There were also considerable departmental operations and according to Copeland during the period from 1901-02 to 1905-06, the number of sal trees operated departmentally were 4182, which yield 35935 nos. of sleepers and 860 nos. of scantlings. During the same period purchasers and tree grantees operated respectively 7423 & 55 Sal trees, 16862 and 10628 dead sal posts, 938 and 42 non-sal trees 820 and 2744 cjh of firewood and 400 and 960 nos. of bamboos. In 1906 the Inspector General of Forests issued an order for bidding further exploitation of the Kamrup Sal Reserves, until a working plan for these is formulated.

11.2 Past system of management:

The system of management which has been followed in the past will be briefly discussed, with a view to prevent repetition of such mistakes as might have been made and also to understand and appreciate the present condition of the crop. In general the account given in the expiring plan will be adopted and updated unless there are definite reasons of revising it. Further, there should be specific mention of status of JFM, community involvement and functioning of the forest development agencies in the division along with the change matrix analysis. Assessment of invasive weed eradication, reduction in grazing, reduction in fuel wood and fodder collection, insect pest management and catchment protection needs to be done. Here secondary data could be used followed by ground truthing on sample basis.

11.2.1 Past system of Management and their Results:

Copeland's plan: As a result of the above mentioned order of the Inspection General of Forests, the first Working Plan for these Reserves was compiled by Late D.P. Copeland for these Reserves compiled by late D.P. Copeland for the period 1909-2010 to 1918-19. The plan listed 27 Reserved Forests extending over an area of 42018 hectares, but Copeland's prescriptions covered only the Sal areas of 16058 hectares which was constituted into the Working Circle (Kamrup Sal “W.C.”). The working Circle was divided into six felling services, and each felling series was sub-divided into 10 (ten) annual coupes the sequence of fellings for a decade was laid down by Copeland's prescribed a girth limit of 6' for sound mature sal subject to silvicultural availability, making of unsound and crooked sal, marking. For felling/girdling of trees of other species interfering with sal, light thinning (if necessary, to be repeated after 5 years) in the congested thickets of Sal poles, climber cutting one year ahead of failings (to be repeated if necessary, after 5 years) and felling/coppicing damaged and crooked sal saplings and poles and also dead and dying stems after the main fellings are over. He also prescribed experimental weddings (cutting back undergrowth suppressing young sal) over limited areas.

1. The achievement of Copeland's plan lies in the fact that for the first time a systematic method of working of these forests was introduced. But immediately on introduction of the plan, there was a considerable degree of resentment among the traders, as it imposed restrictions on their freedom of choosing trees and working in areas of their choice as they like in the past. Most of the traders resorted to working in the unclassed State forests and the Khasi Hills and at the beginning of the plan, fillings could be carried out only in the most accessible plains areas of Kulsi and Singra Ranges, and that too after disposal at a very low price. After 1915 permits in unclassed State forests were refused to be issued, unless all marked areas in the plains compartment were disposed off first and this step brought back the traders to the Reserves and they were soon accustomed to work in such areas. The arrears of fillings in Rani and Kulsi Ranges (Plains portion Singra Range, where there were no purchasers previously also, the marked trees over several thousands of areas could not be old and arrears were nominally wiped off by felling a few trees.
2. Due to the difficulties of extraction as well as poor qualities of trees, there were no purchasers of the trees marked in the hilly areas and the prescriptions continued to fall in arrears. Ultimately from 1916 onwards the department had to go back to the old system of selections by purchasers, as far as the remote hill areas were concerned.
3. Fire protections introduced immediately after reservation continued in the Sal Forest after the introductions of Copeland's plan (although it was not specifically prescribed), and this measure compelled with the light fellings prescribed under the plan, caused the forest to progress towards the climax evergreen formations. The change in the type and vigour of undergrowth and consequent difficulties of establishment of all sal regeneration were observed as harmful effects of fire protections and this measure was abandoned after 1914-15 and in its place forced burning of the Sal forest was introduced.

Milroy's plan: The next working plan for the divisions was compiled by late A.J.W. Milroy for the period from 1919 to 1929. His plan covered 34 reserved forest and 3 areas under process of being formed into reserved forests, the total extent being 58019 Hectors. Milroy, who had the advantage of practical experiences by working as a field officer for different periods in these forests, was responsible for introduction of the revolutionary step of abandoning fire-protection and introduction forced burning of the forests. He divided the forests into three working circles, i.e. Working Circle 'A', consisting of Established plain Sal Forests, Working Circle 'B' consisting of potential plains Sal Forests' young saplings and poles coming up in thatch with scattered larger trees here and there and working circle 'C' included all hill type forests.

1. For Working Circle 'A' Improvement fillings coupled with annual burnings of the forests were prescribed. The marking rules stipulated the followings:

Young averaged pole crop: Free dominants from competition retained, dominated stem over mature and mature trees along all crooked, badly forked, misshapen trees were marked. Also non Sal species interfering with Sal were marked. Middle-aged crop: (older even aged poles): Assist best trees to attain maximum dimensions, mark dominated stem beyond hope also over mature and mature trees.

Even aged or mixed age crop: Marking to be done by IFS Officers depending on ground condition Different technique for different patches, inclusive of clearing thinning were necessary and clear felling

small patched which are beyond redemptions.

There was only one felling services for the entire working circle and ten annual coupes covering it were laid down along with the sequence of fellings. This of course involved working over large areas in one block each year. Dead wood were prescribed to be marked once in five years and climber cutting were to be marked once in five years and climber cuttings were to be carried out long with such markings. Cutting of evergreen undergrowth and burning of all areas annually were obligatory. For regeneration of Sal experiments in small specific plots were asked to be carried out.

2. In working Circle 'B' although he felt that clearing and thinning in the young groups of Sal are desirable, he did not prescribed due to lack of trained staff. Such cleaning of Reserved Forests. Rigid five protection for all sal patches were prescribed.

- i) The prescriptions for areas under Working Circle 'C' were for marking mature, over mature and diseased trees after selection by purchasers for fellings and for this operations the sequence of felling was laid down. A girth limit of 4'6" was fixed for Sal. Marking of deadwood was to be carried out subject to its sale ability. Raising of Teak and Sal plantations were to be done by Taungya.
- ii) From the prescriptions of Milroy for working Circle 'A' it is obvious that he was more concerned with bringing in edaphic conditions in the Forests conducive to the regeneration and perpetuation of Sal them any other considerations. His marking rules also arrived at bringing in a measure of even-aged conditions in the top and his stipulation of marking by IFS Officers in certain areas showed that he was aware of the drastic nature of his marking rules. But it appears that his cautionary remarks was disregarded and due to making by untrained personnel some of the compartments were entreated, but elsewhere the improvement felling and thinning were definitely beneficial. In some of the compartments it had been stated that the feeling encouraged the spread of Eupatorium, instead of the thatch anticipated by Milroy. The annual burnings prescribed could not be carried out completely each year due to the vagaries of weather. The experiment on natural regeneration on Sal failed because of death/blowing down of the mother threes subsequently. His plan deemed to have succeeded in achieving its main objective in producing conditions for perpetuation of Sal in these Forests.
- iii) In the potential plains type Forests clearing and thinning were carried out over limited areas only towards the end of the plan, and such areas must have benefited from this treatment. As regards the Hill type Forests, removal after selection by purchasers must have caused a certain degree of harm, but in the circumstances prevailing in those days it is presumed that it was the best that could be achieved. To quote Dr. Bor—"Sal being what it is the removal of this timber must have been advantageous to many young trees wanting space in which to grow up, and disadvantageous to none. The aim of regenerating the Hill type forests by Taungya did not succeed due to the intransigence of the jhummiars as well as the staff and certain patches which were more closely, planted than the others and some isolated stems remained as the only visible net result of the early taungyas of those days.

Bor's Plan: The next working plan to came into being was that by late Dr. N.L.Bor and it was meant to cover the period from 1930-31 to 1939-40. The plan was formulated for 38 reserved forests extending over 61343 hectares. Three working circles were constituted as follows:

- (a) Conversion to uniform W.C. All established plains Sal Forests as well as some h type forests of the previous plan.
- (b) Hill Sal W.C. The remaining areas of Hill type Forests.
- (c) Miscellaneous W.C. Non Sal areas of the first working Circle and then over lapping.

(a) **In the “Conversation to uniform Working Circle**, Bor fixed a conversation period of 100 years and five periodic blocks with the length of period as 20 years were formed. Out of these periodic blocks, specific allotment of areas were made in respect of PBI and Ph. V and the rest of the areas were lumped together as PB-inter. The Bavarian “Saumfemel-Sehlag or the strip and Group system was adopted for this working circle and it was prescribed that the openings of canopy in PB I is to be effected by clear felling strips (North South) and groups taking advantage of the existing advance growth, the selection of areas being left to the discretion of the Divisional Forest Officer. Initially the width of the strips and groups were limited to one tree height, which were to be subsequently enlarged depending on the progress of regeneration. The yield in PB I was fixed by volume (Total volume divided by length of period ignoring increments). The subsidiary silvicultural operation prescribed in PB I were felling of standing marked trees left by purchasers, coppicing of damaged poles and saplings, annual burning of clear felled groups and strips, cutting of evergreen undergrowth and late burning of such areas and annual burning of all areas not subjected to regeneration fillings. If natural regeneration did not succeed, artificial and was to be given. Bor anticipated the difficulty of inversion by Eupatorium and hoped that the annual cuttings would solve the problem. He also advocated raising of plantations (Sal) in small clear felled plots by way of experiment. For areas allocated to PB Inter in, 10 year thinning cycle was laid down and different sets of marking rules were framed for areas with different age size of crops. Felling of marked standing trees left after main feelings, cropping of damaged steps, felling non-sal interfering with Sal and annual burning of all areas were laid down as subsidiary silvicultural operations in this P.B. For areas under PB-V it was prescribed that clearing cum thinning along with timber cutting are to be taken up departmentally once in five years over the entire area. The young crop should be five protected and the Divisional Forest Officer may raise plantations in blanks at his discretion.

(b) **For the Hill Sal Working Circle** Bor prescribed selection marking subject to a diameter limit of 18” in best sites and 12” worst sites subject to silvicultural availability. Similarly diameter limit for other species were also fixed and thinning in contested Sal patches were laid down. No sequence of feelings were formulated, but the whole area was to be worked over on a 10 years. Cycle, for which three felling service were formed. Regeneration of sal was to be attempted by Taungyan, the annual area to be raised being unspecified climber cutting in Sal patched were prescribed.

(C) **For the miscellaneous Working Circle**, diameter-limit for various species were laid down and these were to be marked and disposal of wherever saleable Regeneration was to be effected by taungyas but annual area was not laid down. Areas fit for wet cultivation and for use as elephant-grazing ground were earmarked and kept apart.

The prescriptions of Bor’s plan for the “Conversation to Uniform W.C.” were not followed properly initially. The operations degenerated into pure and simple revenue feelings and subsidiary silvicultural operations (felling of marked trees of poor, quality of Non-Sal species left standing in groups and strips, cutting of evergreen, burning etc.) were neglected. Eupatorium was not tackled at all, although

this was prescribed in the plan. Yield in subsequent years were removed by enlarging the groups/strips (without regard to progress of regeneration) instead of marking new groups. As a result the PBI areas suffered due to lack of establishment of sal regeneration and at the instance of the then Divisional Forest Officer who asked for a review of the plan, the Forests were subjected to an inspection by the Inspector General of Forests in 1933 and subsequently by the Imperial Silviculturist. It was then decided that further removal yield from PBI compartments will have to be severely restricted till sufficient progress in regeneration is achieved. As a result of these visits, there arrears of subsidiary silvicultural operation were vigorously tackled from 1934 onwards. Compartment by compartment marked trees lefts standing were felled, eupatorium was dug out, pressing and early, burning of thatched areas were done and cutting of evergreen undergrowth and burning were carried out. New group fellings were carried out only at points containing sufficient numbers of advanced growth Apparently no further clear-fellings in strips were resorted to. The results of these operations were found to be satisfactory and in 1936 the opinion veered round to the view that a general opening of the canopy as in the uniform (Shelterwood compartment) system would be more beneficial. It is of course difficult ascertain at this stage as to what was the exact basis for this conclusion and the detailed assessments (if any) on which it was based. Be that as it may, uniform opening of canopy was reported to in 1936 in the compartments, where certain amount of success has already been achieved due to the steps indicated above and some of the compartments which were not severally effected by earlier markings were relegated to the background for marking time till revision. Some other compartments were taken in hand for preparatory treatment as PB-II, although no such specific allocations were made by Bor. From 1934 onwards 1/5th of the area in PB-V was treated for cleanings/thinning. Prior to this only fire protection and some climber cutting was done in such areas. The Inspector General of Forests Inspected the areas in 1936 and apparently the change in the method of treatment in PB-I areas was approved by him. More areas in PB-I were, therefore in the same manner in 1936 and 1937.

One tenth of the total area was worked annually since 1932 in the Hill Sal working Circle Regular Teak-Plantations were created from 1934 onwards in the Miscellaneous Working Circle.

Looking back, it appears that there was nothing fundamentally wrong in the strip and group system prescribed by Bor in his plan, and there should have been no apparent disadvantage in this method compared to the Uniform system adopted later. Excellent groups of saplings and poles located in some of the compartments even now bear a mute testimony to the efficacy of Bor's Plan.

Unfortunately this sophisticated system was far ahead of those time in the hands of indifferent executives. Bor's predecessor Milroy's remarks is worth quoting in this regard there is no tradition in Assam amongst the untrained executive staff, even amongst subordinates of the rank of Rangers, to be anything more than Revenue collector. The protective establishment is content to sit down and wait for order to fetch and carry". As a result of the above and as recorded earlier Bor's prescription were given up during the middle of the plan period and a premature revision of his plan became necessary and a revised plan was introduced from 1938-39.

Jacob's Plan: The revised working plan of Sri K.C. Jacob introduced in 1938-39 was meant for the period upto 1947-48 and it covered an areas of 62298 hectars distributed over 40 Reserved Forests. The Working Circles formed by Jacob were.

(a)	Sal Short-period conversion W.C.	Comprised of plains Sal Forests.
(b)	Sal long period conversion W.C	Comprised of accessible Hill Sal Forests.
(c)	Sal selection W.C.	Comprised of remote Hill Forests.
(d)	Sal Clear-felling W.C.	Comprised of some compartments of plants Sal Forests and some accessible hill sal forests nearer to working centers.
(e)	Miscellaneous W.C.	Overlapping areas containing mixed deciduous, evergreen and savannah for motions, mainly on the lower Hills.

In the "Sal Short period conversion Working Circle" the method of treatment adopted was uniform system with aided natural regeneration. The conversion period was fixed at 120 years, with five periodic blocks of 24 years period in each areas wells allotted to PB-I, II V and test of the areas clumped together as PB-Inter (consisting of PB III and IV for regenerating the Forests, different in entitles to treatments were prescribes for different types or areas depending on the conditions of Top-canopy, Middle canopy, ground cover and existing status of regeneration as follows:

(a)	Dense Sal stocking & evergreen undergrowth	Cautions initial break in top canopy, felling low shade broad-leaved trees, cutting of evergreen undergrowth, burning etc. Subsequent opening of canopy depends on appearance and progress of sal regeneration.
(b)	Fair Sal top-canopy no middle canopy and some regeneration in light thatch	Next stage of (a). Early burning, further opening of top canopy, fire protection for one year. After seed fail, rains tending to produce wippy sal.
(c)	Open Sal top canopy and plenty of whips in thatch	Next stage of (b) Establish seedlings by fire protection for 3-4 year. Elasticity to canopy, otherwise continue early burning and rains tending.
(d)	Fair Sal top-canopy mid-storey of bamboos and patches of young Sal	Cut bamboos over young Sal only, late burn to kill such bamboos, thin rest of the bamboos, rains ending of young Sal.
(e)	Fair Sal top canopy, Kukat midstorey and coffee Bengalese's ground cover	Selective kukat felling, late burning will bring in stage (b). Then tobe treated as in (b)
(f)	Open Sal top canopy, dense Eupatorium and fair young Sal under Eupatorium.	Pull up eupatorium during rains early burning gradual removal of Kukat to bring in stage © and then continue a as such.

Even after such elaborate prescriptions the author was not sure about sent percent success of establishment of regeneration and advocated planting up of recalcitrant areas towards the end of his plan. No felling series was formed in this working circle. The yield from PB-I was prescribed by volume ignoring increment, the selection of area to be marked being left entirely at the discretion of the Divisional Forest Officer, depending on the conditions of the top canopy, middle canopy, ground cover

regeneration different techniques of marking were laid down in the marking rules which are briefly outlined below:

(a)	Complete Sal top-conopy Kukat and Sal mid-storey, evergreen ground cover no advance growth.	Create gaps in top canopy 60' wide, mark all suppressed trees, no further marking till favourable grand cover and regeneration induced.
(b)	Moderate Sal and Kukat top conopy, Sal-Kukat Mid storey, Light thatch ground cover, fair advance growth	Large gaps than in (a) to be created in top conopy selective removal of kukat remove all Sal and Kukat over established advanced growth.
(c)	Open top canopy, little or no mid storey, thatch and eupatorium ground cover, little or no advanced growth	Space outmother trees, but gaps not to excess 80', where no Sal available retain thin leaved Kukat, retained mid- storey stems over largo blanks.
(d)	Moderate top-canopy, Moderate mid storey, light evergreen ground cover and scanty advanced growth	Space out top canopy 80' from stem to stem retained light faliaged kukat where no Sal available, mark suppressed Sal and Kukat.

The subsidiary silvicultural operations prescribed in PB-I areas were falling of standing marked and damaged stump, reduction of stump heights of felled poles and saplings, early burning of thatch areas, late burning in evergreen parches, fire protection of areas with advanced growth, one or two rains tending, pulling out on Eupatorium, cutting of non-Sal coppice-shoots and shrubs, pulling out of climbers, reducing number of Sal coppice shoots from young stumps etc. clean wedding was not desired. Felling of kukat and climber cutting was to be done along with marking or with the subsidiary silvicultural operations. Fencing was prescribed for areas with heavy grazing, the PB-II areas were to be marked in a 10 yr. cycle and sequence of felling were laid down. The marking rules stipulated spacing of top canopy Sal 50 apart, retention of the best stems, marking of suppressed Sal, marking of top canopy kukat if not required for proper spacing, marking of mid-storey kukat if not occupying a gap and retention of over mature and dying trees. The subsidiary and silvicultural operations were to consist of felling of marked standing trees, selective kukat felling, rains tending in areas with advanced growth, early burning of thatched areas, late burning of evergreen areas and climber-cutting along with marking. For the areas in PB inter a sequence of marking in a ten yr cycle was laid down and marking rules framed for marking of over mature and dying trees, marking of mature trees standing over poles, marking of unsound suppressed trees only and spacing out of dominants in the top canopy. Felling of marked standing trees, climber cutting with cleanings and thinning, early burning and late burning according to ground cover where the subsidiary silvicultural operations prescribed for PB inter areas. For BB-V areas a sequence of fellings were laid down on the basis of an initial removal of over woods in those compartments where such work has not done in the previous plan period, to be followed next year by 1st cleaning and a second cleaning to be worked out five years later in all areas in PB V. All matured, middle ages and large sized trees stand over young crop were to be marked for initial over wood removal, older stems of young crop were to be spaced 12' apart and younger stems 9' apart,

suppressed stamps to be marked of disposable patched of unsound stems were to be marked for coppicing and groups of mature, semi mature stems and poles were to be thinned out, the subsidiary silvicultural operations prescribed for PBV consisted of felling of marked standing trees, suppressing of undergrowth and forced early burning, climber-cutting along with thinning and encouragement of grazing.

The same method of treatment under Uniform system with aided natural regeneration was also adopted for the sal long period conversion working circle, but the conversion period (as well as the rotation) was fixed at 50 years. Consequently the period in each of the five PBs chosen was worked out to be 30 yrs. Except for PB-V, which was chosen from compartments of the pains ignoring increment, the selection of area to be marked being left entirely at the discretion of the Divisional Forest Officer, depending on the conditions of the top canopy, middle canopy, ground cover regeneration different techniques of marking were laid down in the marking rules which are briefly outlined below:

(a)	Complete sal top-canopy Kukat and Sal mid-storey, Evergreen ground cover, no advance growth.	: Create gaps in top canopy 60' wide, mark all suppressed trees, no further marking till favourable grand cover and regeneration induced.
(b)	Moderate Sal and Kukat top canopy, Sal-Kukat Mid storey, Light thatch ground cover, fair advance growth	: Large gaps than in (a) to be created in top canopy selective removal of Kukat, remove all Sal & Kukat over established advanced growth.
(c)	Open top-canopy, little or no mid storey, thatch and eupatorium ground cover, little or no advanced growth	: Space out mother trees, but gaps not to excess 80', where no Sal available retain thin leaved kukat, retained mid-storey stems over largo blanks.
(d)	Moderate top-canopy, Moderate mid storey, light evergreen ground cover and scanty advanced growth	: Spaceout top canopy 80' from stem to stem, retained light foliage kukat where no Sal available, mark suppressed Sal and Kukat.

The subsidiary silvicultural operations prescribed in PB-I areas were felling of standing marked and damaged stump, reduction of stump heights of felled poles and saplings, early burning of thatch areas, late burning in evergreen patches, fire protection of areas with advanced growth, one or two rains tending, pulling out on Eupatorium, cutting of non-Sal coppice-shoots and shrubs, pulling out of climbers, reducing number of Sal coppice shoots from young stumps etc. clean wedding was not desired. Felling of Kukat and climber cutting was to be done along with marking or with the subsidiary silvicultural operations. Fencing was prescribed for areas with heavy grazing, the PB-II areas were to be marked in a 10 years. Cycle and the sequence of felling were laid down. The marking rules stipulated spacing of top canopy Sal 50 apart, retention of the best stems, marking of suppressed Sal, marking of top canopy kukat if not required for proper spacing, marking of mid-storey kukat if not occupying a gap and retention of over mature and dying trees. The subsidiary and silvicultural

operations were to consist of felling of marked standing trees, selective kukat felling, rains tending in areas with advanced growth, early burning of thatched areas, late burning of evergreen areas and climber-cutting along with marking. For the areas in PB inter a sequence of marking in a ten yr cycle was laid down and marking rules framed for marking of over mature and dying trees, marking of mature trees standing over poles, marking of unsound suppressed trees only and spacing out of dominants in the top canopy. Felling of marked standing trees. Climber cutting with cleanings and thinning, early burning and late burning according to ground cover where the subsidiary silvicultural operations prescribed for PB inter areas. For BB_V areas a sequence of fellings were laid down on the basis of an initial removal of over woods in those compartments where such work has not done in the previous plan period, to be followed next year by 1st cleaning and a second cleaning to be worked out five years later in all areas in PB V. All matured, middle ages and large sized trees stand over young crop were to be marked for initial over wood removal, older stems of young crop were to be marked for initial over wood removal, older stems of young crop were to be spaced 12' apart and younger stems 9' apart, suppressed stems to be marked of disposable patched of unsound stems were to be marked for coppicing and groups of mature, semi mature stems and poles were to be thinned out, the subsidiary silvicultural operations prescribed for PBV consisted of felling of marked standing trees, suppressing of undergrowth and forced early burning, climber-cutting along with thinning and encouragement of grazing.

i. The same method of treatment under uniform system with aided natural regeneration was also adopted for the Sal long period conversion working Circle, but the conversion period (as well as the rotation) was fixed at 50 years. Consequently the period in each of the five PBs chosen was worked out to be 30 yrs, except for PB-V, which was chosen from compartments of the plains sal forests, the areas of rent of the PBs were located in the Hill Sal Forests, Specific allotment of areas was made for PBs I, II, V and the areas of PB III and IV were lumped together as PB-inter. The Working Circle was not subdivided into following services and yield from PB I was prescribed by volume (same formula as in the proceeding working Circle) and that from the other PBs by areas. No sequence of areas to be taken up for marking and regeneration operations was laid down in PB I, these being left to the discretion of the Divisional Forest Officer. The marking rules for PB I included instructions for creating gaps in to-canopy not exceeding 40' retention of trees with good crown, over mature and dying trees it in proper spacing retention of one mid-story light-leaved kukat (otherwise Sal) in the centre of gap of top canopy marking of suppressed Sal, marking of all other Kukat, marking of large trees standing over patches of saplings and poles and thinning out such patches, marking of all patches of mal formed saplings and poles etc. No further opening or marking was to be carried out till there is a progress in the regeneration. The subsidiary silvicultural operations to be carried out were felling of standing marked trees, coppicing damaged stamps, coppicing of all kukat except for the ones meant for retention drying and late burning of such materials, cutting out and burning clumps of bamboos standing over regeneration, thinning of bamboos else where, rains-tending including pulling out of Eupatorium, Control burning early or late as per nature of ground-cover and climber cutting along with marking. Mr. Jacob also prescribed soil-working along counters in steep-slopes, and broadcasting of Sal seeds (with or without soil working) in areas with insufficient seed bearers. For, PB-II areas a ten yr. Cycle of marking with the sequence of areas to be taken up annually 10th of the PB) were laid

down. The marking rules to be followed for PB II were same as those of PB I, except for the restriction of not marking any gaps in the top-canopy, Unsound trees were required to be marked. The subsidiary silvicultural operations prescribed were felling of standing marked trees, coppicing of damaged stamps, cutting thinning of bamboos, early/late burning of areas and rains tending. Climber cutting was to be carried out along with marking. For areas in PB- inter/1/10th of the area is to be taken up annually for thinning, marking, the sequence of areas being prescribed. The marking in the PB was to be in the nature of thinning, the dominants being spaced out, retention of sound, suppressed stamps. Marking of Kukut interfering with Sal, marking of over nature Sal, marking of nature Sal standing over pole-crops and thinning amongst congested poles. The subsidiary silvicultural operations were felling of marked standing trees, coppicing of damaged stems, loaf-burn in all compartments and climber cutting along with marking. For PB.V areas a marking for preliminary over wood removal was to be followed by two cleanings/thinning at the interval of five years and the sequence of areas to be taken up accordingly were prescribed. Mature, middle aged and large poles standing over young Sal patches ere to be marked coppice of large Sal to be marked if over young crop, otherwise reduce member of shoots on the stamp, patches of malformed young stems were to be coppices, and spacing out young stems (6'-9') and older poles (12') were prescribed in the marking rules. The subsidiary silvicultural operations prescribed were early burning of areas with established Sal, fire protection of other areas, coppicing unsound stems, climber cutting along with thinning, marking and encouragement of grazing.

- ii. In the Sal selection working Circle, removal of trees over a prescribed girth-limit subject to limitation in areas of annual coupe and number of trees as the method of treatment adopted. The rotation was fixed at 150 years. And a felling cycle of 15 Yrs. was laid down. No sequence of area to be marked was fixed but the DFO was to take up 1/15th of the area of the working circle annually, half the number of sal trees over the prescribed girth limit being allowed to be felled in each marking. Yield as thus regulated by area/number of trees and a girth limit of 5' was laid down for sal all non-sal trees above the prescribed girth-limit was allowed to be marked. Half the number of available sal trees over the girth limit (all such trees if there are sufficient trees in the next loer girth class) were to be marked, subject to non large-gaps (80'-100') being created. Dead and dying solitary dal as to be marked. Light thinning in congested clumps and pole corps were prescribed. The subsidiary silvicultural operations were to consist of cutting bamboos over established Sal, thinning bamboos over whippy Sal, leaf burning of all areas, early burning of thatch areas, cutting of climbers in a ten years cycle and obligatory raising of one acre of plantation/taungya for every 60 trees removed. If possible DFO should raise taungya/plantations in areas more than the minimum prescribed.
- iii. Nine compartments, mostly in accessible areas, adjacent to work centers, comprised the Sal clear-felling working circle. A conversion period as well as rotation of 80 years was adopted and the working circle was divided into four felling series. 1/8th of the area of each felling series was to be planted up during the plan period of ten years. Clear felling and planting with teak stumps (Ajhar in the depressions) was advocated in this W.C. two rains weeding in the first year as well as vacancy felling and one rains weeding in the 2nd year was prescribed. The first thinning was to take place in the 5th /6th year, the second in the 10th year and there after thinning were to be carried out at the 10 year intervals. Fire protection for the first five years of plantation was prescribed and thereafter pressing and early burning of undergrowth were to be carried out. Fencing was to be provided for plantations

adjacent to villages only. For the areas outside regeneration block, thinning markings as for PB-inter of conversion Working Circle was to be carried out, except for preference for retention of large stems.

iv. In the miscellaneous working Circle, which comprised of non-sal areas of the Sal conversion working circles, Jacob prescribed minimum girth limit for seven species for exploitation and raising of compensatory plantations, 1 acre for every 60 trees removed. Species recommended for plantations were Teak, Sopha, Gondsoroi and Ajhar. In addition to the above compensatory plantations, it was laid down that five acres of extra plantations are to be raised annually at Naliato, Lokhra, Mounakhurung and Sajiarpara.

v. Jacob's plan, originally intended to cover the period from 1938-39 to 1947-48 was not revised till 1955-56, and the plan prescriptions were continued to be followed in the interim period. This plan enjoyed a span of 17 years, against the normal period of 10 years (or even less) of the previous plans. Works according to the prescriptions of the plan apparently proceeded till about 1943, when the events of world war II intervened, it caused a certain degree of upset in the working as per plan. It has been remarked that certain compartments have been over worked to meet the exigencies of war apply, but this has no notable adverse impact on the quantum of total yield removal during the period 17 years of the plan. From 1945-46 onwards, the prescriptions were again followed as per plan, but it seemed there were considerable deviations for a few yrs. Due to issue of permits for trees to individuals as well as for free-grants this always resulted in selection of trees by the grantees irrespective of any silvicultural considerations.

vi. The record of the compartment histories reveal that at the commencement of Jacob's Plan (i.e. from 1938-39 till 1942-43), almost all the compartments allotted to PB I of both the short period and long period Sal conversion working circle were tackled simultaneously. PB I fellings were recorded to have been carried out in all such compartments, and it is obvious that these fellings were done over very limited patches in each compartment or if larger areas were taken up the openings were inadequate. The tending and burning etc. were also recorded to have been carried out, but it is very difficult to ascertain now as to what extent of area in each compartment was treated annually. During the latter part of the plan (1946-47 onwards), it seems that the compartments nearer to the working centers (Best and Range Offices) received a greater degree of attention, both in respect of fellings as well as tendings, whereas the rest of the compartments were probably, given cursory attention only. Inadequacy of forest and forest personnel might have been one of the reasons of such trend. The succeeding working plans officers, Sri L.C.Das estimated that there has been deficit of 88807 units (67,144 cubic meters approximately) in yield removal PB-I areas of Jacob's plan during 17 years period. This supports the view that the PB-I fellings carried out under Jacob's plan were inadequate and not up to the extent prescribed in the Plan. At the end of this 17 years of treatment under PB-I the next working plans officer could shift only two compartments (Dimali-I and Dumpara-I) to the regenerated PB (i.e. PB V). The two compartments contain a net Sal area of 39 hectares only, of the total of 2345 Ha in PB-I of both long period and short period Sal conversion working circle. Although the successor working plans officer estimated another 1200 hectares in the rent of the PB-contain established regeneration, this assessment was found to be rather optimistic as revealed on the basis of stock-mapping carried out during the field works of the present plan. Almost all the compartments allotted to BB-II in both the long period and short period working circles were subjected to marking, although the sequence laid down could not apparently be followed in the latter years. The records also

reveal that Kukat-Felling, burning and tending of patches of advance growth were also carried out regularly, the extent of area treated being unknown. Similarly almost all the compartments in the PB-Inter of both the Working Circle were subjected to thinning markings (some more than once) and were regularly burnt. In the earlier years even rains-tending of groups and patches of the PB- inter were carried out, although this was not indicated in the prescription. The sequence of felling for over wood removal and thinning in PB-V compartments was followed upto 1943 and then it was upset probably due to the impact of the war. In the Sal clear felling working circle and miscellaneous Working Circle plantations were created each year from 1939 to 1955, although there were considerable fluctuations in the area taken up annually. Approximately 160 hectores of Teak, 46 Hectors of Simul, 5.5 hectores of Ajhar, 3 Hectares of Bagipama and 1 Hectares of mixed plantations were created during this period. In the Sal selection working circle, there are no records of operations in respect of some of the compartment but in case of all other compartments selection markings were carried out in number of years. Operation under permit as well as fellings for war supply were all done in some of the compartments of this working circle. Kukat felling, burning and tending of regenerations were also recorded to have been done in some compartments.

vii. From what has been stated above, it would be obvious that Jacob formulated elaborate prescriptions, particularly in the two Sal conversion Working Circle, to cove all possible categories of canopy conditions and compositions as well as all types of ground cover. The plan was beyond doubt very sound in theory, but its successful implementation depended on the whole-hearted attentions, sustained and systematic efforts on the part of the personel with the highest degree of skill and training which are probably not forthcoming due to various factors already outlined. The elasticity given to the territorial staff as regards the choice of areas to be taken up for regeneration treatment was not judiciously used, and the basic aspect of the uniform system of tackling a whole compartment within a set time was ignored. Instead, the efforts seemed to have been to disadvance growth, so that even regeneration treatments were accorded in PB-inter areas where it was not called for. Consequently the canopy-openings inmost of the PB-I areas were inadequate and although good result were visible in some of the compartments, nearer to work enters, the degree of success as regards the pace of regeneration under Jacob's plan was not commensurate with the prolonged period it covered. In the other Working Circle, consistent with the available resources and personnel useful works were carried out as already stated earlier. The important procedure of writing up of compartment histories was introduced for the first time in the division by Jacob's Plan.

L.C.Das's Plan:

Jacob's plan was revised by Sri L.C. Das and the revised plan came into effect from 1955-56 and it covered the period upto 1969-70. The plan included 41 reserved forests extending over and area of 62953 Ha. The old compartments were subdivided into smaller units and for the first time das introduced the procedure of blocks comprising of several compartments with distinct serial number for each compartment. Instead of the casting procedure of compartments being designated by name only. The working circle were constituted as follows:

(a)	Sal conversion W.C	Comprised of areas of Jacob's short period of long period conversion working circle as well as some areas of Sal selection working circle.
(b)	Protection and Sal improvement W.C	
		The balance area's of Jacob's Sal selection W.C.

(c)	Clear-felling W.C.	(Further sub-divided into 3 sub W.C.)
	i) The firewood sub-working circle	Khanapara R.F.
	ii) The firewood and small wood sub working circle	Area covered by three R.F.'s in the North Bank.
	iii) The Teak Sub working circle	Teak plantation in the south Bank plus same sal areas of both plains and hills.
(d)	Miscellaneous W.C.	Overlapping areas of other working circles containing non-sal forests.
(e)	Bamboo W.C.	Areas containing bamboo, overlapping other working circle.

There was no noticeable difference in the method of treatment adopted under Das' Plan for the "Sal conversion working circle with that formulated by Jacob in his plan. Probably owing to the same system of management (Uniform system) being continued. The rotation/conversion period (150 years) No. of periodic blocks (5), period of each block (30 Years) etc. were same as those prescribed for the Jacob's long period conversion working circle. Similarly specific areas were lumped together as PB inter. Out of the conversion period of 150 years. It was agreed that 35 years. Are to be considered as passed and that the period left for conversion of the working circle is 115 years.

The PB-I areas of Das's plan was made up of all compartments in PB-I of both conversion working circles of Jacob's plan minus areas shifted to PB-V and same compartments relegated to PBII, plus some compartments of Jacob's selection working circle, plus a few compartments promoted from Jacob's PB inter. Therefore, Das's PB-I was not identical with the areas placed in the same periodic block by Jacob's and this PB-I should have been treated as having a new lease of period in the block. The yield from PB-I was prescribed by volume, the total volume of trees of 8" d.b.h. and up in the PB bearing divided by the period of the block minus 8 years presumed to have been passed. A check on the volume yield was also prescribed on the assumption that approx. 1200 hectares of the PB contained established regeneration and the balance area of the PB is to be gone over in 12 years. No sequence of seeding-felling was laid down. And the same procedure (as in the case of Jacob's of annual areas to be taken up being left at the discretion of DFO was adopted. The marking rules for Das's PB-I were same as those formulated by Jacob for PB-I of his short period Sal conversion working circle. The subsidiary silvicultural operation to be carried out were also same as those prescribed by Jacob for both his conversion working circles with the additional provide that the DFO can take up three years areas at any time in anticipation of a bumper seed years. Das also asked for interrupted contour terraces in the hills, lining up of regeneration areas in plains, sowing/broadcasting of seeds, brushing seeds into line five-protection for one year after such measures of desisting natural regeneration.

The PB-II of Das's plan was compost of most of the compartments of Jacob's PB-II plus a few compartments of Jacob's PB. Inter and selection Working Circle, Volume yield was prescribed for this PB. Also on the assumption that all existing trees of 8"-12" and 12-16" d.b.h. classes would be removed within the period of the block less eight years presumed to have been passed. The marking rules formulated were not in conformity with this assumption. It was stated tender the heading "Methods of Executing the Felling" that no sequence is laid down for areas to be gone over in this PB but actually a marking scheme was formulated showing the sequence of areas to be gone over annually in PB-II and appended to the marking rules. The marking rules framed for PB-II were more or less same as those in Jacob's plan, and a check on the volume yield was inherent in the marking rules

by a bar on taking up more than the annual area laid down. The subsidiary silvicultural operations prescribed for this PB were same as those in Jacob's plan for PB-II of short period conversion working circle.

Most of the compartments in PB-Inter of both the conversion working circle of the previous plan and a few compartments of Jacob's Sal selection working circle were lumped together to form the PB. Inter of Das's conversion working circle. Yield from this periodic block was regulated by area and the sequence of fellings were laid down. The marking rules formulated for this PB were laid down. The marking rules formulated for this PB, were a combination of those laid down by Jacob for PB. Inter of his short period and long period conversion, Working Circles, Except for the privies that Kukut should be "introduced" in the middle storey, the rest of the prescription for subsidiary silvicultural operations were same as those for PB-Inter of Jacob's short period Sal conversion W.C.

The PB-V of Das's plan composed of all the PB-V compartments of both the conversion working circles of the previous plan two PB-I compartments (Dimali-I and Dumpara-I with not Sal area of 39 hectares only) for the expired plan. Regulation of yield from this PB was by area and the sequences of fellings were tabulated. The marking rules for this PB were similar to (and a combination of) those formulated by Jacob for PB-V of his long period and short period conversion working circles. Of course, the sequence laid down for some compartments by Jacob of an initial over wood removal to be followed by thinning were omitted. The subsidiary silvicultural operations, prescribed by Jacob for PB-V of both his conversion working circles, were more or less laid down to be followed also in Das's PB-V with the additional provide that blanks in this PB are to be planted up.

The protection and Sal improvement Working Circle of Das's plan comprised areas of Jacob's Sal selection working circle minus compartments transferred by Das to his conversion working circle. The method of treatment adopted was improvement felling on a fifteen years cycle and the sequence of felling were laid down, this regulation of yield being by area only. Retention of trees of large sizes were advocated and the marking rules stipulated that dead, dying top-broken trees were only to be marked, deteriorating over mature trees to be marked subject to no large gaps being created, marking of inferior trees interfering with better species C-grade and D-grade thinning in middle aged pole crop marking of malformed, suppressed stems were advocated felling of marked standing trees, selective cutting of kukat and bamboos over regeneration, annual burning of all compartments, introduction of grazing and climber cutting etc. were prescribed as subsidiary silvicultural operations.

To the firewood sub working circle, Das allocated the Khanapara Reserved Forests, the method of treatment adopted being clear felling and raising of regular plantations. The rotation and conversion period was fixed at 25 years. Two felling series were formed, but it was advocated that creations of plantations 50 acres per year will be confined to the first felling series only for the next fifteen years. If satisfactory results are achieved after five years, plantations may be started on the other felling series also. After clear felling and burning, 2' wide strips 6' apart were to be hoed for direct swings and stamp plantings were to be carried out at 6' X 6' and 8' X 8' spacing. The choice of species was left at discretion of the D.F.O. but kadam teak and a host of other species were recommended. Thinning in the plantations were to be carried out at 6,10,15 and 20 years of age.

Hajo, Sildhar Hill and Agiathuri Hill Reserved Forests comprised the firewood and small wood sub-working circle under Das's plan. Clear felling and planting up on a rotation of 45 years was the method of treatment prescribed. The conversion period was fixed at 45 years. Out of which three year were

assumed to be passed on account of the existing plantations. Two felling series were formed on 15 and 10 pachers as annual area to be raised respectively in each felling series. Hoeing in strips for direct sowings and stump plantings, at similar spacing as given in the preceding para, were advocated. Species recommended were Sal in ridges, sisoo, Nim, Sjina, Kadam and Cassia siamiae. The DFO was at liberty to choose other species also. Pulling out and digging up of eupatorium, two-three rain weddings fire-protection, fencing etc. were prescribed, A scheme for restricted grazing was also exhibited in the plan. Thinning cycles for teak and other species were also laid down.

The teak sub working circle comprised of teak plantation in the south bank plus some sal and miscellaneous areas of both the plains and hills compartments. Clear-felling and planting with a rotation of 75 years were advocated, the conversion period being kept at same figure of 75 years out of which 14 years were assumed to have been passed on account of the existing plantations. The choice of annual coupes were left at the discretion of the D.F.O., 130 acres being fixed for annual clear-felling and plantations (inclusive of clear felling of old Kulsi Teak plantations) Stump planting of Teak at 6' X 6' and 8' X 8' spacing was prescribed, but other species like Sal, Simul, Kadam, Hillock, Poma and Sisoo were also recommended. The tending operations laid down were more or less same as in the preceding working circle. Thinning cycle for teak was fixed at 3, 6, 10, 18, 30 and 45 years of age, whereas the same for Sal and other species were stated to be 6,10,15,20,25,30 and 40 years of age. Creation suggestions for raising taungyas were also incorporated in the prescriptions for this working circle.

Areas containing mixed deciduous forests and evergreen patches (i.e. Non-sal areas excluding Juli lands) of compartments of the first two working circles were allocated to the miscellaneous working circle. In the process very small non-sal patches even upto the extent of 0.8 Ha, in a compartment were allotted to this working circles. Selection markings subject to a minimum limit of d.b.h. for exploitation and compensatory plantations were the method of treatment adopted for this working circle. Rotation was assumed to be 150 years and for diameter limit exploitations at 30 years. Felling cycle was assumed. The minimum exploitable limit of d.b.h. was laid down for 15 marketable species (rest of the species being lumped together as 'other' with a diameter limit of 24" for felling). The number of trees to be marked annually was fixed at 485, the area of annual coupe being 2050 acres. No sequence of felling was laid down, the choice of annual coupe being left at the discretion of the D.F.B. one acre of compensatory plantations was to be raised for every 30 trees marked for felling, the minimum area to be planted up per annum being 20 acres. The choice of planting site, species etc. were left at the discretion of the D.F.O. Fire protection, fencing, cleaning and thinning were prescribed as subsidiary silvicultural operations.

viii. In the prescriptions for Miscellaneous working circle, a climber-cutting schemes for all areas (including area of others working circles) were included. But in the sequence of areas to be taken up given in a table as statement it seems only Sal areas were to be subjected to this operation on a 5 years, cycle, 1/5th of the Sal areas of the divisions being taken up annually.

Over-logging areas of other working circles containing bamboos were formed into a Bamboo working circle. Three felling services (cutting series) were formed and the areas were to be operated on a cutting cycle of four years, yield being regulated by area. Annual cope and sequence of felling were laid down and the annual yield was estimated to be 3930 tens of bamboos.

From what has been outlined above, it would be obvious that the prescriptions under Das's plan for the Sal conversion working circle were essentially the same as those formulated by Jacob for his Sal conversion working circles, probably because of the same method of treatment being continued. The same injudicious use of the elasticity given to the territorial staff for choice of area where regeneration operations were to be carried out was again repeated in the performance under Das's plan. From the compartment histories it was seen that almost all the compartments were subjected to PB-I felling repeatedly (exceptions being Ouguri-I, Chandubi-2 and 4, Phuljola-6, Sajjanpara-6, Uttarjarasal-3 and Garbhanga-2 where no PB-I felling was done during Das's plan). There appears to have been no semblance to systematic markings of compartment by compartment and instead the marking took the form of hobbling at different compartments, apparently in an attempt to make up to the volume yield prescribed. In some of the cases there are even no records of PB-I felling having been followed by tending and other subsidiary silvicultural operations prescribed when choice of area for regeneration felling and operations are left to the lower echelons of the staff of the divisions, they were naturally inclined to pick and choose small area containing patches of advanced growth scattered in different compartments in order to show quicker success. The systematic tackling of a whole compartment at a time, as it customary under the uniform system was sadly neglected in the Division. In the earlier years of the plan there might have been some drawbacks in the shape of inadequate and irregular provisions of funds for regeneration operations, but late on (particularly during the late sixties) this was rectified by inclusive of this work in the Development schemes. During this period also there appear to have been a shift on emphasis to the minor roles of forestry, and the basic and constructive aspect seem to have been suffering in consequence. Instead of trained Forest Rangers and ACFs taking up markings for PB-I felling, in some instances these works were even entrusted to Foresters. The initial openings for seeding-felling were inadequate in most of the compartments, and the tending operations carried out under such conditions were nothing but waste of efforts. In some cases small pockets in the compartments were taken up for regeneration works which was carried out for a few years and the probably owing to the transfer of the local Range Office/Beat Office staff were given up. These areas were lost sight of eventually, and after a lapse of few years were rediscovered and taken up redesignating as a fresh creation of regeneration areas. As a result, although there would be additions in the areas created under Sal regeneration in the records, corresponding progress in areas in the ground would be lacking. Sustained systematic efforts till an area was covered completely with established Sal was unfortunately lacking in case of most of the compartments.

In the Das's plan, the volume yield from PB-I areas was prescribed as 11448 units (1 unit=36.1 c.f.t.) per annum. Therefore during the plan period of 15 years the total yield should have been 1,71,720 units. The compartment histories reveal that the following volume was actually marked during this period from PBI compartments:

Diameter Class	No. of trees	Volume unit (per tree)	Total volume unit for the class
4" – 8"	381	Ignored	--
8"-12"	3259	0.3	977.7
12"-16"	7153	1.0	7153.0
16"-20"	9056	2.0	18130.0
20"-24"	8697	3.0	26091.0
Over 24"	9542	4.0	38168.0
Add. 887 trees of Guwahati Range for which details not available			

Approximately			304.7
			90824.4
		Say	90824

Thus there was a short removal of 80,896 units during the plan period compared with the yield prescriptions, but whether even removal of the above volume was commensurate with the pace of regeneration given in the next para is rather a point of think over.

In the PB-I of Das's plan, majority of the compartments allocated were under PB-I treatment of Jacob's Plan also. In some of the compartments, as stated earlier BB-I treatments under uniform system were even started much earlier during the currency of Bor's plan. Even ignoring such previous treatments, the total period spent by this compartments in PB-I comes to 32 years (17 years under Jacob's Plan) which is longer than the establishment periods indicated in both these plans. Therefore these compartments should have been fully regenerated. But the actual extent of establishment of young Sal in these compartments (ignoring patches and pockets of less than one hectare in extent) as entered in the Working Plan Part-I of Das's successor namely Sri P.C. Das is as follows:

Table. Compartments under PB-I treatments of both Jacob's and L.C. Das's Plan (Area in Ha)

Compartments		Net Area	Gross Forest area	Net Sal area Allocated in L.C.	Area under established young Sal	Area Covered by Teak and Mix plantation
Kalagohain	1	91	59	29	11	22
Kalaghoain	7	235	173	86	2	
Barbakra	1	195	154	138	30	
Koimari	4	188	106	59	25	
Kulsi	3	340	106	124	4	13
Gabbardhan	3	321	259	147	16	12
Simle Hills	1	73	66	88	5	0.4
Khuksi	1	143	128	107		
Khatkhathi	1	46	34	40	21	
Dakhin						
Nampathar	3	282	241	230	141	
Gohain		111	104	87	10	
Guraog						
Mayang Plains		365	294	119	50	1.0
Mayang 2 A		79	79	52	51	19
Chandubi	2	257	182	167	44	
Miranadi	1	219	156	48	35	33
Miranadi	2	216	208	28		
Miranadi	4	91	64	55	4	
Phuljola	4	138	92	87	38	0.4
Phuljola	6	295	104	72	34	1.0
Sajjanpara	3	316	316	153	23	20
Garopara	2	112	73	86	34	
Total		4213	2971	2001	546	102.8

Assuming in equivalent area covered by the smaller patches & pockets of young sal (which is unlikely), the area regenerated comes to 1092 Ha against the not sal area of 2001 ha allocated by L.C. Das in his plan. The proportion works out to approximately 11/20 area generated in 32 years and at this pace the establishment period required would be approximately 58 years which will have the effect of prolonging the rotation to 290 years approximately.

Table.59.The positions in respect of other compartments brought over by Sri L.C.Das to PB-1 (form PB-II, PB-Inter and selection working circle of Jacob) is indicated below:

Comptt. No.		Gross Area	Net forest Area	Net Sal area allocated in Das's Plan	Area under established young Sal	Area cover ed by teak & other plantations
Garbhanga	2	1241	1236	435	12	16
Uttar Jarasal	3	143	124	120	8	1
Chandubi	4	347	121	116	-	-
Mataikhar						
Planins	5	240	238	98	-	55
Jaipur	1	91	71	77	-	-
Omen Plans	3	155	121	46	17	-
Taraibari		319	244	248	17	-
Sikrabura	1	30	22	21	-	-
Dhudkhuri	1	26	24	25	10	2
Dhuniagaon	1	23	23	23	-	-
Patgaon	3	178	103	112	10	-
Ouguri	1	23	22	17	-	4
Kalagohain	4	156	110	132	6	4
Total		3074	2459	1470	63	78

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

As stated earlier, there were apparent contradictions in the provisions (regarding existence or otherwise of a sequence of fellings) for PB-II areas and this led to a certain amount of confusion. Moreover, in the marking scheme incorporated in the plan, parts of compartment (indicated by a designated extent of area to be marked annually) were allocated for marking for a number of years, and in the case of some compartments marking was to be continued through out the plan- period. This was probably done in an attempt to distribute the works amongst different Ranges, end to achieve a mathematical accuracy in equal areas to be taken up annually. As a result is was seen that most of the compartments were subjected to repeated markings in different years , it is difficult to ascertain whether the same areas were gone over in such repeated markings or whether different areas of a compartment were taken up in markings of different years. When such repetitions of markings took place after a lapse of a few years, itis very likely that the some areas of a compartment were subjected to marking in the subsequent round. Only compartments not subjected to PB-II fellings in the plan period were Chandubi-3, Moinakhurang-I, Sattargaon-I. It is therefore obvious that the sequence of feelings laid down was not properly followed. Except for one or two instances of earlier years, there was no record of the follow upactions after feelings in the shape of the subsidiary sivicultural operation of tending, burning etc. This was in sad contrast to works done under the previous plan period, when feelings in PB-II areas were inmost cases recorded to have been followed up by cultural operations. Due to the rather imperfect basis of calculation of volume-yield for PB-II, no attempt would be made to determine whether yield removed in terms of volume were in conformity with the prescriptions. The quantum of removal during the plan period, is however indicate below:

Diameter Class	No. of trees	Volume unit (per tree)	Total volume unit for the class
4" – 8"	284	Ignored	--
8"-12"	1701	0.3	510.3
12"-16"	4470	1	4470
16"-20"	5174	2	10348
20"-24"	4012	3	12216
Over 24"	2880	4	11520
Add. 196 trees of Guwahati Range for which detailed classification not readily available approx.			121
Total			39185.3
Say			39185

The sequence of feelings laid down for PB-Inter of L.C. Das's Plan suffered from the same short covering as recorded for the marking scheme under PB-II. From the records of the compartment histories, it is seen that some attempts were made to follow the sequence of feelings in earlier years of the plan-period, but this was apparently given up in the later years. Repeated greenwood marking were resorted to in the same compartments over a number of years, and for the same reason as stated for PB-II it is not possible to ascertain whether the same areas or different areas of a compartment were subjected to markings in different rounds. In some of the compartments in addition to markings in the years specified in the plan, marking were resorted to in earlier as well as in subsequent years. The extent of marking in PB-Inter during the plan period is furnished below:

Diameter Class	No. of Sal trees in the dai class	Volume unit For the class	Total volume unit for the class
4" – 8"	767	Ignored	--
8"-12"	5976	0.3	1792.8
12"-16"	12134	1	12134
16"-20"	11726	2	23452
20"-24"	7816	3	21648
Over 24"	4198	4	16792
Add. 196 trees of Guwahati Range lacking detailed classification		Approx.	400.3
Total			76219.1
Say			76219

The compartments which were not subjected to PB-Inter markings during the plan period were Dhunigaon-2, Sikrabura-3, Khatkhathi-2, Gaubalda-I and Phuljaola-8. Records in respect of Lokhra 3.6 and Garbanga-1 were of course incomplete. From the nature of working indicated above one has the inescapable feeling that revenue considerations were probably given more weight while carrying out markings in this PB, in preference to the sequence of feelings tabulated in the plan.

As far as PB-V compartments were concerned, records indicate that all of these were subjected to at least one round of thinning during the plan period as envisaged in the plan. The work was spread over a number of years in some of these, and a few compartments were probably subjected to an additional resound of thinning in later half of the plan period.

Diameter Class	No. of Sal trees in the dai class	Volume unit For the class	Total volume unit for the class
4" – 8"	578	Ignored	--
8"-12"	4412	0.3	1323.6
12"-16"	8401	1	8401

The Working Plan of Kamrup West Division for 2021-22 to 2030-31			Assam Forest
16"-20"	7169	2	14318
20"-24"	2859	3	8577
Over 24"	1397	4	5588
Total			38227.6
Say			38228

From the achievements and performance of management under uniform system in the Sal Forests of South Kamrup Division extending over 32 years and more, it can be said that although success of natural regeneration of Sal in Kamrup conditions were assured, the rate of progress of areas, successfully regenerated, in the prevailing circumstances, were very slow, there is also a felling that the felling prescribed under L.C. Das's plan for areas managed under this method of treatment consequently regenerated into pure revenue felling.

As for areas allocated to the protection and Sal improvement working circle, the sequence of felling laid down could not be followed in most of the compartments, probably owing to the difficulty of extractions out of the areas of 36 compartments allocated to the working circle, during the plan period no operations were carried out in 16 compartment, only dead and windfall markings were done in 4 compartments and the rest of the compartments were subjected to one round of felling.

In the fire-wood sun-working circle as per plan prescriptions of minimum of 50 acres of annual plantations, and are of 303 hectars should have been planted up during the plan period. Against this target an area of 112 hectars (as per Divisional Records) of Teak plantations were raised in the working circle during the relevant period.

1. Regarding the performance in the Teak sub-working circle it is difficult to ascertain as to which were the plantations specifically raised in the areas of this working circle, due to the overlapping nature of allocation in some compartments for miscellaneous working circle also. The annual target of plantations fixed under the Teak working Circle was 130 acres and in the Miscellaneous working circle a minimum of 20 acres was indicated. Therefore, the total area to be planted up during the plan period in these two working circles was $150 \times 15 = 2250$ acres or 909 hectares. Against this target areas planted up during the plan-period as per Divisional Records were:

- i. Teak : 940.7 Ha.
- ii. Sal : 2.0 Ha
- iii. Simul : 92.0 Ha
- iv. Other : 2.5 Ha
- v. Total : 1047.2**
- vi. Say : 1047 Ha

2. The records of operations under the miscellaneous working circle are incomplete and as regards the Bamboo Working Circle no large scale extractions, as envisaged in the plan took place due to lack of demand.

3. **Interregnum:** The working plan for erstwhile south Kamrup Division by Sri L.C. Das, expired on 30.9.70. The field work for the next working plan continued in the division till the middle of 1970 and eventually the working plan by P.C. Das was brought out on 1st of October 1973 duration of the plan being 1973-74 to 1982-83. Meanwhile, ad-interim measures were taken to maintain continuity of the work of revenue earnings, in PB-I and preparatory felling in PB-I, PB-II areas, marking in PB-I areas being continued to removal to over wood only over established patches of regeneration, restricted marking for thinning in PB-I and PB-V areas at the discretion of Divisional Forest Officer, continuing of cultural operations in areas taken up for regeneration during the last five year of L.C.

Das's plan, enhanced areas for clear-felling for teak plantations. The broad outline of the prescriptions for the present for the present revised plan were however formulated and communicated in early 1973 and markings as per prescriptions of the revised plan have been taken up in advance during the 1973-74 financial year (control year 1972-73).

P.C. Das's Plan 1973-74 to 1982-83

The working plan of South Kamrup Division by Mr. I.C. Das, expired on 30.09.1970. The instruction of revised plan was deferred 1st October 1993. Mean while the interim measures were taken to maintain continuity of the works by an interregnum. The revised working plan of Mr. P.C. Das came into force w.e.f. the year 1973-74 and continued to 1982-83. The plan included 42 reserved forest over an area of 62904 Ha. Earstwhile South Kamrup Division which was subsequently divided in to 2 divisions namely Kamrup West Division in 1980 during operation of the working plan.

The working circles were constituted as follows:

1. Sal clearfelling W.C.
2. Sal shelterwood W.C.
3. Teak Plantation W.C.
4. Sal protection W.C.

Total 15,576 Ha of R.F. area was included in Sal clear felling W.C. to convert the irregular G.S. to regular G.S. by intensive method of treatment and to accelerate the rate of regeneration of Sal by artificial means. The clear felling system with regeneration of Principal species Sal by artificial means. The clear felling system with regeneration of principal species Sal by plantations was considered suitable Sal by plantations was considered suitable on the conditions that laid down in (1), (2), (3), (4) and (5) of para 202 of old working plan. Rotation was fixed at 120 years and conversion period was taken as 100 years.

Yield was prescribed on the basis of area controlled by volume yield using Sirmanies modification of Von Mantel formula.

Table of felling and marking rules were prescribed. The detailed technique of raising Sal plantation was prescribed and subsidiary silv. Operation.

The review: The aspiration of accelerating the regeneration was frustrated due to failure of large scale Sal plantations because of the following factors:

- (a) Lack of regular seed supply every year due to occurrence of good seed year only on third consecutive years.
- (b) Sometimes, the good seeds years also failed provide mature seeds due early falling seeds during severe cyclones generally occurring in the month of April and early may.
- (c) Viability of Sal seed is only for 7 days, Sowing of seeds to be done on the same day of collection. In large scale plantations proper care was not taken for timely sowing of seeds aired it led to failure of Sal plantations.
- (d) Looking to the success of Sal plantation created in small areas during 1930-40 the prescription large scale plantations after clear felling was given but that turned out to be a failure.

The Sal shelterwood working circle was constituted with seven compartments of containing Kamrup Alluvial Sal.

The silv. System adopted was "Quarter Bleu". The rotation was fixed at 120 years. The regeneration bleak was identified and rest of the areas of W.C. was put into the un-allotted block.

The result of the prescriptions made for the W.C. was found to be satisfactory as seen in the field. But records are not maintained in office in compartment history file showing details of operations done during the plan period and no control forms were prepared by the respective territorial DFO's.

The Sal Forests occurring on steep hill slopes ridges and crest of hills were put to Sal protection W.C. since the forest in the W.C occupy the watershed of the area, the prime object of management to cause least disturbance to existing forest cover.

The G.S. was poor in the W.C. the Silv. System adopted was selection system. The exploitable dia was fixed at 61 cm. Felling cycle was fixed at 20 years. Yield was prescribed by area in hect/annually. As the parts of compartment were allocated in this working circle, it was difficult to identify the area in the field by executive staff. There was no boundary demarcation of the part allotted W.C. in the field though these have been mentioned in paper in area statement.

The Teak plantation working comprised the area bearing the moist mixed deciduous forest with scattered Sal occurring in Slopes of hills inclusive of all post plantation of Teak of 9 Ha or more in extent. The silv. System prescribed was cleared felling followed by creation of regular plantation of Teak and also systematic thinning in old plantations.

The are of the W.C. was divided in 3 blocks viz. Regeneration Block immolated Block, young Block. The area to be covered by new plantations during current plan was included in regeneration Block. The earlier plantations raised during past working plans period were kept in the young block. The rest of allotted areas were ground to un-allotted Block. Rotation was fixed at 60 years. Calculation of yield was on area basis. 20% of area of regeneration Block was retained to provide a better strip of natural vegetation between different plots and along water courses. The balance area is divided by rotation/conversion period gives us the area of annual coupe in each felling series. Thus annual coupe area in earstwhile South Kamrup Division was 400 Ha out of which the present Kamrup East Division had taken up annual coupe area 230 Ha.

No yield was prescribed from un-allotted block in young block, thinning prescription was given and thinning chart was given.

Review: The result of the prescription is found to be successful and Luxuriant Teak plantation are established in regular interval.

After expiry of P.C. Das plan in 1982-83, no working plan was prepared till 1998. The field works were started in 1981-82. But due to frequent transfer of W.P.O's till 1985 no progress could have been made in completion of field work.

From 1981 to 1985, 14 Nos. of w.p.o's took over charge of W.P.O. Lower Assam Circle, Guwahati. After that the intensity of field work was reduced as 2 Nos. of W.P. party had to start field work in Kamrup West Division, also because of expiry of W.plan of that division also. In the mean the Bagaikhas was finally declared as R.F. comprising total area of approx. 246.0 sq. KM which increases the R.F. area of Kamrup West Division from 433 sq. KM to 679 KM. As the field work in Bogaikhas was not done previously hence the field work was started in Bogaikhas in the year 1989-90 and continued upto 1991-92. Hence the working plan of Kamrup West Division was delayed for more than

next working plan period. During this period of 16 years, the prescription of P.C. Das plan was continued on ad-hoc-basis. From the expiry of P.C.Das working plan in 1982 the departmental operation of timber was also started departmental operation of timber without adequate field staff had put tremendous work load on existing field staff and led to improper supervision of operation work and that increased the illicit felling of trees in forests. A great depletion of growing stock had taken place during this period of ad-holism. The present working plan under revision also prepared on the basis of data collected in 1981-82 to 198 to 85 so the prescription particularly yield regulation requires early review during the period of operation of Working Plan.

11.3 Special works of improvement undertaken: Summary and results of works such as fire-protection, improvement in communication, interface activities, amenities to staff, etc.

Table.11.3.Special Works of improvement undertaken:

Year	Range	Improvement of Forest Road	Remarks
2011-12	Kulsi	Kulsi to Bargurung: 15 KM	
	Kulsi	Andhari to Bakalipara: 2 KM	
	Kulsi	Kulsi I.B. to Bahatpur: 1 KM	
	Singra	Kompatoli to Hahim: 6 KM	
2012-13	Bamunigaon	Nobedonga to Hokomari: 3 KM	
2013-14	Loharghat	Gutipathar to Ghilabari: 2 KM	
2014-15	Singra	Nowapara to Paslang: 2 KM	
		Ukiam to Sarupani: 2 KM	
Year	Range	Building	Remarks
2013-14	Singra	Fgd. Quarter at Jongakhuli	
	Singra	DFO's Quarter	
	Singra	Barrack at Singra Range, Headquarter	
	Bamunigaon	Dy. Quarter at Ukiam	
		Fgd. Quarter at Ratanpur	
	Loharghat	Barrack at Rajapara	
	Bondapara	Barrack at Dhupguri	

11.4 Past yield, revenue and expenditure: Revenue Collection and expenditure under Kamrup West Division from 2001-02 to 2019-20 is reflected in the following table (Table 11.4.a)

Table 11.4.The figure of Expenditure and Revenue during the period of 2001-02 to 2019-20

Financial Year	Revenue (in Rs.)			Expenditure (in Rs.)		
	General Revenue (Govt. Timber, Sand, Stone etc.)	Revolving Revenue (Timber)	Total	Non-Plan	Plan	Total
2001-02	9409647.00	0.00	9409647.00	3842228.89	1390683.00	5232912.00
2002-03	7426189.00	13759077.00	21185266.00	3092162.94	1627274.00	4719437.00
2003-04	5652847.00	12885388.00	18538235.00	4014870.00	815000.00	4829870.00
2004-05	9619266.00	13462462.00	23081728.00	3757879.00	810000.00	4567879.00
2005-06	8292534.00	4003342.00	12295876.00	4649838.00	1989200.00	6639038.00
2006-07	14649291.00	6377786.00	21027077.00	4175431.00	1655000.00	5830431.00
2007-08	23900524.00	1252581.00	25153105.00	3153700.00	4673000.00	7826700.00
2008-09	15023803.00	5853700.00	20877503.00	4626583.00	15573222.00	20199805.00

2009-10	20961892.00	6169969.00	27131861.00	3204000.00	11000182.00	14204182.00
2010-11	15441244.00	7281792.00	22723036.00	5729276.00	5297822.00	11027098.00
2011-12	31266520.00	2850980.00	34117500.00	3851000.00	12825231.00	16676231.00
2012-13	7971458.00	3964157.00	11935615.00	3409000.00	7885781.00	11294781.00
2013-14	3998598.00	2963686.00	6962284.00	2499000.00	11091061.00	13590061.00
2014-15	27861650.00	1779150.00	29640800.00	3868000.00	2712354.00	6580354.00
2015-16	23042101.00	768100.00	23810201.00	4922000.00	5000000.00	9922000.00
2016-17	72784345.00	3532640.00	76316985.00	7828193.00	3147600.00	10975793.00
2017-18	91881275.00	5351357.00	97232632.00	16920152.00	0.00	16920152.00
2018-19	31670249.00	0.00	31670249.00	3792936.00	0.00	3792936.00
2019-20	24138502.00	1645692.00	25784194.00	6905987.00	0.00	6905987.00



CHAPTER 12

STATISTICS OF GROWTH AND YIELD

12.1 Statistic of growth-Sal: In the absence of plots of different ages where definite age of the crops known in each case (or regular periodic measurements of plantations) it was not feasible to collect any reliable data regarding the rate of growth of Sal in the division. The data on countings of stumps of Sal varied out by Bor (and quoted in ILC Das's Plan) could not be relied upon in view of grave doubts as to whether true annual rings in Sal are exhibited or not and in view of obvious inadvisability of application of date from individual stamp to a crop.

Height diameter measurements of a large number of Sal trees in natural stands in scattered groups over a number of compartments both in the alluvial plains (20 compartments 769 trees) as well as Khasi Hills type (8 compartments, 227 trees) were taken in this erstwhile Kamrup South Division in the course of compilation of the expired plan. The data from the compartments containing Khasi Hills type Sal exhibited wide fluctuations which being the reason as stated for not plotting in the graph paper. The height diameter relationship from the data of measurements of the alluvial plains-type Sal as well as those from the plantation plots were plotted in graph paper and a smooth curve was obtained. In that same graph, curves for height diameter relationship of different All India Qualities of Sal were also plotted, which revealed that the rate of growth for the lower dimensions is definitely faster than even quality I and that for the larger dimensions there is a gradual falling off of the same. Of course it has to be admitted that the attainment of particular diameter at a particular age would not only depend on the site quality but also on the treatments aimed at providing optimum space for growth of the trees. Hence the graphs would serve only as a rough indication of site quality and in view of the fact that in almost all the stands where measurements were taken number of stems per unit area was higher than those indicated in the yield tables, it can be safely assumed that as per as the alluvial plains type of Sal is concerned, the average quality in the division would be I/II. The average quality for the Khasi-Hills type Sal would of course be lower.

Teak: The measurement of sample plots in the teak plantations of the division maintained by the silviculturist are produced below:

Plot No.	Age (Year)	Top height (m)	Main Crop Diameter (cm)	No. of stems per hectar.
Kamrup	22	27.1	24.6	297
SP8A	23	22.0	20.2	359
SP9	36	29.3	32.5	138
SP5	89	34.4	56.7	100

The yield and stand tables for teak plantation compiled in FRI (Indian Forest Records. Vol. 9, No. 4, 1959), show the following as the top height (converted to metric unity) by site quality for corresponding age.

Age Year	Quality-I Range (m)	Top height Mean (m)	Quality-II Range (m)	Top height mean (m)
22	22.6 to 27.4	25.0	17.4 to 22.6	19.8
23	22.9 to 28.0	25.3	17.7 to 22.9	20.4
36	27.1 to 32.6	29.9	21.3 to 27.1	24.4
89	37.2 to 44.5	40.8	30.2 to 37.2	33.8

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

Statistics of yield-Sal: From the timber marking register of the different Ranges of the Division, the figures of outturn (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 area furnished below:

Diameter class(BHD overbark) (cm)	No. of trees in the Diameter class for which record of outturn elicited	Volume in m3 (under bark)
Over 20 to 30	180	0.20
Over 30 to 40	860	0.60
Over 40 to 50	1430	1.0
Over 50 to 60	1218	1.51
Over 60 to 70	927	2.10
Over 70 to 80	241	2.80
Over 80 to 90	90	3.66
Over 90 to 100	30	4.80
Over 100	11	5.95

1. The record of outturns of three clear-felling coupes in the 1982 teak plantation at Kulsu during 1958-59 were traced out from the timber marking registers and the diameters and outturns (commercial volume in the round) were classified into 10 cm diameter classes. The average volume for each coupe for a diameter class were plotted against the average diameter for the class and smooth. The average 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:

Diameter class (DBH overbark) (cm)	No. of trees in the Diameter class for which record of outturn available	Volume (ever bark) (c.m3)
Over 20 to 30	20	0.34
Over 30 to 40	153	0.60
Over 40 to 50	70	0.91
Over 50 to 60	42	1.39
Over 60 to 70	18	2.05
Over 70 to 80	7	2.95

These figures are rather old and the commercial volume for a tree of each diameter class is likely to be more on the basis of currency trend of utilization and hence the data above would serve the purpose of a rough estimate only.

2. In the course of a survey of plantations in the division, small plots (04 Ha each) for sampling were laid out the thinned in the Teak plantation of different ages. Complete conversion of trees felled during

such thinning were carried out and the data on yield of thinning were collected. The figures given below are overage of figures form a few such sampling plots in the Teak plantations of Loharghat and Kulsi Ranges.

Table.12.1.a Yield/Hectare in thinning of Teak Plantations:

Age	No of plots thinned area (Ha)	Yield per Hectare in terms of				Small wood stacked m3	Total timber & small wood m3
		Logs m3 overbark 61 to 121cm mid girth	Poles (m3. Overbark)		Total timber (m3, ob3)		
			30 to 40 cm mid girth	45 to 60 cm mid girth			
5	2 = 0.08	-	-	-	-	5.06	5.06
10	5 =0.80	-	1.870	1.385	9.55	14.405	23.66
15	2 = 0.08	-	1.612	9.287	10.899	24.987	35.988
25	3 = 0.12	-	1.637	17.850	19.477	13.350	32.837
35	3 = 0.12	5.162	1.208	18.708	25.078	25.078	33.553

Table.12.1.b. Volume class for important tree species

Name of Species	Volume in cubic meter for dia classes in centimeters											
	10-20	21-30	31-40	41-50	51-60	61-70	71- 80	81- 90	91-100	01-110	11-120	120 & above
Bonsum	0.29	0.53	0.79	1.42	1.65	2.49	3.32	4.20	5.12	5.93	6.92	8.09
Sopa	0.58	1.02	1.48	1.94	2.42	3.40	4.10	5.40	6.94	8.4	9.90	12.00
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	4.24	4.94	5.64	6.23
Sida	0.30	0.52	0.77	1.20	1.89	2.60	3.24	-	-	-	-	-
M.Sal	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	-	-
Jam	0.37	-	-	-	-	-	-	-	-	-	-	-
Bogipoma	0.21	0.44	0.72	1.08	1.41	1.91	2.56	3.46	4.40	5.57	6.80	8.06
Am	0.15	0.36	0.54	0.82	1.11	1.74	2.40	3.17	4.00	5.11	6.10	7.10

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

During forest inventory the data on above ground biomass and soil carbon is collected from each sample plot. For collecting soil carbon, two sub-plots of size 1m×1m were laid out within the main plot and at the centre of these two sub-plots, a pit of 30cm × 30cm × 30cm was dug and a composite sample of soil weighing 150 gm was kept for organic carbon analysis. Samples of soil were analysed and were used for carbon calculation. Below ground biomass was being calculated using a relationship (usually a root-to-shoot ratio) to above ground biomass which had been established by

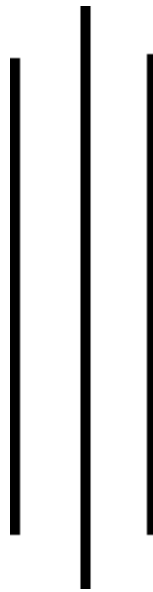
FRI. GPG also provided default ratios for six major global forest types. FSI had selectively used these defaults to arrive at the carbon number. The forest Carbon stock was analysed for different species under different girth classes. It was found that carbon content was maximum under girth class >180 cm. A direct relationship was found between girth class and carbon. Average carbon content in different girth class is shown in table 12.2.a

Table 12.2.a Forest carbon stock under different diameter classes

Dia Class(M)	Count of spp.	Carbon content
<0.1	260	17.59
0.1-0.2	11043	1870.92
0.2-0.3	6677	3251.57
0.3-0.4	1454	1531.70
0.4-0.5	554	1040.16
0.5-0.6	254	656.57
0.6-0.7	87	339.18
0.7-0.8	63	391.50
0.8-0.9	53	289.28
>0.9	62	700.74

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PART II



FUTURE MANAGEMENT

CHAPTER - I

BASIS OF PROPOSAL

The Working Plan of Kamrup West Division is a technical document prepared to manage the forests under Kamrup West Division on sustainable basis. The overall objective of the Working Plan is to increase area under forest cover, enhance biodiversity, improve growing stocks and maintain the environmental stability in the areas under the Division.

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 blow downs, 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 under storey (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, *understorey reinitiation*, involves further disturbance and the creation of gaps; at this point stratification develops, with layers of canopy, midstorey, and understorey appearing. The final stage, known as *old-growth*, is the extension and completion of the understorey reinitiation; a complex multi-aged and multi-layered forest has developed.

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

1.1(III) Forests and Water: Water is the most vital element of all natural resources and is essential to life. Forests and woodlands have a close relationship with our water resources, and forest management and water quality are closely linked. It is widely recognised that sustainably managed forests play an important role in maintaining water quality. Through stabilisation of soil, forests minimise erosion and hence reduce the impairment of water quality due to sedimentation. Woodlands protect water bodies and watercourses by trapping sediments and pollutants from other up-slope land use and activities. Forests also play a role in water availability. They influence the amount of available water by intercepting precipitation, evaporating moisture from vegetative surfaces, transpiring soil moisture, capturing fog water and maintaining soil infiltration. At the same time, forests may influence the timing of water delivery by maintaining and improving soil infiltration and the soil's water-storage capacity.

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

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

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

- **Combating 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 giga tonnes 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(VII) Tool for integrated development: This Working Plan may be a tool for integrated development. The main objective of integrated development is to provide employment opportunities to the poor as well as to provide opportunities to develop their skill sets so as to improve their living conditions. This Working Plan emphasizes in upliftment of socio-economic condition the village community. Working in convergence with other line departments for upliftment of socio economic condition of rural people shall be emphasized. Details are mentioned in para 9.15, chapter-9 of Part- II.

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

- i) To restock the depleted and degraded forests with its origin indigenous variety of species (Sal) under intensive system of management with the aim of attainment of normal forest in due course.
- ii) To protect the forest from various forest depletion drivers e.g., illegal felling, encroachments and other anthropogenic factors.
- iii) To improve of degraded habitat of wildlife ensuring availability of basic habitat formation criteria e.g, food, water and shelter. Biodiversity conservation shall be one of the prime agendas.
- iv) To retain and enrich all the moist deciduous forests of comparatively poor value by raising plantations of more valuable indigenous species.
- v) To protect the crests, ridges and steep slopes from the point of view of watershed management and soil conservation.

- vi) To protect and preserve some of the miscellaneous forests in its present state to maintain bio-diversity by a system involving least disturbance to the forest cover.
- vii) To raise plantations of timber species, fuel wood and minor forest produce with people's participation for household requirement and economic upliftment of the communities who are bonafide residents of the Reserved Forests of the Division and also those living in the outskirts of the Reserved Forests & proposed Reserved Forests to save the Forests from rampant destruction.
- viii) To improve the living conditions of tribals and forest dependent communities through sustainable harvest of non timber forest products.
- ix) To protect the forest areas outside the Protected Areas (PA) for protection and conservation of wildlife.

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

Irregular Shelterwood system, structurally different from even-aged and balanced uneven-aged forest, is a silvicultural system most desirable for maintenance or restoration of irregular stand (forest) especially for ecosystem-based management. This silvicultural system is compatible with ecosystem-based management in forest types driven by partial stand mortality and gap dynamics and provides opportunities for maintaining old-growth forest attributes. This is a system involving successive regeneration with a long and indefinite period of regeneration. The aim is to produce more or less even aged crops.

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 coppices 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 with uneven-aged stands and Coppice system deals with even-aged forest.

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

- iii) Special habitat management for wildlife conservation will receive high priority. There are areas preferred by migrating, straying wildlife especially members of cat family.
- iv) Kamrup West 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 forest areas.
- v) Preference will be accorded to natural regeneration and promising coppice growth will receive suitable tending and soil working to stimulate growth and development.
- vi) Artificial regeneration will be used as supplementary activity, at places, where natural regeneration is inadequate or is not likely to succeed.
- 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 the village.
- ix) Management of forests close to villages shall primarily be done through JFM committees.
- x) Sustainable Non-Timber Forest Produce (NTFP) production will be given high priority in the forest management.
- 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 livestock improvement.
- xii) Involving local people in managing forests and generating awareness in rural and tribal areas is considered indispensable for the forest conservation.
- xiii) Reducing biotic pressure on forests, particularly, illicit felling, unsustainable grazing, fire and encroachment near villages will be considered on priority basis.
- xiv) Forests capable of producing medium to large sized timber will be harvested under the Selection-Cum-Improvement management system.
- xv) Boundary demarcation will be carried out in time-bound manner for ensuring territorial integrity of forests.
- xvi) Action will be taken to convert all the miscellaneous forests adjoining the Reserved Forests and large patches, away from villages into Reserved Forests.

1.3 Constitution of Working Circles: The working circles proposed and approved in Preliminary Working Plan Report (PWPR) for Kamrup West forest division are as follows:

1. Sal Regeneration Working Circle
2. Teak Regeneration Working Circle
3. Joint Forest Management Working Circle
4. Forest Protection (Overlapping) Working Circle.
5. Non Timber Forest Produce (Overlapping) Working Circle.
6. Wildlife Management (Overlapping) Working Circle

1.3.1 Justification for constitution of the Working Circles:

1. Sal Regeneration Working Circle: The main objective of the Working Circle is to raise large areas under aided natural regeneration supported by artificial regeneration. Opportunity of good seed year of Sal which occurs every 3rd year shall be taken. In the previous Working Plan, Clear felling system was replaced by Shelter Wood System; but was not materialized due to the reasons mentioned in previous chapter. Maximum numbers of harvestable Sal trees were exploited by illegal felling leaving less than minimum required trees per hectare for sheltering natural regeneration. Coppices of these stumps are coming up and attained pole size. Now these coppice forests are to be protected with intensive care. So, the method to be adopted is suggested, combination of Irregular shelterwood system and Coppice system. Combination of both these systems will improve the forest with heterogeneous nature suitable for biodiversity enrichment. All the compartments containing Kamrup Alluvial Plain Sal and Hill Sal have been placed in this Working Circle. Teak plantations up to the extent of 10 Ha raised in such compartments in the past is also included in this Working Circle. 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.

2. Teak Regeneration Working Circle: All the Forest areas covered under moist mixed deciduous formations in the hill slopes, crest, ridges, spurs as well as the existing teak plantation have been allotted to this working circle. The silvicultural operations viz. climber cutting, weeding and thinning shall be allowed. Maximum numbers of harvestable Teak trees were exploited by illegal felling leaving less than minimum required trees per hectare for sheltering natural regeneration. Coppices of these stumps are coming up and attained pole size. Now these coppice forests are to be protected with intensive care. So, the method to be adopted is suggested, combination of Irregular shelterwood system and Coppice system. Combination of both these systems will improve the forest with heterogeneous nature. There will not be any harvesting in this plan period.

3. Joint Forest Management (Overlapping) 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 along with 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 Rules 1998."*

This Working Circle shall include the entire existing plantation in this division raised with the help of JFMCs under different schemes. The areas allotted to this Working Circle will mainly consist of fringe forest areas that are poorly stocked or 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.

4. Wildlife Management (overlapping) Working Circle: Kamrup West Division lies, Zoo-Geographically under traditional zone between Indian Sub Region and Indo-Chinese sub region of oriental region. As a result, there is intermingling of species of both region. Though previously this region was very rich in diversity of its wildlife, at present diversity has been reduced. The man-elephant conflict which is a main issue as regards to wildlife management of the Division will be taken into account besides improvement of wildlife habitat. The biotic factor which acts as forest destruction driver is destroying the wildlife habitat too. Prevention measures against such destructive issues shall be undertaken.

5. Non Timber Forest Produce (overlapping) Working Circle: The NTFP working circle shall comprise largely of fringe forest areas or such other areas, which according to WPO, are fit for extraction of 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 present and future generation. 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 period 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. NTFP 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. The Kamrup West Forest Division consist of various NTFP such as broom grass, kher, honey, nageswar along with the various medicinal and aromatic plants.

This Working Circle aims at the production and harvesting of high quality bamboo on a sustainable basis. All the poorly stock bamboo bearing areas, particularly, in the fringe areas, shall be restocked with indigenous and commercially harvestable species. The Working Circle shall not only meet the demands of Paper Mill, Households, Crafts and Cottage Industries but also provide proper facilities for processing, storing and marketing of bamboo.

6. Forest Protection (Overlapping) Working Circle: Forests of Kamrup West Division are under tremendous pressure from encroachment, illicit felling, grazing besides other anthropogenic activities. As per Land use change analysis, significant forest area has been lost during last couple of decades. Growing Stock of the forest has been exhausted to such an extent that almost all harvestable trees have been removed illegally by timber smugglers leaving the landscape as an open forest. Satellite imagery of the landscape shows mainly scrub forest in places of high forest which used to be existed 20 years back. It is need of hour to protect the last vestiges of the rich growing stock checking further deterioration. The activities of Forest Protection are control and combating Illicit felling, checking Illegal encroachment, protection from various forest degradation drivers i.e., fire, poaching, hunting, killing of wild animals, smuggling etc. All these protection activities are incorporated in an overlapping working

circle applicable to entire Division with priorities starting from problematic areas. Creation of base camps, strike forces, mobile parties, flying squad parties, engagement of professional lawyers for prosecuting the offenders and confiscation of forest produce with vehicles, illegal encroachment eviction forces, watch towers, wildlife protection force etc. shall be the major activities under this working circle.

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.

1.5 Compartment wise forest area earmarked for different Working Circles

Compartment wise area distribution in various Working Circle are given as under.

Table: 1.5a Compartment wise forest area earmarked for different Working Circles

Name of W.S.	Name Reserved Forest	Compartment No.	Area in Ha	Net workable area	Sal WC	Teak WC	Area allotted in JFMC Overlapping W.C.	Area allotted in NTFP Overlapping W.C.
Loharghat	Mayang Hill	1	348.772	250.00	348.772	-	100.00	10.00
	Mayang Hill	2	531.560	375.00	-	531.560	100.00	-
	Mayang Hill	3	783.697	500.00	783.697	-	100.00	-
	Mayang Hill	4	360.899	310.00	-	360.899	100.00	15.00
	Mataikhar R F	1	558.057	400.00	783.697	-	100.00	-
	Mataikhar R F	3	579.850	400.00	783.697	-	100.00	10.00
	Mataikhar R F	2	546.929	490.00	-	546.929	100.00	10.00
W.S. Total			3709.764	2725.00	2699.863	1439.388	700.00	45.00
Kulsi	Kulsi R F	7	337.080	186.00	-	337.080	100.00	20.00
	Kulsi R F	1	154.468	75.00	-	154.468	75.00	-
	Kulsi R F	2	58.0158	44.00	-	58.0158	-	-
	Kulsi R F	6	114.162	59.00	-	114.162	-	-
	Kulsi R F	9	210.066	50.00	-	210.066	100.00	10.00
	Kulsi R F	8	226.925	170.00	-	226.925	100.00	10.00
	Kulsi R F	3	37.688	32.00	37.688	-	-	-
	Kulsi R F	4	192.577	130.00	192.577	-	-	-

	Kulsi R F	5	270.733	170.00	-	270.733	100.00	10.00
W.S. Total			1601.715	916.00	230.265	1371.45	475.00	50.00
Bamunigaon	Milmilia R F	1	167.251	100.00	167.251	-	100.00	10.00
	Milmilia R F	2	59.800	25.00	59.800	-	-	-
	Milmilia R F	3	91.593	60.00	91.593	-	-	-
	Milmilia R F	4	233.744	190.00	233.744	-	150.00	12.00
	Milmilia R F	5	88.785	65.00	88.785	-	50.00	10.00
	Milmilia R F	6	87.440	45.00	87.440	-	40.00	10.00
	Milmilia R F	7	287.931	170.00	287.931	-	200.00	10.00
	Milmilia R F	8	304.381	200.00	304.381	-	100.00	12.00
	Milmilia R F	9	342.312	210.00	342.312	-	200.00	10.00
	Milmilia R F	10	240.244	160.00	240.244	-	100.00	-
	Chhaygaon	1	71.065	45.00	-	71.065	-	-
	Chhaygaon	2	334.472	300.00	-	334.472	200.00	-
	Chhaygaon	3	544.218	430.00	544.218	-	300.00	10.00
	Chhaygaon	4	161.749	100.00	-	161.749	100.00	10.00
	Chhaygaon	5	144.675	95.00	144.675	-	55.00	8.00
	Khaksi Sikrabura	6	320.176	200.00	320.176	-	100.00	-
	Khaksi Sikrabura	1	117.132	80.00	117.132	-	-	-
	Khaksi Sikrabura	2	54.022	42.00	54.022	-	-	-
	Khaksi Sikrabura	3	101.741	72.00	-	101.741	25.00	10.00
	Khaksi Sikrabura	7	85.120	65.00	85.120	-	25.00	10.00
	Khaksi Sikrabura	4	142.612	118.00	-	142.612	65.00	12.00
	Khaksi Sikrabura	5	141.138	100.00	141.138	-	-	-
	Melaghat	1	362.606	271.00	362.606	-	200.00	10.00
	Dumpara	1	193.443	177.00	193.443	-	100.00	10.00
	Simla	1	126.264	90.00	126.264	-	55.00	-
	Gohaingurung	1	125.455	96.00	125.455	-	45.00	-
	Dudhkhuri	1	98.340	86.00	98.340	-	85.00	-
	Dimali	1	52.610	42.00	52.610	-	25.00	10.00
	Ghoraputa	1	47.753	31.00	47.753	-	-	-
	Dhuniagaon	1	36.422	23.00	36.422	-	20.00	10.00
W.S. Total			5164.494	3688.00	4352.855	811.639	2340.00	174.00
Singra Range	Moman R F	H1	400.303	345.00	-	400.303	200.00	-
	Moman R F	H2	265.143	250.00	-	265.143	200.00	10.00
	Moman R F	H3	421.966	420.00	-	421.966	200.00	10.00
	Moman R F	H4	981.848	793.00	-	981.848	400.00	10.00
	Moman R F	P1	417.086	400.00	417.086	-	300.00	-
	Moman R F	P2	90.934	50.00	90.934	-	50.00	-
	Moman R F	P3	112.439	90.00	112.439	-	100.00	10.00
	Moman R F	P4	572.125	529.00	572.125	-	-	12.00
	Moman R F	P5	239.715	223.00	239.715	-	-	10.00
	Jharikhuri R F	1	457.663	400.00	457.663	-	400.00	-
	Jharikhuri R F	2	638.056	600.00	638.056	-	600.00	11.00
	Jharikhuri R F	3	127.505	100.00	127.505	-	100.00	-
	Luki R F	3	338.210	290.00	338.210	-	200.00	10.00
	Luki R F	1	96.861	80.00	96.861	-	50.00	10.00
	Luki R F	2	324.013	267.00	324.013	-	200.00	-
	Sursuria	1	389.720	350.00	389.720	-	300.00	-
	Taraibari	1	319.303	280.00	319.303	-	200.00	10.00
	Khatkhathi Hill	1	248.482	225.00	-	248.482	100.00	10.00
	Mugakhal	1	129.097	119.00	129.097	-	100.00	10.00
	Garubaldha	1	110.076	90.00	110.076	-	100.00	-
	Khurkhuri	1	66.167	50.00	66.167	-	20.00	10.00
W.S. Total			6746.713	5609.00	4428.97	2317.742	3820.00	133.00
Bondapara	Gizang R F	H1	913.762	900.00	-	913.762	100.00	10.00

	Gizang R F	H2	1311.594	1300.00	-	1311.594	100.00	10.00
	Gizang R F	P3	235.823	123.00	235.823	-	150.00	-
	Gizang R F	P2	237.425	160.00	237.425	-	150.00	-
	Gizang R F	P1B	165.349	93.00	165.349	-	100.00	11.00
	Gizang R F	P1A	495.480	272.00	495.480	-	100.00	12.00
	Nampathar R F	U2	234.442	125.00	234.442	-	100.00	12.00
	Nampathar R F	D5	179.089	100.00	-	179.089	100.00	11.00
	Nampathar R F	D3B	81.207	50.00	-	81.207	100.00	-
	Nampathar R F	D3A	72.321	50.00	-	72.321	100.00	-
	Nampathar R F	U3	177.316	100.00	-	177.316	100.00	-
	Nampathar R F	D4	281.499	200.00	-	281.499	100.00	10.00
	Nampathar R F	D2	99.648	29.00	99.648	-	45.00	12.00
	Nampathar R F	D1	117.242	42.00	117.242	-	100.00	10.00
	Nampathar R F	U1	98.632	93.00	98.632	-	100.00	10.00
	Barjuli R F	3B	234.548	165.00	234.548	-	50.00	10.00
	Barjuli R F	1	396.042	225.00	396.042	-	100.00	11.00
	Barjuli R F	3A	279.414	164.00	279.414	-	100.00	11.00
	Barjuli R F	2	165.534	140.00	165.534	-	100.00	11.00
	Boradova	1	434.641	329.00	434.641	-	100.00	10.00
	Singra (part I)	1	379.080	342.00	379.080	-	100.00	10.00
	Jaipur	1	326.183	286.00	326.183	-	100.00	11.00
	Khatajuli	1	110.160	80.00	110.160	-	100.00	10.00
	Singra (part II)	1	95.180	80.00	95.180	-	100.00	10.00
	Mahipara	1	93.980	40.00	93.980	-	100.00	10.00
W.S. Total			7215.591	5488.00	4198.803	3016.788	2495.00	212.00
Bamunigaon- Singra	Bogaikhas R F	1	707.733	600.00	-	707.733	100.00	10.00
	Bogaikhas R F	2	819.126	685.00	-	819.126	20.00	20.00
	Bogaikhas R F	3	483.010	350.00	-	483.010	20.00	25.00
	Bogaikhas R F	4	536.686	400.00	-	536.686	80.00	50.00
	Bogaikhas R F	5	687.551	515.00	-	687.551	80.00	45.00
	Bogaikhas R F	6	945.932	800.00	-	945.932	100.00	32.00
	Bogaikhas R F	8	815.435	690.00	-	815.435	100.00	35.00
	Bogaikhas R F	7	786.374	650.00	-	786.374	100.00	30.00
	Bogaikhas R F	9	514.044	400.00	-	514.044	100.00	28.00
	Bogaikhas R F	10	846.344	650.00	-	846.344	150.00	22.00
	Bogaikhas R F	11	889.210	680.00	-	889.210	200.00	18.00
	Bogaikhas R F	12	733.606	580.00	-	733.606	85.00	33.00
	Bogaikhas R F	13	873.423	700.00	-	873.423	200.00	38.00
	Bogaikhas R F	14	973.484	770.00	-	973.484	50.00	35.00
	Bogaikhas R F	15	550.500	400.00	-	550.500	200.00	36.00
	Bogaikhas R F	16	970.783	805.00	970.783	-	300.00	20.00
	Bogaikhas R F	17	1177.738	800.00	1177.738	-	200.00	18.00
	Bogaikhas R F	18	1052.970	840.00	1052.970	-	100.00	16.00
	Bogaikhas R F	19	577.223	350.00	577.223	-	100.00	12.00
	Bogaikhas R F	20	876.759	700.00	876.759	-	100.00	14.00
	Bogaikhas R F	21	839.076	700.00	839.076	-	20.00	16.00
	Bogaikhas R F	22	884.242	600.00	884.242	-	200.00	30.00
	Bogaikhas R F	23	897.741	605.00	897.741	-	50.00	33.00
	Bogaikhas R F	24	411.841	300.00	411.841	-	200.00	38.00
	Bogaikhas R F	25	863.242	600.00	863.242	-	300.00	50.00
	Bogaikhas R F	26	1052.631	815.00	1052.631	-	100.00	50.00
	Bogaikhas R F	27	918.061	715.00	918.061	-	100.00	45.00
W.S. Total			21684.770	16700.00	10522.31	11162.46	3355	799.00
Bamunigaon- Kulsi	Pantan R F	H6	915.686	715.00	915.686		200.00	-
	Pantan R F	K6	89.605	50.00	89.605		50.00	25.00
	Pantan R F	1A	256.851	195.00	256.851		200.00	20.00

	Pantan R F	1B	103.154	85.00	103.154	-	300.00	15.00
	Pantan R F	C2	478.773	300.00	478.773	-	200.00	16.00
	Pantan R F	C1	362.059	215.00	362.059	-	100.00	20.00
	Pantan R F	H11	1060.835	750.00	-	1060.835	100.00	20.00
	Pantan R F	H9	370.482	200.00	-	370.482	100.00	22.00
	Pantan R F	H10	1003.323	740.00	-	1003.323	20.00	25.00
	Pantan R F	H8	665.567	300.00	665.567	-	100.00	25.00
	Pantan R F	H5	493.441	315.00	493.441	-	20.00	30.00
	Pantan R F	H7	611.903	405.00	611.903	-	20.00	25.00
	Pantan R F	H4	269.769	120.00	269.769	-	55.00	27.00
	Pantan R F	H3	263.367	130.00	263.367	-	25.00	29.00
	Pantan R F	H2	266.034	160.00	266.034	-	18.00	30.00
	Pantan R F	H1	291.944	180.00	291.944	-	100.00	32.00
	Pantan R F	C5	233.298	190.00	-	233.298	300.00	-
	Pantan R F	C4	147.872	90.00	-	147.872	200.00	-
	Pantan R F	C3	254.600	195.00	-	254.600	100.00	-
	Pantan R F	2	686.321	260.00	686.321	-	300.00	-
	Pantan R F	3	355.661	285.00	355.661	-	200.00	-
	Pantan R F	4	943.623	700.00	943.623	-	100.00	-
	Pantan R F	5	552.000	415.00	552.000	-	150.00	-
W.S. Total			10676.170	6995.00	7605.758	3070.41	2938.00	361.00
Kulsi-Loharghat	Barduar R F	1	206.041	180.00	-	206.041	100.00	-
	Barduar R F	2	72.330	50.00	-	72.330	20.00	-
	Barduar R F	3	34.919	20.00	-	34.919	20.00	-
	Barduar R F	4A	128.975	90.00	-	128.975	55.00	17.00
	Barduar R F	4B	77.642	50.00	-	77.642	25.00	15.00
	Barduar R F	5	121.013	80.00	121.013	-	18.00	16.00
	Barduar R F	H1	154.797	100.00	154.797	-	100.00	14.00
	Barduar R F	H2	197.101	125.00	197.101	-	50.00	28.00
	Barduar R F	H3	337.873	300.00	337.873	-	100.00	22.00
	Barduar R F	H4	387.433	300.00	387.433	-	100.00	24.00
	Barduar R F	H5	214.214	180.00	214.214	-	100.00	30.00
	Barduar R F	H6	345.151	290.00	345.151	-	200.00	15.00
	Barduar R F	H7	530.059	420.00	530.059	-	300.00	20.00
	Barduar R F	C1	195.204	125.00	-	195.204	100.00	18.00
	Barduar R F	C2	64.744	50.00	-	64.744	20.00	15.00
	Barduar R F	C3	183.775	120.00	-	183.775	20.00	17.00
	Barduar R F	C4	68.221	40.00	-	68.221	85.00	23.00
	Barduar R F	KG1	90.589	60.00	90.589	-	50.00	14.00
	Barduar R F	KG2	195.409	120.00	195.409	-	100.00	10.00
	Barduar R F	KG3	56.450	40.00	56.450	-	20.00	28.00
	Barduar R F	KG4	170.051	120.00	170.051	-	100.00	-
	Barduar R F	KG5	257.664	200.00	257.664	-	200.00	-
	Barduar R F	KG6	521.477	485.00	521.477	-	335.00	-
	Barduar R F	KG7	133.273	100.00	133.273	-	100.00	-
	Barduar R F	KG8	304.375	260.00	304.375	-	100.00	-
	Barduar R F	KG9	594.298	500.00	594.298	-	400.00	-
	Barduar R F	KG10	78.787	50.00	78.787	-	100.00	-
	Barduar R F	KG11	83.250	55.00	83.250	-	100.00	-
	Barduar R F	KG12	506.538	405.00	506.538	-	400.00	-
	Barduar R F	KG13	803.192	700.00	803.192	-	200.00	-
W.S. Total			7114.845	5615.00	6082.994	1031.851	3598.00	326.00
Division Total			63914.060	47736.00	39692.33	24221.73	13575.00	2100.00

Net workable area= Gross area of Compartment - (Ridge & crest + Area under Water Body/marshy land + area under Forest Village + area under encroachment)

CHAPTER 2

SAL REGENERATION WORKING CIRCLE

2.1 Name of the Working Circle: Sal Regeneration Working Circle. The detail map of this working circle is shown in Plate 2.1.

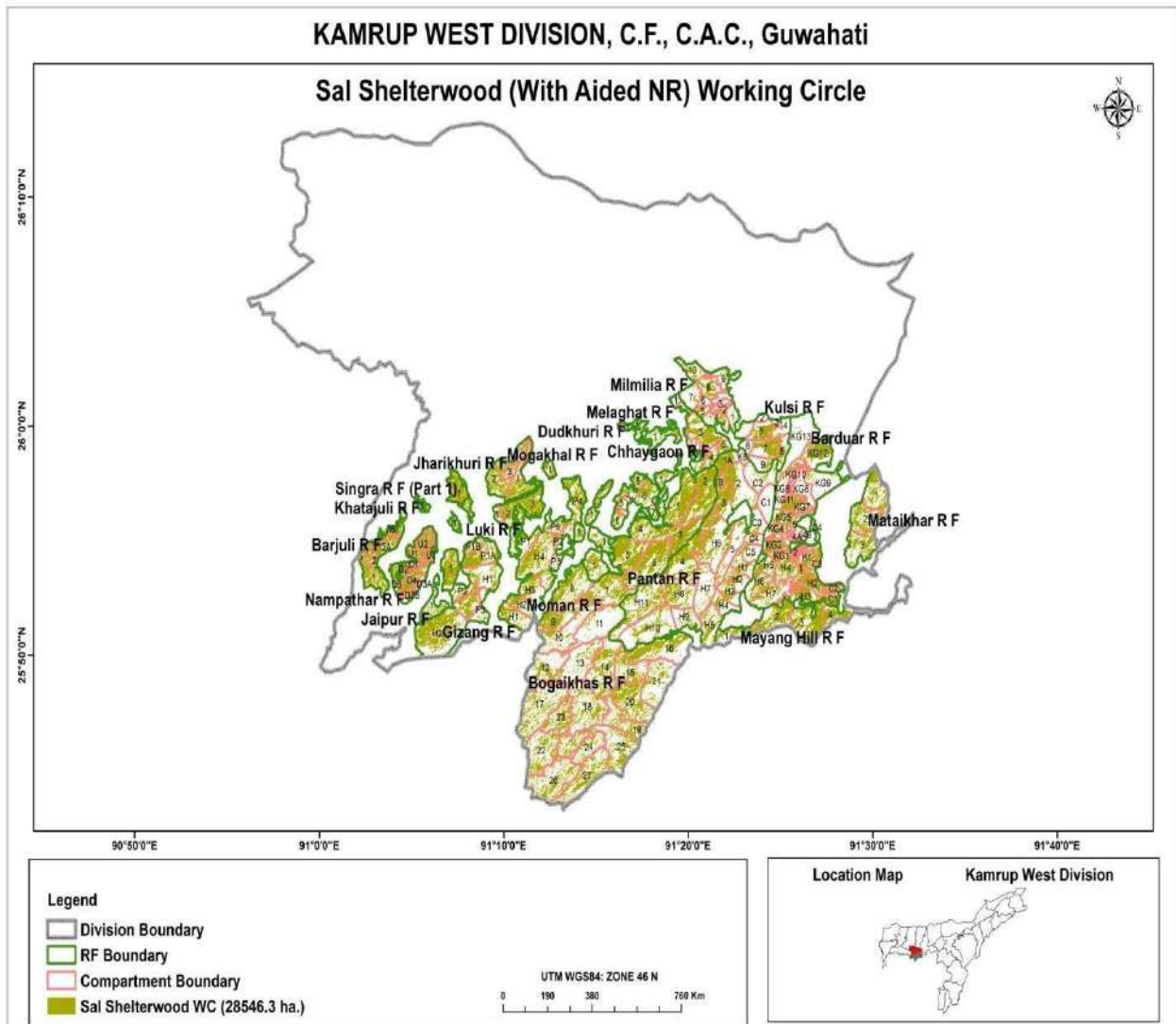


Fig. 2.1. Sal Regeneration Working Circle of Kamrup West Division

2.2 General constitution of 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 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. This working circle comprises of all commercially important and well stocked forests of Sal situated on the almost flat floor, the lower slopes of the Khasi hills.

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 Assisting Natural Regeneration (A.N.R) and supplementary planting of Sal and its associates in the Sal growing areas.

Objectives of the Working Circle: The broad objective of this working circle is to improve the Sal stocks of the forest of this division by regeneration and gap filling. Specific objectives are given below:

- i) To regenerate naturally the Sal growing areas by nursing the existing coppice and seedling supported by artificial regeneration process (ANR), in gaps planting of Sal associates wherever necessary is recommended.
- ii) To assist vigorous growth of existing suppressed young crop by creating adequate space for them.
- iii) To conserve and to maintain the existing Sal ecosystem in the interest of soil, water and environment;
- iv) To achieve normal forest by manipulating towards normal distribution of age classes; and
- v) Consistent with the above, to obtain maximum possible sustained yield of large timber.

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 monospecific. *Shorea robusta* has contributed about 90% of the total stand density (2559 individual per hectare) of the forest, while species like *Erythrina suberosa*, *Delonix regia* and *Pterospermum acerifolium* 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 M² and 63 individuals per M², respectively. Based on the dominance, *Shorea robusta* showed highest dominance followed by *Zizyphus rugosus*. 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.a Phytosociological analysis of trees, in Kamrup Sal forest stands

Name of Species	Family	Density/ha	Basal area (m ² /ha)	IVI	A/F ratio
Shorea robusta Gaertn.	Dipterocarpaceae	2431	26.087	212.67	0.972

Zizyphus rugosa Lam.	Rhamnaceae	29	0.18	13.33	0.047
Schima walichii (DC.) Korth.	Theaceae	22	0.172	8.39	0.096
Stereospermum personatum (Hassk. Chatt.	Bignoniaceae	13	0.135	7.94	0.059
Lagerstroemia speciosa (L.) Pers	Lythraceae	8	0.08	7.51	0.033
Streblus aspera Lour.	Moraceae	5	0.119	5.24	0.05
Trewia nudiflora L.	Euphorbiaceae	5	0.071	5.07	0.05
Tectona grandis L.	Verbenaceae	12	0.256	4.46	0.263
Alstonia scholaris L. R.Br.	Apocynaceae	4	0.064	4.24	0.06
Dillenia indica L.	Dilleniaceae	3	0.053	3.4	0.075
Actinodaphne obovata (Nees) Blume	Lauraceae	3	0.015	3.26	0.075
Spondias mangifera Willd.	Anacardiaceae	3	0.059	2.62	0.1
Talauma hodgsonii Hooker f. & T. Thomas	Magnoliaceae	3	0.045	2.57	0.1
Bauhinia purpurea L.	Leguminosae	3	0.029	2.51	0.1
Bischofia javanica Blume.	Euphorbiaceae	3	0.019	2.48	0.1
Syzygium cumini Linn.	Myrtaceae	2	0.033	1.72	0.15
Mallotus philippensis (Lam.) Muell.	Euphorbiaceae	2	0.026	1.7	0.15
Oroxylum indicum Vent.	Bignoniaceae	2	0.019	1.67	0.15
Callicarpa arborea Roxb.	Verbenaceae	2	0.018	1.67	0.15
Sterculia villosa Roxb.	Malvaceae	2	0.015	1.66	0.15
Cassia fistula L.	Leguminosae	2	0.015	1.66	0.15
Sapium baccatum Roxb.	Euphorbiaceae	2	0.01	1.64	0.15
Delonix regia (Boj.ex Hook.) Raf.	Leguminosae	1	0.045	0.97	0.3
Erythrina variegata L.	Leguminosae	1	0.007	0.83	0.3
Pterospemum acerifolium Willd.	Malvaceae	1	0.005	0.82	0.3

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

Scientific Name	Family	Density/ ha	IVI	A/F Ratio
Shrub layer				
Chromolaena odorata (L.) King & Robinson	Asteraceae	5147	37.45	1.033
Cledodendron viscosum Vent.	Verbenaceae	4627	36.1	0.805
Urena lobata L.	Malvaceae	4160	33.44	0.776
Flemingia strobilifera (L.) Aiton f.	Leguminosae	3573	29.21	0.836
Desmodium latifolium DC.	Leguminosae	1453	16.92	0.531
Lantana camara L.	Verbenaceae	280	5.9	0.506
Solanum torvum L.	Solanaceae	333	5.63	0.762
Rauvolfia tetraphylla L.	Apocynaceae	373	5.3	1.114
Rauvolfia serpentina Benth.	Apocynaceae	347	5.18	1.035
Cassia sophera L.	Leguminosae	387	4.85	1.571
Cannabis sativa Linn.	Cannabaceae	480	4.25	4.388
Leea indica (Burm.f.) Merr.	Vitaceae	120	3.63	0.488
Abutilon indicum L.(Sweet)	Malvaceae	213	3.54	1.248
Sida cordifolia L.	Malvaceae	160	3.3	0.936
Caesaria vereca Roxb.	Flacourtiaceae	93	2.99	0.546
Leea crispa L.	Vitaceae	53	2.3	0.488
Herbaceous layer				
Ageratum conyzoides L.	Asteraceae	52000	16.13	0.937
Xanthium strumarium Linn.	Asteraceae	32667	12.32	0.719
Commelina benghalensis Linn.	Commelinaceae	39000	11.43	1.582
Borreria articularis Linn.f.	Rubiaceae	37333	11.17	1.514
Cyperus brevifolius (Rottb.) Hassk	Cyperaceae	45333	10.92	3.604
Cynodon dactylon Pers.	Poaceae	42667	9.37	6.922
Mikania macrantha Kunth ex H.B.K.	Asteraceae	24667	8.42	1.362
Dryopteris spp.	Dryopteridaceae	24000	8.31	1.325
Centella asiatica Linn.	Apiaceae	24000	7.56	1.908
Spilanthes peniculata Wall. ex DC.	Asteraceae	24000	7.56	1.908
Oplismenus spp.	Poaceae	22000	7.24	1.749
Melastoma malabathricum L.	Melastomataceae	18667	7.1	1.226
Chrysopogon aciculatus (Retz.) Trin.	Poaceae	28000	7.06	4.543
Borreria hispida(Linn.) K. Schum.	Rubiaceae	21333	6.76	2.094
Costus speciosus (J. Konig) Smith	Costaceae	11333	6.32	0.626

Cleome viscosa L.	Capparidaceae	18667	5.96	2.319
Drymeria cordata (L.) Roem. & Schult.	Caryophyllaceae	16000	5.92	1.57
Achyranthes aspera L.	Amaranthaceae	18000	5.86	2.236
Oxalis corniculata L.	Oxalidaceae	21667	4.93	10.766
Crotalaria spp.	Leguminosae	6333	4.77	0.503
Polygonum hydropiper Linn.	Polygonaceae	18667	4.45	9.275
Justicia simplex D. Don	Acanthaceae	15333	4.31	4.876
Polia japonica Thunb.	Commelinaceae	15333	4.31	4.876
Amorphophallus campanulatus Roxb.	Araceae	5333	4.24	0.523
Leucas aspera (Willd.) Linn.	Lamiaceae	9667	4.17	1.568
Brunella vulgaris L.	Lamiaceae	9333	3.36	2.968
Polygonum chinense Linn.	Polygonaceae	12000	3.02	10.6
Crassocephalum crepidioides (Benth.) S.Moore	Asteraceae	6000	2.46	2.981
Cyperus rotundas Linn.	Cyperaceae	5333	2.35	2.65
Scoparia dulcis Linn.	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). Eight Working Series namely, Bondapara, Singra, Bamunigaon, Kulsi, Loharghat, Bagaikhas (Bamunigaon-Singra), Pantan (Bamunigaon-Kulsi) and Borduar (Kulsi-Loharghat) have been constituted in this Working Plan.

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). Compartment wise detail under the Sal regeneration working circle is shown below.

Table 2.5.a: Proposed area (ha) under Sal regeneration Working Circle of Kamrup West division

Name of Working Series	Name Reserved Forest	Compartment No.	Area in Ha	Density Sapling/ha	Growing Stock M ³ /Ha	Net workable area
Loharghat	Mayang Hill R F	1	348.772	246	19.48	200.00
	Mayang Hill R F	3	783.697	482	35.86	500.00
	Mataikhar R F	1	558.057	277	6.34	400.00
	Mataikhar R F	3	579.850	195	2.67	400.00
Total			2270.376			1500.00
Kulsi	Kulsi R F	3	37.688		2.06	32.00
	Kulsi R F	4	192.577	600	6.07	130.00
Total			230.265			162.00
Bamunigaon	Milmilia R F	1	167.251	140	0.11	100.00
	Milmilia R F	2	59.800	1050	12.64	25.00
	Milmilia R F	3	91.593		1.82	60.00
	Milmilia R F	4	233.744		2.87	190.00
	Milmilia R F	5	88.785		2.84	65.00
	Milmilia R F	6	87.440		2.96	45.00
	Milmilia R F	7	287.931	590	5.76	170.00
	Milmilia R F	8	304.381	690	2.76	200.00

	Milmilia R F	9	342.312	255	0.34	210.00
	Milmilia R F	10	240.244	385	1.32	160.00
	Chhaygaon R F	3	544.218	103	16.18	430.00
	Chhaygaon R F	5	144.675	160	10.45	95.00
	Khaksi Sikraborta	6	320.176	245	6.76	200.00
	Khaksi Sikraborta	1	117.132		8.19	80.00
	Khaksi Sikraborta	2	54.022		4.27	42.00
	Khaksi Sikraborta	7	85.120	470	5.83	65.00
	Khaksi Sikraborta	5	141.138		5.76	100.00
	Melaghat	1	362.606	686	6.67	271.00
	Dumpara	1	193.443	80	0.18	177.00
	Simla	1	126.264	1540	15.43	90.00
	Gohaingurung	1	125.455	2587	27.62	96.00
	Dudhkuri	1	98.340		37.17	86.00
	Dimali	1	52.610	1620	8.48	42.00
	Ghoraputa	1	47.753	480	2.36	31.00
	Dhuniagaon R F	1	36.422		7.00	23.00
Total			4352.855			3053.00
Singra	Moman R F	P1	417.086		3.31	400.00
	Moman R F	P2	90.934		7.59	50.00
	Moman R F	P3	112.439		6.73	90.00
	Moman R F	P4	572.125	235	6.02	529.00
	Moman R F	P5	239.715	45	10.26	223.00
	Jharikhuri R F	2	638.056	350	3.20	390.00
	Jharikhuri R F	1	457.663	260	4.20	268.00
	Jharikhuri R F	3	127.505		3.72	100.00
	Luki R F	3	338.210	350	2.90	290.00
	Luki R F	1	96.861	50	4.26	80.00
	Luki R F	2	324.013	500	7.89	267.00
	Sursuria	1	389.720		42.45	350.00
	Taraibari	1	319.303		2.23	280.00
	Mugakhal	1	129.097	45	1.21	119.00
	Garubaldha	1	110.076		12.99	90.00
	Khurkhuri	1	66.167	20	0.00	50.00
Total			4428.97			3576.00
Bondapara	Gizang R F	P3	235.823		3.29	123.00
	Gizang R F	P2	237.425		9.67	160.00
	Gizang R F	P1B	165.349		6.50	93.00
	Gizang R F	P1A	495.480	20	0.03	272.00
	Namphathar R F	U2	234.442	428	25.62	125.00
	Namphathar R F	D2	99.648		0.18	29.00
	Namphathar R F	D1	117.242		5.93	42.00
	Namphathar R F	U1	98.632		10.37	93.00
	Barjuli R F	3B	234.548		0.01	165.00
	Barjuli R F	1	396.042		1.58	225.00
	Barjuli R F	3A	279.414	83	1.82	164.00
	Barjuli R F	2	165.534	200	4.40	140.00
	Boradova	1	434.641	163	1.39	329.00
	Singra (part I)	1	379.080	203	3.00	342.00
	Jaipur	1	326.183	30	0.05	286.00
	Khatajuli	1	110.160	15	0.09	80.00
	Singra (part II)	1	95.180	1436	9.04	80.00
	Mahipara	1	93.980	43	2.56	40.00
Total			4198.803			2788.00
Bamunigaon-Singra	Bogaikhas R F	16	970.783	593	8.93	805.00
	Bogaikhas R F	17	1177.738	170	3.76	800.00
	Bogaikhas R F	18	1052.970	50	16.21	840.00
	Bogaikhas R F	19	577.223		12.29	350.00
	Bogaikhas R F	20	876.759	380	4.74	700.00
	Bogaikhas R F	21	839.076	305	11.73	700.00
	Bogaikhas R F	22	884.242	325	3.20	600.00

	Bogaikhas R F	23	897.741	95	9.24	605.00
	Bogaikhas R F	24	411.841	40	3.26	300.00
	Bogaikhas R F	25	863.242		9.80	600.00
	Bogaikhas R F	26	1052.631	245	2.88	815.00
	Bogaikhas R F	27	918.061		5.13	715.00
Total			10522.31			7830.00
Bamunigaon-Kulsi	Pantan R F	H6	915.686	572	28.07	715.00
	Pantan R F	K6	89.605		7.86	50.00
	Pantan R F	1A	256.851		26.30	195.00
	Pantan R F	1B	103.154		25.27	85.00
	Pantan R F	C2	478.773		9.66	300.00
	Pantan R F	C1	362.059		11.72	215.00
	Pantan R F	H8	665.567	340	48.80	300.00
	Pantan R F	H5	493.441	110	3.90	315.00
	Pantan R F	H7	611.903	225	9.42	405.00
	Pantan R F	H4	269.769	1065	13.56	120.00
	Pantan R F	H3	263.367		18.26	130.00
	Pantan R F	H2	266.034	315	45.90	160.00
	Pantan R F	H1	291.944		17.02	180.00
	Pantan R F	2	686.321	440	13.72	260.00
	Pantan R F	3	355.661	380	9.78	285.00
	Pantan R F	4	943.623	490	6.03	700.00
	Pantan R F	5	552.000	774	18.69	415.00
Total			7605.758			4830.00
Kulsi-Loharghat	Barduar R F	5	121.013	340	13.72	80.00
	Barduar R F	H1	154.797	300	30.79	100.00
	Barduar R F	H2	197.101	950	37.64	125.00
	Barduar R F	H3	337.873		3.96	300.00
	Barduar R F	H4	387.433	580	25.06	300.00
	Barduar R F	H5	214.214	748	28.63	180.00
	Barduar R F	H6	345.151	350	5.12	290.00
	Barduar R F	H7	530.059		13.97	420.00
	Barduar R F	KG1	90.589		15.94	60.00
	Barduar R F	KG2	195.409	235	19.36	120.00
	Barduar R F	KG3	56.450		16.38	40.00
	Barduar R F	KG4	170.051	555	1.19	120.00
	Barduar R F	KG5	257.664	560	5.34	200.00
	Barduar R F	KG6	521.477	895	20.36	485.00
	Barduar R F	KG7	133.273	90	1.86	100.00
	Barduar R F	KG8	304.375	250	2.66	260.00
	Barduar R F	KG9	594.298		3.83	500.00
	Barduar R F	KG10	78.787	20	0.88	50.00
	Barduar R F	KG11	83.250		20.38	55.00
	Barduar R F	KG12	506.538		8.38	405.00
	Barduar R F	KG13	803.192		0.16	700.00
Total			6082.994			4890.00
Division Total			39692.330			28629.00

Footnote: Net workable area= Gross area of Compartment - (Area under Ridge & crest + Area under Water Body/ marshy land + area under Forest Village + area under encroachment).

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 27.57m² per hectare. Presence of large number of individuals in the lower girth classes contributed the maximum basal area. The tree species *Shorea robusta* 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.

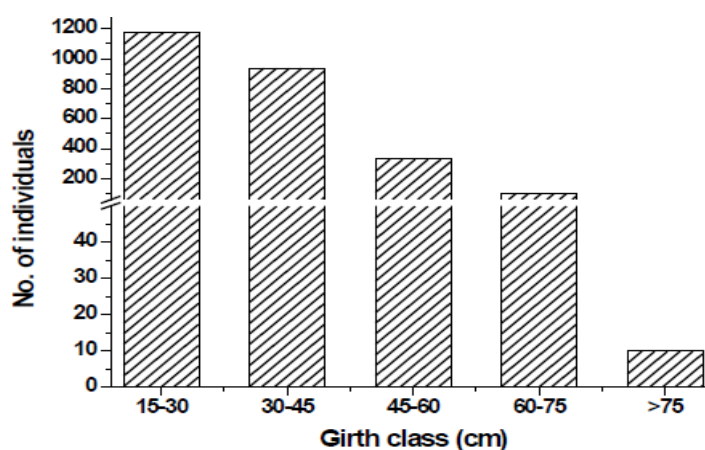


Figure: 2.6.1.a Girth class distribution of tree species

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

Table 2.6.1: Summary of Estimated Timber Volume (cum)

Forest Type	Forest Density	Girth Class						Total
		G1 (0.30-0.60)	G2 (0.61-0.90)	G3 (0.91-1.20)	G4 (1.21-1.50)	G5 (1.51-1.80)	G6 (>1.81)	
Mixed Moist Forest	D1	20493.63	44478.63	16519.83	24040.51	21168.36	39933.04	166634.00
	D2	49914.67	115089.85	45159.69	26094.49	20088.33	102043.88	358390.91
	D3	17699.41	22430.62	5082.72	5726.86	4588.78	15799.59	71327.98
	D4	4116.12	7262.56	4554.49	2791.43	3481.85	7558.10	29764.55
Kamrup Sal Forest	D1	23464.99	24878.48	25585.54	9731.05	9044.67	18919.54	111624.27
	D2	29545.26	61341.47	41480.04	55422.88	21143.91	58986.91	267920.47
	D3	27237.06	42743.64	17128.33	6321.94	8664.30	38494.72	140589.99
	D4	11277.99	14345.14	6277.24	2075.12	1708.98	13887.49	49571.96
Khasi Hill Sal Forest	D1	1242.10	3902.45	400.91	1199.72	5101.08	4895.83	16742.09
	D2	4079.87	14630.09	13756.01	1563.77	1608.33	3239.20	38877.27
	D3	1956.84	18708.93	8321.88	1296.71	3529.55	4131.49	37945.40
	D4	1806.57	6949.65	1966.59	5017.11	7971.28	6068.17	29779.37
Total		192834.51	376761.51	186233.27	141281.59	108099.42	313957.96	1319168.26

2.6.2 Silvicultural system: silvicultural system to be adopted is a **combination of Irregular Shelter Wood system and Coppice system**. Irregular Shelterwood system, structurally different from even-aged and balanced uneven-aged forest, is a silvicultural system most desirable for maintenance or restoration of irregular stand (forest) especially for ecosystem-based management. This silvicultural system is compatible with ecosystem-based management in forest types driven by partial stand mortality and gap dynamics and provides opportunities for maintaining old-growth forest attributes. This is a system involving successive regeneration with a long and indefinite period of regeneration. The aim is to produce more or less even aged crops.

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 coppices 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 with uneven-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) dia as 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 prescribed except 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 inter plant 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, *Michenea spp* 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 can not 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.

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

Name Reserved Forest	Compartment No.	Workable Area (Ha)	Y1 Ha	Y2 Ha	Y3 Ha	Y4 Ha	Y5 Ha	Y6 Ha	Y7 Ha	Y8 Ha	Y9 Ha	Y10 Ha
Mayang Hill R F	1	200.00	25	25	25	25	25	25	25	25	-	-

Mayang Hill R F	3	500.00	50	50	50	50	50	50	50	50	50	50
Gohaingurung	1	96.00	10	10	10	10	16	10	-	10	10	10
Dudhkhuri	1	86.00	10	10	10	15	11	-	10	10	10	-
Sursuria	1	350.00	35	35	35	35	35	35	35	35	35	35
Nampathar R F	U2	125.00	25	25	25	25	25	-	-	-	-	-
Barjuli R F	3B	165.00	20	20	20	30	25	20	-	10	10	10
Pantan R F	H6	715.00	75	75	75	75	75	75	75	75	75	40
Pantan R F	1A	195.00	20	20	20	20	20	20	20	20	20	15
Pantan R F	1B	85.00	20	20	20	15	10	-	-	-	-	-
Pantan R F	H8	300.00	30	30	30	30	30	30	30	30	30	30
Pantan R F	H2	160.00	20	20	20	20	20	20	20	20	-	-
Barduar R F	H1	100.00	15	15	15	15	15	15	10	-	-	-
Barduar R F	H2	125.00	25	25	25	25	25	-	-	-	-	-
Barduar R F	H4	300.00	30	30	30	30	30	30	30	30	30	30
Barduar R F	H5	180.00	20	20	20	20	20	20	20	20	20	-
Barduar R F	KG6	485.00	50	50	50	50	50	50	50	50	50	35
Barduar R F	KG11	55.00	20	20	15	-	-	-	-	-	-	-
Chhaygaon R F	3	430.00	50	50	50	50	50	50	40	40	25	25
Simla	1	90.00	30	30	30	-	-	-	-	-	-	-
Bogaikhas R F	18	840.00	80	50	50	100	100	80	80	100	100	100
Pantan R F	H3	130.00	20	20	20	20	20	15	15	-	-	-
Pantan R F	H1	180.00	20	20	20	20	20	20	20	20	20	-
Pantan R F	5	415.00	50	50	50	50	50	50	40	40	20	15
Barduar R F	KG1	60.00	10	10	10	10	10	10	-	-	-	-
Barduar R F	KG2	120.00	20	20	20	20	20	20	-	-	-	-
Barduar R F	KG3	40.00					-	-	10	10	10	10
Milmilia R F	2	25.00	25	-	-	-	-	-	-	-	-	-
Chhaygaon R F	5	95.00			-	-	-	25	-	20	25	25
Moman R F	P5	223.00	25	25	25	30	30	13	-	25	25	25
Garubaldha	1	90.00		40	-	-	-	-	25	-	-	25
Nampathar R F	U1	93.00	-	43	-	-	-	-	25	-	-	25
Bogaikhas R F	19	350.00	35	35	35	35	35	35	35	35	35	35
Bogaikhas R F	21	700.00	70	70	70	70	70	70	70	70	70	70
Pantan R F	C1	215.00	50	25	25	25	15	-	-	25	25	25
Pantan R F	H4	120.00	20	20	20	20	20	20	-	-	-	-
Pantan R F	2	260.00	25	25	25	50	30	30	-	25	25	25
Barduar R F	5	80.00	-	30	-	-	-	-	25	-	-	25
Barduar R F	H7	420.00	50	50	50	50	50	25	50	50	20	25
Mataikhar R F	1	400.00	50	50	50	50	50	50	25	25	25	25
Mataikhar R F	3	400.00	50	50	50	50	50	50	25	25	25	25
Kulsi R F	3	32.00	32	-	-	-	-	-	-	-	-	-
Kulsi R F	4	130.00	25	25	30	-	-	-	25	25	-	-
Milmilia R F	1	100.00	25	25	-	-	-	-	-	-	25	25
Milmilia R F	3	60.00	40	20	-	-	-	-	-	-	-	-
Milmilia R F	4	190.00	40	40	40	40	30	-	-	-	-	-
Milmilia R F	5	65.00	-	25	-	-	-	-	-	-	20	20
Milmilia R F	6	45.00	25	20	-	-	-	-	-	-	-	-
Milmilia R F	7	170.00	25	25	25	20	-	25	25	25	-	-
Milmilia R F	8	200.00	25	25	25	25	25	25	-	-	25	25
Milmilia R F	9	210.00	25	25	25	25	35	25	-	25	25	-
Milmilia R F	10	160.00	20	20	20	20	20	20	20	20	-	-
Khaksi Sikrabura	6	200.00	25	25	25	25	25	25	-	-	25	25
Khaksi Sikrabura	1	80.00	50	30	-	-	-	-	-	-	-	-
Khaksi Sikrabura	2	42.00	42	-	-	-	-	-	-	-	-	-
Khaksi Sikrabura	7	65.00	35	30	-	-	-	-	-	-	-	-
Khaksi Sikrabura	5	100.00	25	25	-	-	-	25	25	-	-	-
Melaghat	1	271.00	25	25	25	50	40	31	-	25	25	25
Dumpara	1	177.00	50	50	50	27	-	-	-	-	-	-
Dimali	1	42.00	42	-	-	-	-	-	-	-	-	-
Ghoraputa	1	31.00	31	-	-	-	-	-	-	-	-	-
Dhuniagaon R F	1	23.00	23	-	-	-	-	-	-	-	-	-

The Working Plan of Kamru, West Division for 202 -22 to 2030-31										Assan Forest		
Moman R F	P1	400.00	25	25	50	50	50	50	50	50	25	25
Moman R F	P2	50.00	50	-	-	-	-	-	-	-	-	-
Moman R F	P3	90.00	20	20	25	-	-	25	-	-	-	-
Moman R F	P4	529.00	60	60	59	50	50	50	50	50	50	50
Jharikhuri R F	2	390.00	50	50	25	25	25	50	50	50	25	40
Jharikhuri R F	1	268.00	50	50	50	50	50	18	-	-	-	-
Jharikhuri R F	3	100.00	50	50	-	-	-	-	-	-	-	-
Luki R F	3	290.00	25	25	25	25	50	40	25	25	25	25
Luki R F	1	80.00	20	20	-	-	-	20	-	-	-	20
Luki R F	2	267.00	25	25	25	25	50	17	25	25	25	25
Taraibari	1	280.00	25	25	50	50	50	30	-	25	25	-
Mugakhal	1	119.00	25	25	19	-	-	25	25	-	-	-
Khurkhuri	1	50.00	50	-	-	-	-	-	-	-	-	-
Gizang R F	P3	123.00	25	25	23	-	25	25	-	-	-	-
Gizang R F	P2	160.00	25	25	40	20	-	-	-	-	25	25
Gizang R F	P1B	93.00	50	43	-	-	-	-	-	-	-	-
Gizang R F	P1A	272.00	25	25	50	40	32	25	25	25	25	-
Nampathar R F	D2	29.00	29	-	-	-	-	-	-	-	-	-
Nampathar R F	D1	42.00	42	-	-	-	-	-	-	-	-	-
Barjuli R F	1	225.00	50	50	25	25	25	25	25	-	-	-
Barjuli R F	3A	164.00	25	25	40	24	-	-	-	25	25	-
Barjuli R F	2	140.00	25	25	40	-	-	-	-	-	25	25
Boradova	1	329.00	25	25	25	50	50	50	29	25	25	25
Singra (part I)	1	342.00	25	25	25	25	25	50	42	25	50	50
Jaipur	1	286.00	25	25	25	50	50	36	-	25	25	25
Khatajuli	1	80.00			-	-	-	-	-	-	50	30
Singra (part II)	1	80.00			-	-	-	-	-	-	50	30
Mahipara	1	40.00	40	-	-	-	-	-	-	-	-	-
Bogaikhas R F	16	805.00	85	80	80	80	80	80	80	80	80	80
Bogaikhas R F	17	800.00	80	80	80	80	80	80	80	80	80	80
Bogaikhas R F	20	700.00	70	70	70	70	70	70	70	70	70	70
Bogaikhas R F	22	600.00	60	60	60	60	60	60	60	60	60	60
Bogaikhas R F	23	605.00	65	60	60	60	60	60	60	60	60	60
Bogaikhas R F	24	300.00	25	25	25	25	50	50	25	25	25	25
Bogaikhas R F	25	600.00	60	60	60	60	60	60	60	60	60	60
Bogaikhas R F	26	815.00	90	90	80	80	80	80	80	80	80	75
Bogaikhas R F	27	715.00	85	70	70	70	70	70	70	70	70	70
Pantan R F	K6	50.00				-	-	-	-	-	25	25
Pantan R F	C2	300.00	25	25	25	25	50	50	-	50	50	-
Pantan R F	H5	315.00	25	25	25	50	50	50	15	25	25	25
Pantan R F	H7	405.00	25	30	50	25	25	50	50	50	50	50
Pantan R F	3	285.00	50	50	50	50	50	35	-	-	-	-
Pantan R F	4	700.00	70	70	70	70	70	70	70	70	70	70
Barduar R F	H3	300.00	50	50	25	25	25	50		25	25	25
Barduar R F	H6	290.00			50	50	50	40	-	50	50	-
Barduar R F	KG4	120.00	25	25	20	-	-	-	-	-	25	25
Barduar R F	KG5	200.00			50	50	-	-	-	-	50	50
Barduar R F	KG7	100.00	25	25	-	25	25	-	-	-	-	-
Barduar R F	KG8	260.00	25	25	25	50	50	10	-	25	25	25
Barduar R F	KG9	500.00	50	50	50	50	50	50	50	50	50	50
Barduar R F	KG10	50.00		-	-	-	-	-	-	-	-	50
Barduar R F	KG12	405.00	25	25	25	25	50	50	50	50	55	50
Barduar R F	KG13	700.00	70	70	70	70	70	70	70	70	70	70
Division Total		28629.00	3781	3381	3076	3041	2992	2817	219	2415	2565	2370

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 West Forest Division, there is provision for thinning in each compartment of Plantation Working Circle. The thinning is targeted for sapling, pole

and young trees within the compartments. Proper method for thinning operation is lacking in the Division. The spacing between the stems depends upon the size of stem to be retained after thinning. Number and average size of stem need to be assessed to fix the required number of stem in compartment. For this objective, the condition of pole and sapling in each compartment requires further assessment.

Year wise thinning sequence is not prescribed to give DFO flexibility in the field. Though, broadly 'A' grade thinning (Light Thinning) has been prescribed; thinning operations will depend upon the density of the crop. Therefore, marking and thinning operations will require much care in the field. It is therefore, kept in the discretion of DFO to select the area. However, in one year $1/10^{\text{th}}$ of the total area of this WC will be taken up. The prescribed rules for marking officer should be followed properly. Thinning operation will be done only once during the plan period in normal conditions in a particular area. However, if an area needs special attention; it can be revisited in the fifth year after proper deviation is sanctioned prior to working in the area.

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.

In the past, thinning was not done in the Plantation as there was no approved Working Plan. Thinning is prescribed in the plantations by taking into account the average site quality class of the area. Under this Plan, only four thinnings are prescribed. The first two thinnings are mechanical cum silvicultural and other two are silvicultural thinning. Significant number of trees are to be retained after the first thinning so as to compensate towards damages caused by wild elephants, which is quite common in this area. The details of the thinnings regime recommended are given below: -

- i. First mechanical cum silvicultural thinning at the 10th year by retaining about 70% of the total trees by marking the stems silviculturally in the alternative diagonals.
- ii. Second mechanical cum silvicultural thinning at the 20th year by retaining about 50% by marking the trees silviculturally in the alternate lines.
- iii. First silviculture thinning at the 30th year (leaving about 35% of the balance trees).
- iv. Second silviculture thinning at the 40th year (leaving about 15 % of the balance trees).

2.8.2 Guide for Thinning:

Thinning are to be carried out comparing the field stock with that given in yield table for certain age and specific site quality for ordinary C grade thinning.

- i. Site quality may be ascertained first by measuring top diameter and height of crop.
- ii. Age of the plantation to be ascertained from record or from age/dia curve drawn from yield table.
- iii. The basal area of the stock of plantation is to be determined using Wedge Prism or Relascope.

- iv. The basal area figure/ha thus obtained should be compared with yield table figure against the crop age and for that particular site quality class. Care should be taken not only to compare the number of trees/ha as per yield table but also the basal area as per the age of the crop. Thus requirement of thinning for a particular plot may be ascertained and to be followed by marking.
- v. In between marking and felling recheck is to be made in similar method as to whether the marking is proper or not. Over thinning must be avoided.
- vi. The exercise must be done by an officer not below the rank of Assistant Conservator of Forests.

2.8.3 Marking Rules for thinning: The following instructions are included for guidance of marking for thinning.

A. In older plantations where growth differentiation has already set in, follow the steps given in Para 2.8.2 and for silvicultural thinning marking may be done as follows.

- i. Mark all dead, top broken, mid broken, uprooted and suppressed trees.
- ii. Mark all mal-formed or crooked trees provided no large gaps are created.
- iii. Mark all stems of inferior species interfering with dominant commercial species.
- iv. Rare, endangered and threatened species should not be marked.
- v. In case of any doubt regarding removal or otherwise of a tree, decide in favour of retention.
- vi. Care should be taken that no permanent open up of the canopy should result due to the thinning

B. In younger plots without crown differentiation-

- i. Where material spacing is 2.00 m x 2.00 m, the first thinnings from 10th year thinning is to be carried out. If the spacing of plantation is 3.00 m x 3.00 m or more, the first thinning may be omitted or may be done mechanically at the discretion of the DFO after taken up due care and calculation as given in Para 2.8.2.
- ii. Remove dead, top broken, mid broken, uprooted and suppressed trees.
- iii. The spacing out should be done mechanically by removing alternate stem in each thinning.

Importance is given to retain a definite number of trees with appropriate basal area after the thinnings. This is to ensure that any subsequent variation in the number of trees in the plantation at the time of thinning should not result in excess thinning of plantation.

The prescriptions laid down above should be followed in all the plantations where regular thinnings have been carried out in the past. But in case the thinning regime as given in the previous plan has not been followed in the past it is not desirable to reduce the number of stems as per these prescriptions at one stroke as such action may cause opening of canopy and consequently invasion of weeds and also make the stand susceptible to wind damage. In such cases, gradual reduction of excess number of stems during the next thinnings or over a period of time will be desirable. Modified thinnings in such plantations are proposed from this point of view. In case if more number of trees are found in certain pockets of the same plantation where overall number of trees per ha. is less in that case desirable number of trees may be felled to remove the congestion after verification and marked by the Deputy Conservator of Forests and/or Chief Conservator of Forests. Care should be taken so

that sufficient number of trees per ha. is retained to fulfill the requirement of prescribed thinning regime for the particular closely spaced trees.

- C. For guidance of thinning in congested patch and in areas where plantation (regeneration) data is absent, to follow Laurie's Formula.

Laurie's Formula: $S = 1.5 (d + 3)$ {Where S = average spacing in feet in triangular spacing; d = average crop diameter in inches} may also be used for this exercise.

By using this formula, the desired triangular spacing for a given plantation is estimated to work out the number of plants to be retained. This formula is very useful when one does not have the history of past thinning of a plantation. The guiding principle is the number of trees with better crown, stem-form and free from the attack of pests and diseases, to be retained with even spacing. The number of sound trees retained after any thinning should be as per the number worked out by using Laurie's formula. This method of thinning has merits as well as some constraints. It is easy to fix the required distance, more objective, technically standard and reduces the personal error but it demands relatively more skilled human resource for enumeration and measurement especially for identifying stems to be retained with the help of GIS.

- ii. The spacing and desirable number of trees per hectare by diameter (BH) are given in table 3.7.4a. However, the number of trees to be retained may be increased considering local conditions, threats etc. as found fit by the DFO.

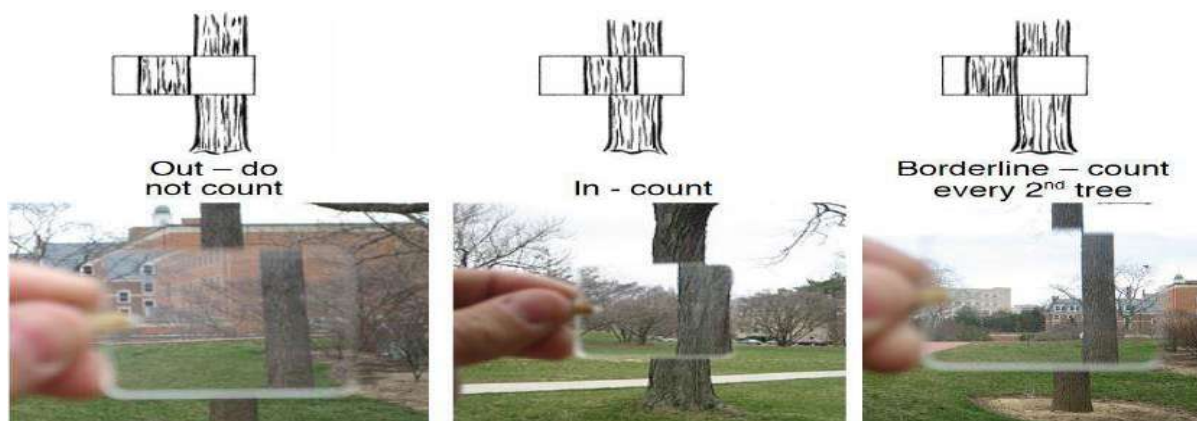
Table 2.8.3: The designed method for thinning

Diameter	Spacing	Minimum No of trees to be retained/hect	Considering local conditions may be increased upto 10% or more
10 cm	3.15 m	1170	+ 120
15 cm	4.00 m	725	+ 80
20 cm	5.00 m	460	+ 50
25 cm	5.86 m	340	+ 40
30 cm	6.81 m	250	+ 30
35 cm	7.66 m	195	+ 20
40 cm	8.64 m	155	+ 20
45 cm	9.46 m	129	+ 15
50 cm	10.36 m	108	+ 10

Measure Basal Area using Wedge Prism

1. Hold prism (not your eye) over the selected point at a comfortable distance from the eye, with the long side horizontal. Hold prism with right hand by lower part of the thicker edge.
2. With one eye closed, point with the upper part of the prism so as to divide the tree in question at breast height. Refraction of light through the prism will cause the portion of the tree below breast height to appear separated. Count as 1 all of the trees whose figures are superimposed, as 1/2, or measure for accuracy those which touch only at the edge. If they do not touch each other they are not counted.
3. Turn in a circle, checking each visible tree, making sure not to count the same tree twice.
4. The number of trees counted, multiplied by basal area conversion factor of prism gives us the basal area per stand acre.

$BA/Acre = (Total\ number\ of\ trees\ counted \times BAF\ of\ prism) / (Number\ of\ samples)$



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.

2.9 Regeneration:

***Shorea robusta* 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 West 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 well maintained seed stand. Sal seed loses viability rapidly. 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 and simple.

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 is suggested:

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 foliated species like mallottus may be thinned where absolutely necessary. Oxy, mallottus (a preferred species by elephant) and makri sal needs to be regenerated. Hence, it is prescribed that poles of teak & its species will be preferred for removal in place of middle storey Sal associates like Oxy, Makri sal, Jamun, Bahera, Aonla, etc. Regeneration of associate species of Sal will also be emphasized along with the regeneration of Sal.

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 West 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 West 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 is 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 in time.

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 *Mikania*, *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, *Hoplocerambyx spinicornis*. 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 browseable; 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 later stages.

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 chain link 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 erecting 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 area 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 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. 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 debris 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 along with 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, firelines 4 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 seedlings strips and seedling patches. 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 debris. All inflammable materials should also be burnt together with debris. 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 remainder part of dry season.
11. The operations outlined under item no. 5,6,7,8 & 9 along with repairs/renewals of fencings are to be repeated during 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

3^{rs} 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, along with 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. These 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: 2.9.2a: Year-wise Plantation activity proposed in Sal Regeneration Working Circle

Name RF	Compt. No.	Area (Ha)	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Mayang Hill R F	1	50.00	50	-	-	-	-	-	-	-	-	-
Mayang Hill R F	3	100.00	-	45	55	-	-	-	-	-	-	-
Sursuria	1	50.00	-	-	-	50	-	-	-	-	-	-
Nampathar R F	U2	50.00	-	-	-	-	50	-	-	-	-	-
Pantan R F	H6	150.00	55	45	50	-	-	-	-	-	-	-
Pantan R F	H8	100.00	-	-	-	55	45	-	-	-	-	-
Pantan R F	H2	50.00	-	-	-	-	-	50	-	-	-	-
Barduar R F	H1	100.00	-	-	-	-	-	-	55	45	-	-
Chhaygaon R F	3	100.00	-	-	-	-	-	-	-	-	50	50
Pantan R F	H3	100.00	55	45	-	-	-	-	-	-	-	-
Pantan R F	H1	100.00	-	-	50	50	-	-	-	-	-	-
Pantan R F	5	100.00	-	-	-	55	45	-	-	-	-	-
Barduar R F	KG2	100.00	-	-	-	-	-	50	50	-	-	-
Barduar R F	KG3	50.00	-	-	-	-	-	-	-	-	-	50
Chhaygaon R F	5	50.00	-	-	-	-	-	-	50	-	-	-
Moman R F	P5	100.00	-	-	-	-	-	-	-	55	45	-
Bogaikhas R F	19	100.00	-	-	-	-	-	50	-	50	-	-
Pantan R F	H4	100.00	50	-	-	-	-	-	-	-	-	50
Barduar R F	H7	100.00	-	-	-	-	-	-	-	-	50	50
Mataikhar R F	1	50.00	-	-	-	-	-	-	-	-	-	50

Mataikhar R F	3	50.00	-	50	-	-	-	-	-	-	-	-
Kulsi R F	4	50.00	-	-	50	-	-	-	-	-	-	-
Milmilia R F	1	50.00	-	-	-	50	-	-	-	-	-	-
Milmilia R F	4	100.00	55	45	-	-	-	-	-	-	-	-
Khaksi Sikrabura	6	100.00	-	-	-	55	45	-	-	-	-	-
Khaksi Sikrabura	5	100.00	-	-	-	-	-	55	45	-	-	-
Melaghat	1	50.00	-	-	-	-	-	-	-	50	-	-
Dumpara	1	50.00	-	-	-	-	-	-	50	-	-	-
Moman R F	P1	100.00	-	-	-	-	-	-	-	55	45	-
Moman R F	P3	50.00	-	-	-	-	-	50	-	-	-	-
Moman R F	P4	100.00	-	-	-	-	-	-	-	50	-	50
Luki R F	3	100.00	-	-	-	-	-	-	-	50	50	-
Luki R F	2	50.00	-	-	50	-	-	-	-	-	-	-
Taraibari	1	50.00	-	-	50	-	-	-	-	-	-	-
Mugakhal	1	50.00	-	-	-	-	50	-	-	-	-	-
Khurkhuri	1	50.00	50	-	-	-	-	-	-	-	-	-
Gizang R F	P3	50.00	-	50	-	-	-	-	-	-	-	-
Gizang R F	P2	50.00	-	-	50	-	-	-	-	-	-	-
Gizang R F	P1A	100.00	-	-	-	55	45	-	-	-	-	-
Barjuli R F	1	200.00	55	45	-	-	55	45	-	-	-	-
Barjuli R F	3A	50.00	-	-	-	-	-	50	-	-	-	-
Barjuli R F	2	200.00	-	-	55	45	50	-	50	-	-	-
Boradova	1	100.00	-	-	-	-	-	-	50	-	50	-
Singra (part I)	1	50.00	-	-	-	-	-	50	-	-	-	-
Jaipur	1	50.00	-	-	-	-	-	-	-	50	-	-
Khatajuli	1	25.00	25	-	-	-	-	-	-	-	-	-
Mahipara	1	25.00	25	-	-	-	-	-	-	-	-	-
Bogaikhas R F	16	100.00	50	50	-	-	-	-	-	-	-	-
Pantan R F	C2	200.00	-	-	55	45	-	-	50	50	-	-
Barduar R F	H3	200.00	-	-	-	-	55	45	-	-	50	50
Barduar R F	KG13	100.00	-	50	-	-	-	-	50	-	-	-
		4300.00	450	450	450	450	450	450	450	450	350	350

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.

2.9.2b :Year-wise plantation sequence

Yearwise activity	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Plantation	450	450	450	450	450	450	450	450	350	350
Maintenance	-	450	900	1350	1800	2250	2250	2250	2250	2150

2.9.2 c: Maintenance will spill over upto 15th year as follows which shall be carried forward to subsequent Working Plan

Yearwise activity	Y11	Y12	Y13	Y14	Y15
Plantation	-	-	-	-	-
Maintenance	2050	1600	1150	700	350

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 West 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 West 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 strand barbed 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.

2.10.8 Marking of Hollow Unfit Trees: Marking of hollow unfit trees will not be done in the interest of birds.

2.10.7 : Annual targets of Sal Regeneration Working Circle for the Plan period:

Prescribed activity	Physical target over a period of ten years (in hectare)									
	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Silvicultural operation Cleaning and Thinning	5226	4501	3591	3286	3042	2662	1946	1800	1350	1225
Regeneration (Natural) ANR supported by artificial regeneration 4300 hect area shall be covered up for ANR work during the plan period.	450	450	450	450	450	450	450	450	350	350
1 st weeding = May/June 2 nd weeding = July/August 3 ^{rs} weeding = September Pressing and Control burning = Late October to early November	-	450	900	1350	1800	2250	2250	2250	2250	2150

CHAPTER 3

TEAK REGENERATION WORKING CIRCLE

3.1 Name of the Working Circle: Teak Regeneration Working Circle. The detail map of this working circle is shown in Fig 2.1.a

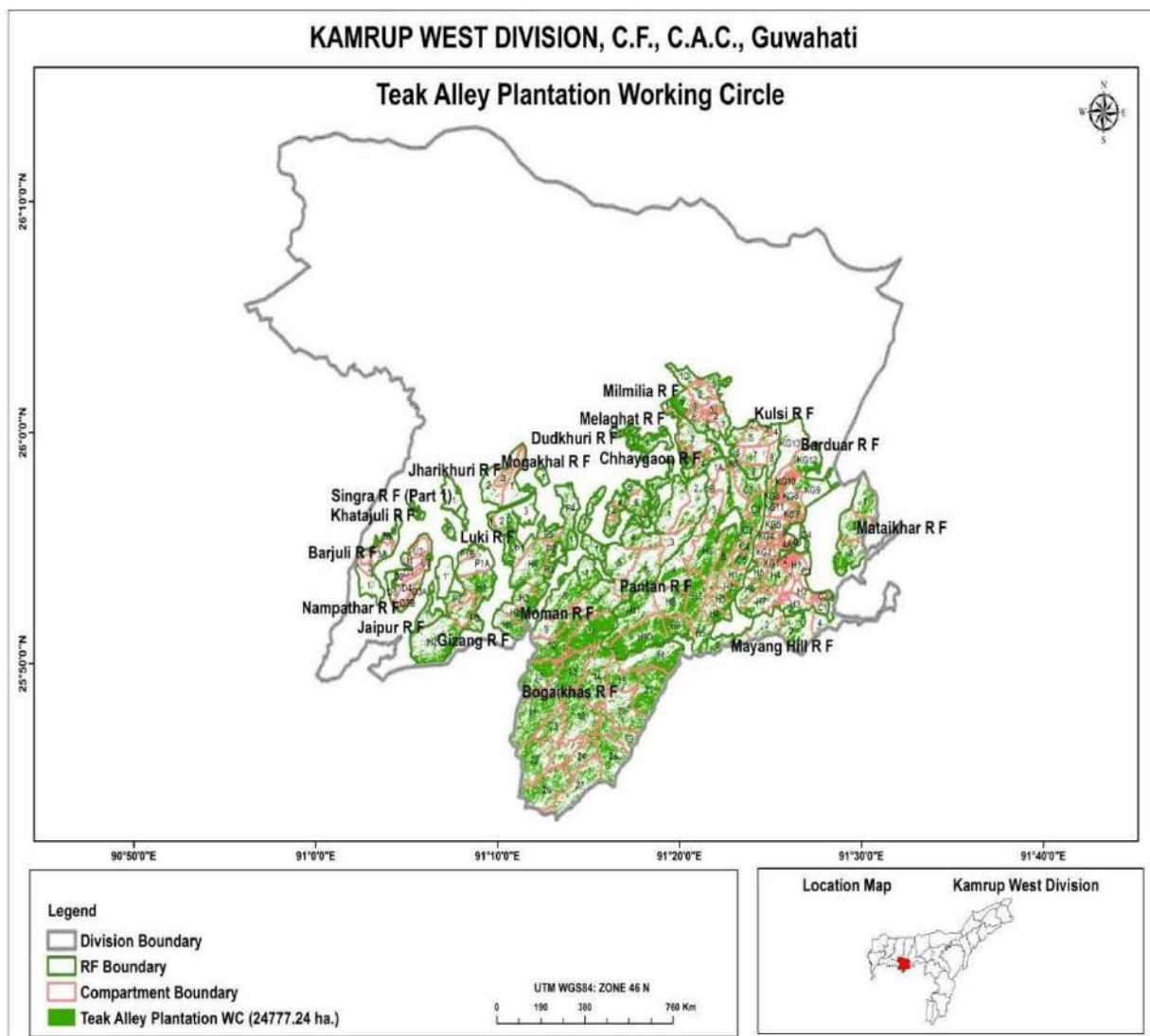


Fig. 3.1 Teak working circle of Kamrup West Division

3.2 General constitution of the Working Circle

All the Forest areas covered under moist mixed deciduous formations in the hill slopes, crest, ridges, spurs as well as the existing Teak plantation have been allotted to this working circle. The silvicultural operations viz. climber cutting, weeding and thinning allowed.

Objectives of the Working Circle

The broad objective of this working circle is to improve the stocks of Teak forest of this division through plantation to fill the gaps and regeneration of the species in areas where earlier plantation haven't survived or have been exploited by illegal felling. Specific objectives are –

- i) To augment the value of existing forest crop by introducing more valuable species like teak without disturbing the heterogeneity of the forest by adopting alley plantation between narrow strips of natural forest.
- ii) To introduce second story forest species under pure teak forest to increase productivity per unit area with a view for revenue generation.
- iii) To bring all past plantations of similar nature into same pattern of management.
- iv) Consistent with above to meet the part of local demand for firewood, timber etc. from the outputs that would come out from the thinning of the plantation crop.

3.3 General characteristics of vegetation: The diameter distribution of individuals in all the forest types has a gradual decline with increasing girth class for the stems above 30 cm whereas the number of individuals is less in 10-30 cm class. The importance value of *Lagerstroemia parviflora* is among the three most dominant species in all the forest types. *Tectona grandis* in moist Sal-bearing forest and teak plantation and *Shorea robusta* in moist Sal-bearing forest, *Dillenia pentagyna* in moist mixed deciduous forest, *Schima wallichii* and *Litsea salicifolia* in semievergreen forest, *Litsea salicifolia*, a shrub or small tree, contributed the maximum number of individuals in lower girth class. *Lagerstroemia parviflora*, in all forest types, showed an inverted J-shaped curve except in teak plantation. The low density of teak in the girth class 10-30 cm might be due to suppression of teak saplings, probably due to low light intensity in addition to forest fire which damages teak seedlings. *Gmelina arborea* which was the second dominant species in teak plantation showed a maximum density of population.

Table: 3.3. Number of individuals of dominant species in different girth classes in teak Plantation sample area as per study report

Teak Plantation						
GBH class(cm)	<i>T.grandis</i>	% of Total	<i>G.arborea</i>	% of total	<i>L.parviflora</i>	% of total
A(10-30)	298	16.36	-	0.00	19	31.15
B(30-50)	459	25.21	5	9.80	25	40.98
C(50-70)	293	16.09	7	13.73	10	16.39
D(70-90)	272	14.94	13	25.49	3	4.92
E(90-110)	240	13.18	13	25.49	3	4.92
F(110-130)	142	7.80	4	7.84	1	1.64
G(130-150)	68	3.73	7	13.73	-	0.00
H(150-170)	40	2.20	1	1.96	-	0.00
I(≥170)	9	0.49	1	1.96	-	0.00

3.4 Felling Series(Working Series): 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”.

Eight Working Serieses namely, Bondapara, Singra, Bamunigaon, Kusi, Loharghat, Bagaikhas (Bamunigaon-Singra), Pantan (Bamunigaon-Kulsi) and Borduar (Kulsi-Loharghat) have been constituted in this Working Plan.

3.5 Blocks and Compartment allotment Areas: Blocks, compartment and the area to be covered in this working circle is provided in the table below (Table 3.5.a). Compartmentwise detail under the Teak regeneration working circle is shown below.

Table: 3.5: Proposed area (ha) under Teak regeneration Working Circle of Kamrup West division

Name of W.S	Name Reserved Forest	Compt No.	Area in Ha	Net workable area	Density Sapling/ha	Growing Stock M ³ /Ha
Loharghat	Mayang Hill R F	2	531.560	375.00	383	6.44
	Mayang Hill R F	4	360.899	310.00	370	35.11
	Mataikhar R F	2	546.929	490.00	87	2.67
W.S. Total			1439.388	1175.00		
Kulsi R F	Kulsi R F	1	154.468	75.00	-	2.00
	Kulsi R F	2	58.0158	44.00	-	1.49
	Kulsi R F	5	270.733	170.00	45	0.27
	Kulsi R F	6	114.162	59.00	-	1.21
	Kulsi R F	7	337.080	186.00	260	4.52
	Kulsi R F	8	226.925	170.00	10	0.02
	Kulsi R F	9	210.066	50.00	60	0.87
W.S. Total			1371.45	754.00		
Bamunigaon	Chhaygaon R F	1	71.065	45.00	-	6.61
	Chhaygaon R F	2	334.472	300.00	325	8.13
	Chhaygaon R F	4	161.749	100.00	100	14.91
	Khaksi Sikratura	3	101.741	72.00	-	7.17
	Khaksi Sikratura	4	142.612	118.00	-	5.94
W.S. Total			811.639	635		
Singra Range	Moman R F	H1	400.303	345.00	-	8.07
	Moman R F	H2	265.143	250.00	-	8.83
	Moman R F	H3	421.966	420.00	70	14.98
	Moman R F	H4	981.848	793.00	45	8.98
	Khatkhati Hill	1	248.482	225.00	-	0.41
W.S. Total			2317.742	2033.00		
Bondapara	Gizang R F	H1	913.762	900.00	110	18.04
	Gizang R F	H2	1311.594	1300.00	157	8.67
	Nampathar	D5	179.089	100.00	-	6.75
	Nampathar	D3B	81.207	50.00	-	3.67
	Nampathar	D3A	72.321	50.00	-	4.42
	Nampathar	U3	177.316	100.00	270	3.41
	Nampathar	D4	281.499	200.00	80	9.68
W.S. Total			3016.788	2700.00		
Bamunigaon Singra	Bogaikhas R F	1	707.733	600.00	505	23.91
	Bogaikhas R F	2	819.126	685.00	497	14.11
	Bogaikhas R F	3	483.010	350.00	452	35.72
	Bogaikhas R F	4	536.686	400.00	380	13.36
	Bogaikhas R F	5	687.551	515.00	-	35.57
	Bogaikhas R F	6	945.932	800.00	453	28.90
	Bogaikhas R F	8	815.435	690.00	-	5.25
	Bogaikhas R F	7	786.374	650.00	-	19.01
	Bogaikhas R F	9	514.044	400.00	155	5.25

	Bogaikhas R F	10	846.344	650.00	-	12.39
	Bogaikhas R F	11	889.210	680.00	-	8.01
	Bogaikhas R F	12	733.606	580.00	243	19.76
	Bogaikhas R F	13	873.423	700.00	790	11.40
	Bogaikhas R F	14	973.484	770.00	-	10.35
	Bogaikhas R F	15	550.500	400.00	-	14.86
W.S. Total			11162.46	8870.00		
Bamunigaon-Kulsi	Pantan R F	H11	1060.835	750.00	1080	26.99
	Pantan R F	H9	370.482	200.00	-	22.19
	Pantan R F	H10	1003.323	740.00	375	17.00
	Pantan R F	C5	233.298	190.00	170	14.04
	Pantan R F	C4	147.872	90.00	490	14.42
	Pantan R F	C3	254.600	195.00	380	13.79
W.S. Total			3070.410	2165.00		
Kulsi-Loharghat	Barduar R F	1	206.041	180.00	400	3.38
	Barduar R F	2	72.330	50.00	360	13.72
	Barduar R F	3	34.919	20.00	90	10.55
	Barduar R F	4A	128.975	90.00	755	3.00
	Barduar R F	4B	77.642	50.00	-	5.19
	Barduar R F	C1	195.204	125.00	-	11.52
	Barduar R F	C2	64.744	50.00	337	15.43
	Barduar R F	C3	183.775	120.00	1533	38.92
	Barduar R F	C4	68.221	40.00	555	1.67
W.S. Total			1031.851	725.00		
Division Total			24221.73	19057.00		

Net workable area= Gross area of Compartment - (Area under Ridge & crest + Area under Water Body/ marshy land + area under Forest Village + area under encroachment).

3.6 Special objectives of Management

- i) **Economic objective:** To augment regeneration of valuable tree species (Teak) and ensure to increase productivity, restocking teak in areas especially where teak was planted and subsequently degraded owing to various reasons, with a view to earn revenues.
- ii) **Social objective:** To engage village communities in plantation 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.
- iii) **Biodiversity & Ecological objective:** To create forest of heterogeneous nature with valuable species as well as with other indigenous species to maintain Forest Eco-system.

3.6.1 Analysis of the crop: In Teak plantations, *Tectona grandis* (59.24%) had the highest IVI followed by *Gmelina arborea* (3.3%) and *Lagerstroemia parviflora* (2.96%) In *Tectona grandis* highest density (25.20%) is recorded in 30-50 cm girth class In girth class 10-30 cm and 50-70 cm, number of individuals recorded was 16.36% and 16.09% respectively. From the girth class 30-50 cm, there is a gradual decrease in the density with increasing girth class. *Gmelina arborea* had 51% of density in girth class 70-90 cm and 90-110 cm. In *Lagerstroemia parviflora* no individual is recorded in higher girth class from the girth 130-150 cm, but had the highest density in 30-50 cm girth class. The highest number of individuals are recorded for *Tectona grandis* (30%) in 5-10 m height class, for *Gmelina arborea* (45%), in 10-15 m and *Lagerstroemia parviflora* (40%) in <5 m height class.

3.6.2 Silvicultural system: silvicultural system to be adopted is a combination of Irregular Shelter Wood system and Coppice system. Irregular Shelterwood system, structurally different from even-aged and balanced uneven-aged forest, is a silvicultural system most desirable for maintenance or restoration of irregular stand (forest) especially for ecosystem-based management. This silvicultural system is compatible with ecosystem-based management in forest types driven by partial stand mortality and gap dynamics and provides opportunities for maintaining old-growth forest attributes. This is a system involving successive regeneration with a long and indefinite period of regeneration. The aim is to produce more or less even aged crops.

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 coppices 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 with uneven-aged stands and Coppice system deals with even-aged forest.

3.6.3 Rotation period: As in the previous Working Plan, the rotation period of 60 years is fixed to get average diameter of 45 cm. For the sake of conformity, the conversion period to convert the present heterogeneous and irregular stock is also fixed at 60 years.

3.6.4 Harvestable diameters: Harvestable diameter for teak is fixed at 45 cm.

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

3.6.6 Felling cycle: The planned period, in years, within which all parts of a forest zoned for wood production and being managed under a selection silvicultural system should be selectively cut for logs. The term is synonymous with Cutting Cycle. As there is no harvesting prescription, felling cycle is not fixed.

Table:3.6.6: Year-wise Silvicultural operations proposed in Teak Regeneration Working Circle

Name Reserved Forest	Compartment No	Area	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Mayang Hill R F	4	310.00	50	50	40	40	30	30	25	25	20	-
Bogaikhas R F	1	600.00	60	60	60	60	60	60	60	60	60	60
Bogaikhas R F	3	350.00	25	25	25	50	50	50	50	25	25	25
Bogaikhas R F	5	515.00	60	60	60	60	50	50	50	50	50	25
Bogaikhas R F	6	800.00	80	80	80	80	80	80	80	80	80	80
Pantan R F	H11	750.00	75	75	75	75	75	75	75	75	75	75
Pantan R F	H9	200.00			25	25	25	25	25	25	25	25
Barduar R F	C3	120.00	25	25	20	-	-	-	-	-	25	25
Chhaygaon R F	4	100.00	25	25	-	-	-	25	25	-	-	-
Moman R F	H3	420.00	25	50	50	50	50	50	50	50	20	25
Gizang R F	H1	900.00	90	90	90	90	90	90	90	90	90	90
Bogaikhas R F	2	685.00	75	75	75	75	75	75	75	75	75	10
Bogaikhas R F	4	400.00	25	50	50	50	50	50	50	25	25	25

The Working Plan of Kamrup West Division for 2021-22 to 2030-31										Assam Forest		
Bogaikhas R F	7	650.00	25	75	75	75	75	75	75	75	50	50
Bogaikhas R F	10	650.00	25	75	75	75	75	75	75	75	50	50
Bogaikhas R F	12	580.00	25	75	75	75	75	75	75	55	-	50
Bogaikhas R F	13	700.00	70	70	70	70	70	70	70	70	70	70
Bogaikhas R F	14	770.00	50	90	90	90	90	75	75	75	75	60
Bogaikhas R F	15	400.00	50	50	50	25	25	50	50	50	25	25
Pantan R F	H10	740.00	90	90	70	70	70	70	70	70	70	70
Pantan R F	C5	190.00	25	15	25	25	25	25	25	25	-	-
Pantan R F	C4	90.00		40	-	-	-	-	25	-	-	25
Pantan R F	C3	195.00	50	50	50	45	-	-	-	-	-	-
Barduar R F	2	50.00	50	-	-	-	-	-	-	-	-	-
Barduar R F	3	20.00	20	-	-	-	-	-	-	-	-	-
Barduar R F	C1	125.00		50	25	-	-	-	-	-	-	50
Barduar R F	C2	50.00	50	-	-	-	-	-	-	-	-	-
Mayang Hill R F	2	375.00	50	25	50	50	50	25	50	25	25	25
Mataikhar R F	2	490.00	70	25	25	70	60	50	50	50	45	45
Kulsi R F	1	75.00	50	25	-	-	-	-	-	-	-	-
Kulsi R F	2	44.00		-	-	-	-	-	-	-	-	44
Kulsi R F	5	170.00		25	25	20	-	25	25	-	-	50
Kulsi R F	6	59.00		-	-	-	-	-	-	25	-	34
Kulsi R F	7	186.00	50	25	25	36	25	25	-	-	-	-
Kulsi R F	8	170.00	25	25	25	20	-	-	25	25	25	-
Kulsi R F	9	50.00	25	-	-	-	-	-	-	25	-	-
Chhaygaon R F	1	45.00	25	-	-	-	20	-	-	-	-	-
Chhaygaon R F	2	300.00	25	25	50	25	50	25	25	25	25	25
Khaksi Sikrabura	3	72.00	50	22	-	-	-	-	-	-	-	-
Khaksi Sikrabura	4	118.00	50	40	28	-	-	-	-	-	-	-
Moman R F	H1	345.00	25	25	25	50	50	50	45	25	25	25
Moman R F	H2	250.00	25	25	25	25	50	-	25	25	25	25
Moman R F	H4	793.00	90	90	80	80	75	75	75	75	75	78
Khatkhati Hill	1	225.00	25	25	25	25	25	-	25	25	25	25
Gizang R F	H2	1300.00	150	150	150	150	150	150	150	150	50	50
Nampathar R F	D5	100.00	25	25	25	25	-	-	-	-	-	-
Nampathar R F	D3B	50.00		-	-	-	-	-	-	-	25	25
Nampathar R F	D3A	50.00	25	-	-	-	-	-	-	-	-	25
Nampathar R F	U3	100.00		25	25	25	-	-	-	-	-	25
Nampathar R F	D4	200.00	25	25	25	50	-	-	-	25	25	25
Bogaikhas R F	8	690.00	75	75	75	75	75	75	75	65	50	50
Bogaikhas R F	9	400.00	25	25	50	50	50	50	50	50	25	25
Bogaikhas R F	11	680.00	75	75	75	75	75	75	75	65	50	40
Barduar R F	1	180.00			25	30	-	25	25	25	25	25
Barduar R F	4A	90.00		40	25	-	-	-	-	25	-	-
Barduar R F	4B	50.00		-	-	-	-	-	-	-	25	25
Barduar R F	C4	40.00		20	-	-	-	-	-	-	20	-
Division Total		19057.00	2130	2207	2113	2086	1895	1825	1915	1805	1475	1606

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

3.6.10 Method of executing the felling: Not prescribed.

3.7 Subsidiary silvicultural operations cleaning and thinning:

3.7.1 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.

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.

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.

3.7.2 Thinning

Thinning is considered as principal tending operation. The aim of thinning is to achieve appropriate stand density and enhance diameter growth. In Kamrup West Forest Division, there is provision for thinning 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. The spacing between the stems depends upon the size of stem to be retained after thinning. Number and average size of stem need to be assessed to fix the required number of stem in compartment. For this objective, the condition of pole and sapling in each compartment requires further assessment.

In the past, no thinning was done in The Teak Plantation as timber harvesting was done by Clear Felling Coupes followed by Artificial Regeneration. Thinnings were prescribed in the teak plantations by taking into account the average site quality class of the area. Under this Plan, only five thinnings are prescribed. The first two thinnings are mechanical cum silvicultural and other three are silvicultural thinning. Though the number of trees to be retained after the first thinning is more, the same is being adopted in the present plan as the excess number of stems will compensate towards damages caused by wild elephants, which is quite common in this area. The details of the thinnings regime recommended are given below:

- First mechanical cum silvicultural thinning at the 10th year by retaining about 50% of the total trees by marking the stems silviculturally in the alternative diagonals.
- Second mechanical cum silvicultural thinning at the 20th year by retaining about 30% by marking the trees silviculturally in the alternate lines.
- First silviculture thinning at the 30th year (leaving about 15% of the balance trees).
- Second silviculture thinning at the 40th year (leaving about 7.5 % of the balance trees).

- v. Third silvicultural thinning at the 50th year by operating balance 7.5% of the trees.

3.7.3 Guide for Thinning:

Thinning are to be carried out comparing the field stock with that given in yield table for certain age and specific site quality for ordinary C grade thinning.

- vii. Site quality may be ascertained first by measuring top diameter and height of crop.
- viii. Age of the plantation to be ascertained from record or from age/dia curve drawn from yield table.
- ix. The basal area of the stock of plantation is to be determined using Wedge Prism or Relaskope.
- x. The basal area figure/ha thus obtained should be compared with yield table figure against the crop age and for that particular site quality class.
Thus requirement of thinning for a particular plot may be ascertained and to be followed by marking.
- xi. In between marking and felling recheck is to be made in similar method as to whether the marking is adequate or not. Over thinning must be avoided.
- xii. The exercise must be done by an officer not below the rank of Assistant Conservator of Forests.

3.7.4 Marking Rules for thinning: The following instructions are included for guidance of marking for thinning.

A. In older plantations where growth differentiation has already set in, follow the steps given in Para 3.7.3 and for silvicultural thinning marking may be done as follows.

- i. Mark all dead, top broken, mid broken, uprooted and suppressed trees.
- ii. Mark all mal-formed or crooked trees provided no large gaps are created.
- iii. Mark all stems of inferior species interfering with dominant commercial species.
- iv. Rare, endangered and threatened species should not be marked.
- v. In case of any doubt regarding removal or otherwise of a tree, decide in favour of retention.
- vi. Care should be taken that no permanent open up of the canopy should result due to the thinning

B. In younger plots without crown differentiation-

- i. Where material spacing is 2.00 m x 2.00 m, the first thinnings from 10th year thinning is to be carried out. If the spacing of plantation is 3.00 m x 3.00 m or more, the first thinning may be omitted or may be done mechanically at the discretion of the DFO after taken up due care and calculation as given in Para 3.7.3.
- ii. Remove dead, top broken, mid broken, uprooted and suppressed trees.
- iii. The spacing out should be done mechanically by removing alternate stem in each thinning.

Importance is given to retain a definite number of trees with appropriate basal area after the thinnings. This is to ensure that any subsequent variation in the number of trees in the plantation at the time of thinning should not result in excess thinning of plantation.

The prescriptions laid down above should be followed in all the plantations where regular thinnings have been carried out in the past. But in case the thinning regime as given in the previous plan has

not been followed in the past it is not desirable to reduce the number of stems as per these prescriptions at one stroke as such action may cause opening of canopy and consequently invasion of weeds and also make the stand susceptible to wind damage. In such cases, gradual reduction of excess number of stems during the next thinnings or over a period of time will be desirable. Modified thinnings in such plantations are proposed from this point of view. In case if more number of trees are found in certain pockets of the same plantation where overall number of trees per ha. is less in that case desirable number of trees may be felled to remove the congestion after verification and marked by the Deputy Conservator of Forests and/or Chief Conservator of Forests. Care should be taken so that sufficient number of trees per ha. is retained to fulfill the requirement of prescribed thinning regime for the particular closely spaced trees.

C. For guidance of thinning in congested patch and in areas where plantation (regeneration) data is absent, to follow Laurie's Formula.

Laurie's Formula: $S = 1.5 (d + 3)$ {Where S = average spacing in feet in triangular spacing; d = average crop diameter in inches} may also be used for this exercise.

By using this formula, the desired triangular spacing for a given plantation is estimated to work out the number of plants to be retained. This formula is very useful when one does not have the history of past thinning of a plantation. The guiding principle is the number of trees with better crown, stem-form and free from the attack of pests and diseases, to be retained with even spacing. The number of sound trees retained after any thinning should be as per the number worked out by using Laurie's formula. This method of thinning has merits as well as some constraints. It is easy to fix the required distance, more objective, technically standard and reduces the personal error but it demands relatively more skilled human resource for enumeration and measurement especially for identifying stems to be retained with the help of GIS.

- ii. The spacing and desirable number of trees per hectare by diameter (BH) are given in table 3.7.4. However, the number of trees to be retained may be increased considering local conditions, threats etc. as found fit by the DFO.

Table 3.7.4: The designed method for thinning

Diameter	Spacing	Minimum No of trees to be retained/hect	Considering local conditions may be increased upto 10% or more
10 cm	3.15 m	1170	+ 120
15 cm	4.00 m	725	+ 80
20 cm	5.00 m	460	+ 50
25 cm	5.86 m	340	+ 40
30 cm	6.81 m	250	+ 30
35 cm	7.66 m	195	+ 20
40 cm	8.64 m	155	+ 20
45 cm	9.46 m	129	+ 15
50 cm	10.36 m	108	+ 10

The prescriptions laid down above should be followed in all the teak plantations where regular thinnings have been carried out in the past. But in case the thinning regime as given in the previous plan has not been followed in the past it is not desirable to reduce the number of stems as per these

prescriptions at one stroke as such action may cause opening of canopy and consequently invasion of weeds and also make the stand susceptible to wind damage. In such cases, gradual reduction of excess number of stems during the next thinnings or over a period of time will be desirable. Modified thinnings in such plantations are proposed from this point of view. In case if more number of trees are found in certain pockets of the same plantation where overall number of trees per ha. is less in that case desirable number of trees may be felled to remove the congestion after verification and marked by the Deputy Conservator of Forests and Chief Conservator of Forests. Care should be taken so that sufficient number of trees per ha. is retained to fulfill the requirement of prescribed thinning regime for the particular closely spaced trees.

3.7.5 Coppice management option:

Simple coppice management is one of the most suitable forest management options to produce maximum biomass including fuelwood and fodder from Teak forest in short rotations. Simple coppice management option is not suitable for timber production. 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 West 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 artificial regenerations 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 5/6 years and then it is clearfelled. In Kamrup West Division, after singling out, coppices shall be retained for next ten years.

3.8 Regeneration:

***Tectona grandis* Linn.f, Family: Verbenaceae, Local name: Segun, Teak**

General: It is a very valuable tree as it gives one of the outstanding timbers. The wood is dark golden–yellow when freshly cut, ageing to brown or almost black, moderately hard, extremely durable, takes a beautiful polish. The timber is unique for ship building, extensively used for bridges, buildings, piles, cabinet work, beams, poles, decorative paneling, carving, general carpentry etc. Timber is easy to air-season, easy to work and saw, makes excellent plywood. Wood yields tar oil; scraps and rejections are used for this purpose. The various parts of the tree have medicinal uses.

Description: A large deciduous tree. Bark light brown or grayish, peeling off in thin layers. Leaves large obviate-elliptic, stellately yellowish, tomentose beneath. Flowers white, shortly stalked, numerous in terminal large panicles of cymes. Fruit sub-globose, enclosed in the inflated calyx.

Distribution: Indigenous in the central and southern part of India. Planted extensively in the plains forest and lower hill forests including Kamrup West Division.

Seed: Seeds ripen in January-March. However, every year does not turn out to be good seed year. That is why, it is advisable to collect seeds in quantity more than current year's requirement and thus build up a reserve for the next year. Seeds (fruits) can be stored in gunny bags or sealed tins for at least two years. Weight of the seed is about 1430 seeds per kg. Seeds are collected from the ground which is cleaned beforehand. Fruits being hard nut require treatment before sowing. Two methods of treatment are described below.

(1) Seeds are soaked in water for 48 hours and then dried in the sun for 48 hours. This process of alternate soaking and baking is continued for 12 to 15 days.

(2) Pit Treatment – It is the most commonly used method. A pit of dimension , 60-90 cm deep, and 90-120cm square section- is dug and filled with water. The bottom and the sides of the pit are covered with teak leaves. Seeds are soaked in a tub and placed in the sun for 48 hours. Thereafter the seeds are put in the pits with alternate layers of teak leaves/saw dust and seeds and a final cover of 15 cm of earth. Before filling the pit, 5 bamboo pipes are put into the pit – one at the centre, one at each corner with holes cut in them – so that in the filled pit water can reach all layers. Seeds are kept in the pit for about 10 days and watering is done every alternate day. When the pit is opened, about 10% of the seeds are normally found germinated.

Propagation: In general, Teak is propagated by artificial regeneration or plantation.

Artificial Regeneration: Stump planting is the commonly practised method for teak plantation. In this method the teak seedling is raised for up to 2 years in a nursery to produce a straight and unbranched tap-root. The nursery should be unshaded and not laid out in beds. The nursery may be a patch of hoed up land wherein treated seeds may be sown 8cm x 18 cm. One or two rains old nursery seedlings are fit for making stumps. At planting time, the seedling is lifted and the planting stump prepared by cutting off the shoot and lateral roots, leaving only the main tap-root attached to 3- to 5-cm of the lower stem. The main tap root is also pruned and trimmed down to 20-23 cm. About 1.0 to 2.0 cm collar diameter is the optimum size of the stumps.

Stump planting – A hole equal in depth to the length of the root is made in the centre of the thali with the help of a crowbar. The stump is inserted and the soil is firmly pressed by thrusting the crowbar at an angle close to the root and leveling the soil tight against the root. The stump should be planted exactly upto the collar. The stump should be firmly planted so that no air spaces are left below or around the root. Planting is done at 2m x2m spacing.

Important Notes:

2. 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.
3. The stump planting of Teak should be done in 1st part of April each year.
4. The planting of other species is to be started during April/May.
5. 3(three) Rain Weedings should be done in first 2 (two) years.
6. In third year, number of weeding may be reduced to 2 (two).
7. The plantation should be established at the end of 5th year.
8. Grazing and fire shall strictly be prohibited.

Tending: Young plantations need at least 3 weeding/cleaning in the first year, 2 in the second and 1 in the third. The frequency of tending will of course be also guided by the requirement of other species in the plantation. In pure teak blocks thinning should not be delayed. Heavy D grade thinning is suggested in the literature. Teak should not be allowed to become suppressed, because once suppressed it does not respond to thinning for 3-4 years and much of increment is lost.

Injury/damage: Seedlings are sensitive to drought and frost, intolerant of shades and suppression by weeds. Rats and pigs cause damage to seedlings; bison, sambhar, cheetal and elephants cause damage in later stages. Caterpillars of *Hyblea puer* and other defoliators often defoliate Teak over large areas. *Dihamus cervinus*, a borer, is common in young plantations.

3.8 a: Annual targets of Teak Regeneration Working Circle:

Prescribed activity	Physical target over a period of ten years									
	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Silvicultural operation Cleaning and Thinning Area earmarked for Teak regeneration = 19057.00 hect.	2130	2207	2113	2086	1895	1825	1915	1805	1475	1606
Creation of Nursery for 3800 hect plantation during the Working Plan period. No of Nursery = 5, one each in every Range for 10 years 1.95 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 of Teak in Kamrup West Division during the Working Plan period. Area earmarked for Teak regeneration = 3800 hect. Requirement of stumps= 3800 x 2600/hect = 98,80,000	400	400	400	400	400	400	400	350	350	300
Weeding: 3 rain weedings in 1 st & 2 nd year 2 weedings in 3 rd & 4 th year It should be ensured that the plantations are established at the end of 5 th year.	-	400	800	1200	1600	2000	2000	2000	1950	1900

3.8 b: Year-wise Plantation activities in Compartments in Teak Regeneration Working Circle:

Name Reserved Forest	Compt No	Area	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Mayang Hill R F	4	50.00	50									
Bogaikhas R F	1	150.00		50	50							50
Bogaikhas R F	3	75.00									50	25
Bogaikhas R F	5	100.00				50	50					
Bogaikhas R F	6	150.00						50	50	50		
Pantan R F	H11	100.00	50	50								
Moman R F	H3	100.00			50	50						
Gizang R F	H1	100.00					50	50				
Bogaikhas R F	2	125.00							50	50		25
Bogaikhas R F	4	100.00	50	50								
Bogaikhas R F	7	150.00			50	50	50					
Bogaikhas R F	13	150.00						50	50	50		

Bogaikhas R F	14	150.00	50	50	50							
Bogaikhas R F	15	100.00				50	50					
Pantan R F	H10	200.00						50	50	50	50	
Pantan R F	C5	100.00							50			50
Barduar R F	C1	75.00									50	25
Barduar R F	C2	50.00	50									
Mayang Hill R F	2	100.00		50	50							
Mataikhar R F	2	100.00				50	50					
Kulsi R F	7	100.00						50	50			
Kulsi R F	8	100.00									50	50
Chhaygaon R F	2	100.00	50	50								
Khaksi Sikrabura	4	100.00				50	50					
Moman R F	H1	125.00								50	50	25
Moman R F	H2	100.00		50	50							
Moman R F	H4	100.00					50	50				
Khatkhathi Hill	1	50.00	50									
Gizang R F	H2	100.00								50	50	
Nampathar R F	D5	100.00			50	50						
Nampathar R F	D4	100.00						50	50			
Bogaikhas R F	8	100.00	50	50								
Bogaikhas R F	9	100.00			50	50						
Bogaikhas R F	11	200.00					50	50	50	50		
Barduar R F	1	100.00									50	50
		3800.00	400	400	400	400	400	400	400	350	350	300

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.

3.8 c: Year-wise Plantation sequence

Yearwise activities	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Plantation	400	400	400	400	400	400	400	350	350	300
Maintenance	-	400	800	1200	1600	2000	2000	2000	1950	1900

3.8 d: Maintenance will spill over upto 15th year as follows which shall carried forward to the subsequent Working Plan

Yearwise activity	Y11	Y12	Y13	Y14	Y15
Plantation	-	-	-	-	-
Maintenance	1850	1450	1050	700	350

3.9 Associated regulations, measures and prescriptions: 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.

No demarcation of annual planting coupe is prescribed in this plan. It is left to the discretion of the Divisional Forest Officer to select suitable areas in continuation to the areas already planted up during last working plan period. The areas so selected should not be in a scattered manner but also cover a whole compartment and then the whole RF in a sequence so as to facilitate the future management of these areas under particular silvicultural system.

- Compartment and reserve boundaries should be demarcated and maintained on the ground. Works of proper relaying of reserve boundaries on the ground and fixing up of boundary pillars should be undertaken immediately.
- The boundary of each plantation plot should be permanently maintained.

- c) Plantation records should be properly maintained. This will greatly help in carrying out the field surveys when this becomes due for revision. Sufficient data of a reliable nature will be available from these records for incorporation in the next plan.
- d) Fire protection measures depending upon the vulnerability of the area should also be taken for young block and regeneration block.
- e) Teak plantation should be carried out on plain area and on foothills. Steep hill slopes should be avoided for teak plantation.
- f) The monitoring system of progress of plantations needs to be strengthened.
- g) Protection and Regeneration committee should be constituted locally and the area of T.W.C. should be managed by active involvement of members of the committee for protection of existing as well as new plantations.



Te

Tectona grandis (Source: <http://thehealingherbsofindia.blogspot.com/>; <http://luirig.altervista.org/naturaitaliana>)

CHAPTER 4

JOINT FOREST MANAGEMENT (Overlapping) WORKING CIRCLE

4.1 Name of the Working Circle: Joint Forest Management (Overlapping) Working Circle. The detail map of this working circle is shown in Figure 4.1.a.

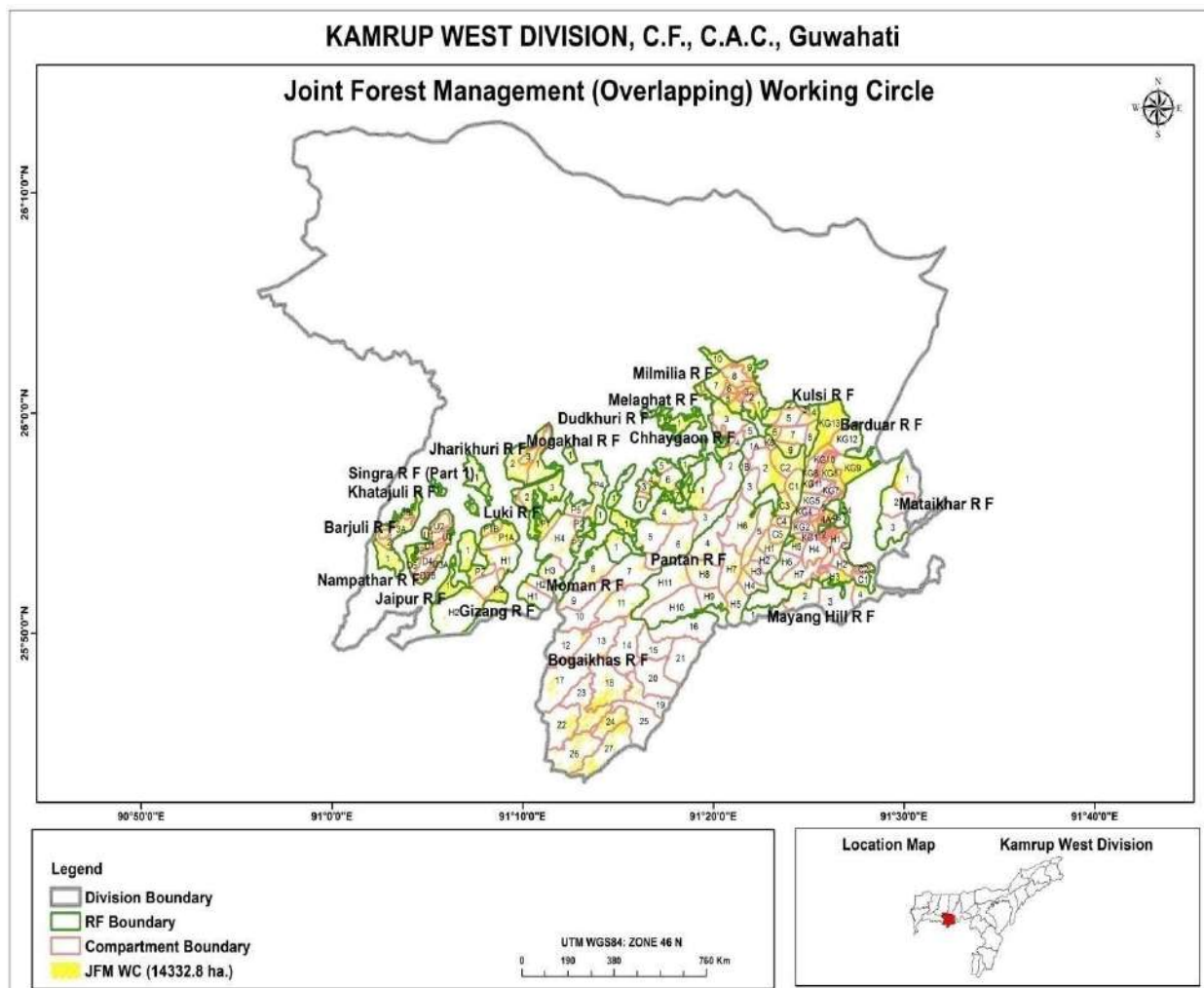


Fig. 4.1 : Joint Forest Management (Overlapping) Working Circle map

4.2 General constitution of the Working Circle: Fringe Villages located within a span of 200m to 500m from degraded, and/or open forests areas RFs are included in the JFMC Working Circle. Selected scrub areas, open forest, moderately dense forest will also be covered under this overlapping working circle. Forest areas which are much susceptible for biotic interference are to be covered in JFMC Working Circle. Existing JFMCs will be boosted.

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

Name of W.S	Name Reserved Forest	Compt No.	Area in Ha	Net workable area	Area allotted to JFMC Overlapping W.C.
Loharghat	Mayang Hill	1	348.772	250.00	100.00
	Mayang Hill	2	531.560	375.00	100.00
	Mayang Hill	3	783.697	500.00	100.00
	Mayang Hill	4	360.899	310.00	100.00
	Mataikhar R F	1	558.057	400.00	100.00
	Mataikhar R F	2	546.929	490.00	100.00
	Mataikhar R F	3	579.850	400.00	100.00
W.S. Total			3709.764	2725.00	700.00
Kulsi	Kulsi R F	7	337.080	186.00	100.00
	Kulsi R F	1	154.468	75.00	75.00
	Kulsi R F	9	210.066	50.00	100.00
	Kulsi R F	8	226.925	170.00	150.00
	Kulsi R F	5	270.733	170.00	100.00
W.S. Total			1199.272	651.00	525.00
Bamunigaon	Milmilia R F	1	167.251	100.00	100.00

	Milmilia R F	4	233.744	190.00	150.00
	Milmilia R F	5	88.785	65.00	50.00
	Milmilia R F	6	87.440	45.00	40.00
	Milmilia R F	7	287.931	200.00	200.00
	Milmilia R F	8	304.381	200.00	100.00
	Milmilia R F	9	342.312	210.00	200.00
	Milmilia R F	10	240.244	160.00	100.00
	Chhaygaon	2	334.472	300.00	200.00
	Chhaygaon	3	544.218	430.00	300.00
	Chhaygaon	4	161.749	100.00	100.00
	Chhaygaon	5	144.675	95.00	55.00
	Khaksi Sikrabura	6	320.176	200.00	100.00
	Khaksi Sikrabura	7	85.120	65.00	25.00
	Khaksi Sikrabura	3	101.741	72.00	25.00
	Khaksi Sikrabura	4	142.612	118.00	65.00
	Ghoraputa	1	47.753	40.00	40.00
	Melaghat	1	362.606	271.00	200.00
	Dumpara	1	193.443	177.00	100.00
	Simla	1	126.264	90.00	55.00
	Gohaingurung	1	125.455	96.00	45.00
	Dudhkhuri	1	98.340	86.00	85.00
	Dimali	1	52.610	42.00	25.00
	Dhuniagaon	1	36.422	23.00	20.00
W.S. Total			4699.123	3345.00	2380.00
Singra Range	Moman R F	H1	400.303	350.00	200.00
	Moman R F	H2	265.143	250.00	200.00
	Moman R F	H3	421.966	420.00	200.00
	Moman R F	H4	981.848	793.00	400.00
	Moman R F	P1	417.086	400.00	300.00
	Moman R F	P2	90.934	50.00	50.00
	Moman R F	P3	112.439	100.00	100.00
	Moman R F	P4	572.125	529.00	300.00
	Moman R F	P5	239.715	223.00	200.00
	Jharikhuri R F	1	457.663	400.00	400.00
	Jharikhuri R F	2	638.056	600.00	500.00
	Jharikhuri R F	3	127.00	100.00	100.00
	Luki R F	1	96.861	80.00	50.00
	Luki R F	2	324.013	267.00	200.00
	Luki R F	3	338.210	290.00	200.00
	Sursuria	1	389.720	350.00	300.00
	Taraibari	1	319.303	280.00	200.00
	Khatkhathi Hill	1	248.482	225.00	100.00
	Mugakhal	1	129.097	119.00	100.00
	Garubaldha	1	110.076	90.00	100.00
	Khurkhuri	1	66.167	50.00	20.00
W.S. Total			6619.207	5956.00	4220.00
Bondapara	Gizang R F	H1	913.762	900.00	100.00
	Gizang R F	H2	1311.594	1300.00	100.00
	Gizang R F	P3	235.823	200.00	150.00
	Gizang R F	P2	237.425	200.00	150.00
	Gizang R F	P1B	165.349	93.00	25.00
	Gizang R F	P1A	495.480	300.00	150.00
	Nampathar R F	U1	98.632	93.00	50.00
	Nampathar R F	U2	234.442	125.00	150.00

	Nampathar R F	D5	179.089	100.00	100.00
	Nampathar R F	D4	281.499	200.00	120.00
	Nampathar R F	D2	99.648	29.00	45.00
	Nampathar R F	D1	117.242	100.00	100.00
	Barjuli R F	3A	279.414	164.00	50.00
	Barjuli R F	3B	234.548	165.00	85.00
	Boradova	1	434.641	329.00	90.00
	Singra (part I)	1	379.080	342.00	200.00
	Jaipur	1	326.183	286.00	200.00
	Singra (part II)	1	95.180	80.00	80.00
W.S. Total			6884.747	4803.00	1945.00
Bamunigaon-Singra	Bogaikhas R F	1	707.733	600.00	100.00
	Bogaikhas R F	2	819.126	685.00	100.00
W.S. Total			7504.418	1285.00	200.00
	Pantan R F	C1	362.059	215.00	200.00
	Pantan R F	C5	233.298	190.00	150.00
	Pantan R F	C4	147.872	100.00	100.00
	Pantan R F	C3	254.600	195.00	150.00
	Pantan R F	C2	686.321	260.00	150.00
W.S. Total			4463.817	960.00	750.00
Kulsi-Loharghat	Barduar R F	1	206.041	180.00	100.00
	Barduar R F	2	72.330	50.00	20.00
	Barduar R F	3	34.919	20.00	20.00
	Barduar R F	4A	128.975	90.00	55.00
	Barduar R F	4B	77.642	50.00	25.00
	Barduar R F	5	121.013	80.00	80.00
	Barduar R F	H1	154.797	100.00	100.00
	Barduar R F	H2	197.101	125.00	50.00
	Barduar R F	H3	337.873	300.00	100.00
	Barduar R F	H4	387.433	300.00	100.00
	Barduar R F	H5	214.214	180.00	100.00
	Barduar R F	H6	345.151	290.00	200.00
	Barduar R F	H7	530.059	420.00	300.00
	Barduar R F	KG1	90.589	60.00	50.00
	Barduar R F	KG2	195.409	120.00	100.00
	Barduar R F	KG3	56.450	40.00	20.00
	Barduar R F	KG4	170.051	120.00	100.00
	Barduar R F	KG5	257.664	200.00	200.00
	Barduar R F	KG6	521.477	485.00	335.00
	Barduar R F	KG7	133.273	100.00	100.00
	Barduar R F	KG8	304.375	260.00	100.00
	Barduar R F	KG9	594.298	500.00	400.00
	Barduar R F	KG13	803.192	700.00	200.00
W.S. Total			6602.901	4770.00	2855.00
Division Total			41683.25	31648.00	13575.00

Net workable area= Gross area of Compartment - (Ridge & crest + Area under Water Body/marshy land + area under Forest Village + area under encroachment)

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 West 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 West FDA for the year 2009-10 are in Table.8.3.b,

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 Kamrup West forest division the JFM was started in 2006-07 The details of JFMCs are as under:

Table:4.6.4a: Details of JFMCs in Kamrup West Division

Range	SI No	Name JFMC	Name of RF/PRF/Compt	Area allotted in present WP(Ha)
Bamunigaon	1	Akchelia-Puthimari-Phulguri-Borjhar	Milmila (Compt-1,)	50
	2	Alukhunda	Milmila (Compt-4)	100
	3	Alukhunda-Kharkhari-Kadamguri	Milmila (Compt-5)	50
	4	Amringkona	Bogaikhas	200
	5	Barghuli-Doledonga-Borjhar	Pantan (C3,C4)	110
	6	Baghmara	Khuksi Chikrabura	130
	7	Chakrasila	Ghoraputa RF	40
	8	Dighalneel-Noonmati--Makhamdol	Pantan C1,C2,)	180
	9	Dudhkhuri Anchalik	Dudhkhuri (Compt-1)	85
	10	Gohai gurung (Lamapra-Kekopara)	Gohai gurung	45
	11	Hatigarh-Ouguri	Milmila (compt-6)	40
	12	Jalukbari	Pantan (C5)	150
	13	Kalabakra 1 No. Ratanpur	Milmila (Compt-7)	50
	14	Kalabakra-Ratanpur-Rahpur	Milmila (Compt-8)	100
	15	Kochpara	Khuksi Chikrabura	105
	16	Koimari	Milmila (Compt-9)	150
	17	Milaghat	Milaghat	150
	18	Mathura Pahar	Chaygaon RF C2,C3	190
	19	Noonmati	Pantan RF (1B)	75
	20	Paglapara-Moinapara-Khalbakhal	Chaygaon RF C1,C2	110
	21	Ratanpur	Milmila (Compt-10)	100
	22	Santipur	Dumapara	100
	23	Ukium	Pantan (Compt 4,5)	200
		Range Total		2510
Loharghat	24	Barjhuli-Hudupara	Barduar (C1,2,3)	125
	25	Deopani-Bogdoba-Hanapara	Barduar (4A,4B)	80
	26	Ghilabari	Barduar (H1,H2,H3)	80
	27	Ghilabari-Khirkijuli-Sipahipara	Barduar (H1,H2,H3)	220
	28	Hatigarh	Mayang hill (C 1)	100
	29	Japangbari-Hatibandha-Tengakhil	Barduar (H4,H5,H6,H7)	450
	30	Jaramukhia	Barduar (KG1,2,3)	120
	31	Manikpur-Sildubi	Barduar (KG4,5,6)	275
	32	Mataikhar	Mataikhar C1,C2	200
	33	Muduki	Mayang hill (C 2)	100
	34	Ouguri	Mayang hill (C 3)	100
	35	Pokapam-Bogaline	Mataikhar C3	100
	36	Rajapara	Barduar KG 13	200

	37	Ranikhamar	Mayang hill (C 4)	100
	38	Sarurani-Hajorani	Barduar (KG7,8,9)	125
	39	Deopani-Bogdoba-Henapara JFMC	Barduar (KG7,8,9)	100
		Range Total		2475
Bondapara	40	Baradova JFMC	Baradova, (Comp-1)	90
	41	Dareng	Nampathar (U1, U2)	200
	42	Dekapara JFMC	Singra Pt-1	100
	43	Dhupguri	Singra Pt-2	80
	44	Dakhin Sekadari	Singra Pt-1	100
	45	Gamarimura Gangrapara	Nampathar (D1,D2)	85
	46	Lanagapara- Sikuniapara	Joypur	100
	47	Malchapara	Gizang (H1,H2)	400
	48	Mirzaghat	Nampathar (D4,D5)	225
	49	Rabhapara Chiristianpara JFMC	Joypur	100
	50	Salbari	Gizang (PI, P2,P3)	175
	51	Barjuli JFMC	Barjuli (3A,3B)	135
	52	Gadhaputa JFMC	Gizang	50
	53	Upper Bamunigaon JFMC	Nampathar	50
		Range Total		1890
Singra	54	Pub Palahpara	Jarikhuri (Compt-1)	100
	55	Balapara	Jarikhuri (Compt-1)	100
	56	Bargaonpara	Jarikhuri (Compt-1)	100
	57	Bhalapara	Jarikhuri (Compt-1)	100
	58	Bhogdabari	Jarikhuri (Compt-2)	100
	59	Chokabaha	Mugakhal (Compt-1)	50
	60	Chakrapani	Taraibari (Compt-1)	100
	61	Dilinga (Garopara)	Jarikhuri (Compt-2)	100
	62	Dilinga (Pragatipur)	Jarikhuri (Compt-2)	100
	63	Dilinga (Sonapur)	Jarikhuri (Compt-2)	150
	64	Gohalkona	Moman (H1)	100
	65	Halidibari	Luki (Compt-1)	50
	66	Dakuapara-Hazangbasti	Moman (H2)	100
	67	Jarapara	Moman (H3)	200
	68	Jobepara	Jarikhuri (Compt-2)	150
	69	Khatkhati	Khatkhati	100
	70	Moman	Moman (H4)	300
	71	Mugakhal	Mugakhal (Compt-1)	50
	72	Nalapara	Luki (Compt-2)	100
	73	Nagopara	Luki (Compt-2)	50
	74	Nowapara	Jarikhuri (Compt-3)	50
	75	Pakharapara	Moman (P1,P2,P3)	305
	76	Palahpara	Jarikhuri (Compt-3)	50
	77	Rajapara	Sursuria	200
	78	Sakhati	Moman (P4)	300
	79	Samuka	Moman (P5)	100
	80	Sijubari	Luki (Compt-3)	200

		Range Total		3405
Kulsi RF	81	Aliha-Ghograchiuk	Barduar (1,2,3 4A,4B)	220
	82	Balijuri Bakalipara JFMC	Kulsi (Compt 7)	100
	83	Bherbheri Andheri JFMC	Kulsi (Compt 1,5)	175
	84	Bogbaha Garubaldha JFMC	Barduar (5, H1,H2,H3)	300
	85	Dewanbeel JFMC	Barduar (H4,H5,H6)	400
	86	Dimali, Dhanipara JFMC	Barduar (H7, KG1,2,3)	370
	87	Dolong-Molong	Barduar (KG4,KG5)	155
	88	Jarugaon Karegura JFMC	Pantan (C1,C5)	350
	89	Kahuwa Bahatpur JFMC	Kulsi (Compt 8,9)	250
	90	Kordoiguri Sanyashi JFMC	Pantan (C2,C3,C4)	400
	91	Kulsi JFMC	Barduar KG 6,7,8)	275
	92	Nalbari Bogapani JFMC	Barduar (KG9, KG13)	300
		Range Total		3295
		Division Total		13575

4.6.5 Details of villages under JFM in Kamrup West Forest Division: Number of JFM committees in division is 92. Area allotted initially for protection Plantation area 3489 hectare. The population depends on agriculture and allied activities for the livelihood and most of the SC, ST population are land less and work as agricultural labourers. The population adjoining forests mostly depend upon forests for day to day needs, naturally causing pressure on forests. The cattle population also cause 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 management Rule-1998” shall be followed. At present out of 92 committees constituted in the division, forest area of 13575.00 hect 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 in consonance 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 West Division shall prepare Microplans for the area to be assigned to concerned JFM Committee as provided in the The Assam Joint (Peoples Participation) Forestry management Rule-1998 and guidelines issued by Govt. of India from time to time.

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

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

4.7.5 Proposed activities under JFMC working circle:

1. Raising of grafted fruit plants in forest areas, nearby fringe villages.
2. Raising of fast growing timber yielding species such as Azar, Tita sopa, Kadam, Bandordima, Hatipoliya, etc. endemic to the division.

3. Raising of firewood species - Kadam, Simalu.
4. Development of nurseries for local forest species with technical guidance from the forest department.
5. Training on bamboo and cane based skill development training for providing employment opportunities.
6. Developing participatory catchment area treatment plans in area under 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 their homesteads.
8. As entry point activities promotion of improved cooking mechanism - biogas, improved chullas, solar lamps etc.
9. Eco-tourism activities shall be developed in the Eco-tourism spots mentioned in para 8.6 (Part-I).

4.7.6 Additional Prescriptions under JFMC working circle:

- i) Forest department staffs with active participation of JFMC conduct PRA exercises and develop microplans for the socioeconomic upliftment and livelihoods development of the local people. This microplans needs to be submitted to DFO for technical feasibility for final approval of the microplan as per the available government schemes and any other 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 least quarterly.
- iii) NTFPs to be collected and sustainably harvested from forest fringe areas under the JFMC and shall be sold by the concerned JFMC.
- iv) Continuous efforts should be made to create and sustain the JFMC movement by creating required awareness among the people and the staff through training programmes.
- v) Agroforestry plantations should be carried out in the encroached areas through the JFMC. In between tree lines ginger, turmeric and other medicinal herbs should be cultivated.
- vi) JFMC areas to practice minimum tillage, organic formulations.
- vii) As entry point activities, development of roads, community hall, culverts, fibre boat/machine boat as per the technical feasibility, for carriage and transportation, construction of drinking water facilities, if mentioned in the micro plans.
- viii) System of rice intensification ensures higher productivity with optimum utilizing the resources, may be promoted in JFMC cultivated paddy fields to increase productivity.
- ix) Establishment of biogas plant as an entry point activity based on the microplans.
- x) JFMC plantation assistance will be released as per the standard government norms, funder norms based on the survival of the plants.
- xi) The forest areas and plantations under the control of Joint Forest Management Committee (JFMC) should be mapped out clearly and necessary records maintained in the Beat, Range and DFO office. While doing so, the provisions of guidelines and resolutions of Govt. of Assam may be followed strictly.

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

adoption of concerned Micro Plan, the prescriptions contained in the Micro- Plan would be deemed to have superseded the Working Plan of that area to that extent.

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

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

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 = 6500 hect	650	650	650	650	650	650	650	650	650	650
Maintenance 22750 hect	-	650	1300	1950	2600	3250	3250	3250	3250	3250
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 Chandubi, Kulsi, Ukium, Jongakhuli, gamarimura (<i>Jeep safari, Boat riding, Ethni cruising, night halt at cottages etc.</i>)	5	5	5	5	5	5	5	5	5	5

Maintenance will spill over upto 15th year as follows which shall be carried forward to subsequent Working Plan

Yearwise activity	Y11	Y12	Y13	Y14	Y15
JFMC Plantation	-	-	-	-	-
Maintenance	3250	2600	1950	1300	650

NB: Location and area of plantation activity shall be decided as per microplan prescription prepared for this purpose

CHAPTER 5

FOREST PROTECTION (Overlapping) WORKING CIRCLE

5.1 Name of the Working Circle: Forest protection (Overlapping) working circle. The detail map of this working circle is shown in the figure.5.1

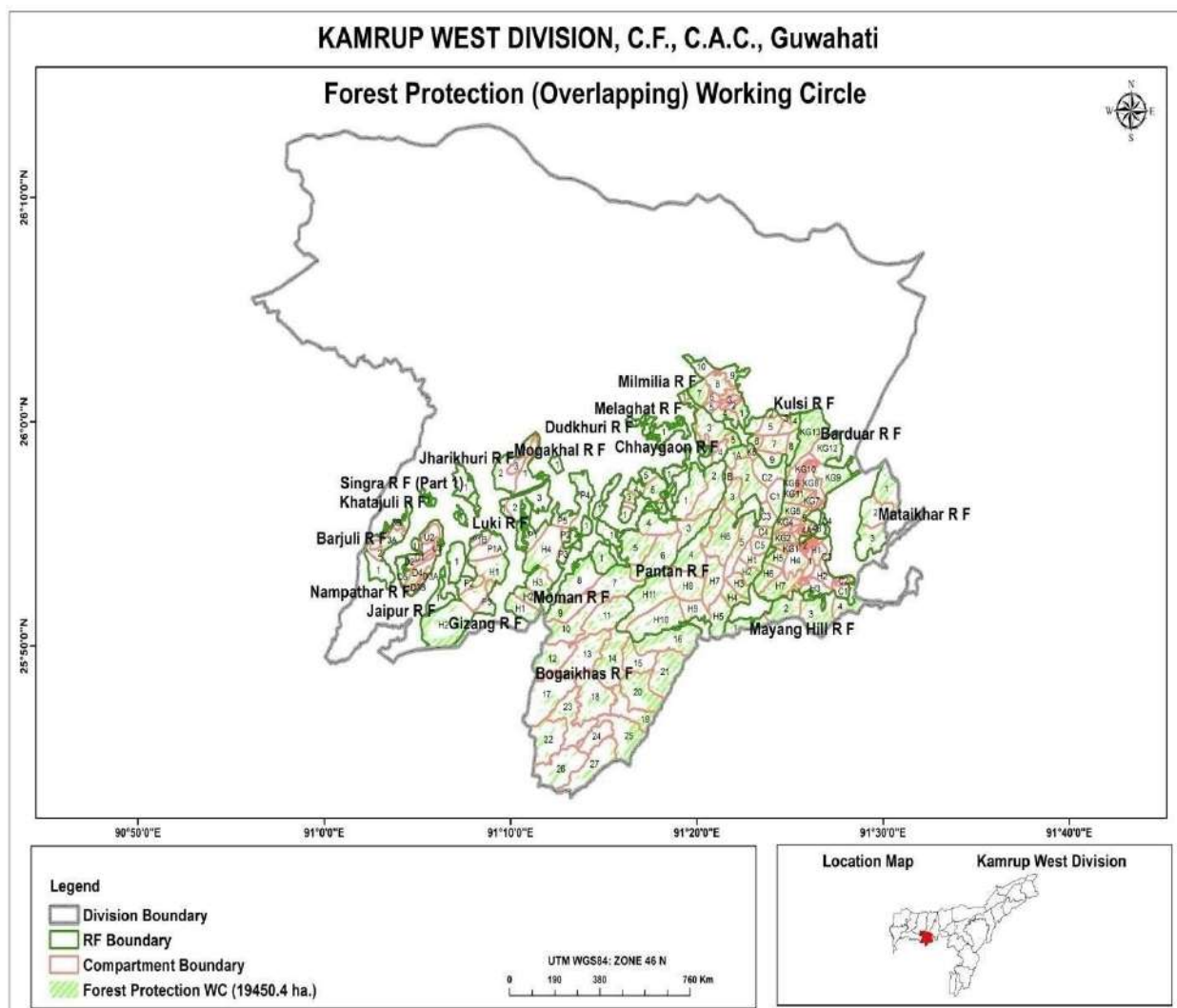


Fig. 5.1. Forest protection working circle map of Kamrup West Division

5.2 General constituents of the Working Circle: The areas with canopy cover above 70% and other areas under extreme biotic pressure and natural hazard prone areas will be under this working circle. 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. No harvesting prescription is given under this Working Circle. In future, when the forests start functioning again at its peak productivity, sustainable extraction from these forests may be allowed. Till that time, forests falling under the identified working circle shall function as nature's laboratories, which will keep 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 herbivores so it is necessary to protect these areas. The division, serves as catchments to critical wetlands, its denudation facilitates erosion especially after heavy monsoon rains 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 four months from June to September, needs no emphasis. In the past, these forests were worked repeatedly and heavily in accessible areas and along riverbanks.

It will include all the water bodies of the forest 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 forest productivity, the flow of ecosystem services and also protect from floods.

The ecological and environmental role of forests has precedence over all other roles one can think of. Forests are the natural resources which are to be passed on to the posterity with least disturbance to the natural processes they are being subjected. Keeping this mandate in view, the protection working circle is carved out.

5.3 Objectives of the Working Circle: The broad objective of this Working Circle is to protect the Reserved 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 restoration 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 given below:

5.4 Blocks & Compartment Allotment of Areas: Forest protection working circle comprises all the forest area of Kamrup West Division comprising 68176.692 hect.

5.5 Forest Protection Aspect:

5.5.1 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 West 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/Illegallities/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 struggling 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 M³ (cubic meter) of timbers were seized by the forest staffs besides drawing up Offence Reports and accused been sent to jail.

5.5.2 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.
- iv) **Biodiversity & Ecological objective:** To create forest of heterogeneous nature with valuable species as well as with other indigenous species to maintain Forest Eco-system. The increased growth of biomass will help in carbon sequestration.

5.5.3 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 Reserved forests of this division are 802 whereas 108 Forest Guards are placed at various places to protect forests. Therefore there is a need to seek the co-operation of local people in forest protection. The main components of strategy are given below.

- (1) Existing forest needs to be well protected and developmental works like soil and moisture conservation measures, natural and artificial regeneration works and other cultural operations shall be carried out in order to increase productivity of forests.
- (2) Regulation of grazing and controlling fire.
- (3) Seeking co-operation and active participation of local people in all operations of forest management and employment generation to local people during lean period.
- (4) Fulfilling the demands of local people for forest produce.
- (5) Effective utilization of existing infrastructure, strengthen and updating infra-structural facilities, improvement in communication facility and mobility of the forest staff.

- (6) Installation of new Check posts at hyper sensitive and sensitive points.
- (7) Patrolling sensitive forest areas along with the local people/ JFM Committee members.
- (8) Intelligence gathering including introducing Rewards, Awards and informer system and making forest offences high risk low gain process.

5.5.4 Protection measures:

5.5.4.1 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.

5.5.4.2 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.

5.5.4.3 Protection Squad: The Protection Squad of the Division is very much weak. It shall be strengthened with posting of one Range Officer, at least 8 foresters, 12 forest Guards and one section of armed Assam Forest Protection Force (AFPF) battalion. Two vehicles including one Mini truck shall be at the disposal of Protection Squad. Jurisdiction of the Protection Squad shall be the entire Kamrup West 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.

5.5.4.4 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.

5.5.4.5 Mobility of staff: In Kamrup West 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.

5.5.4.6 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.

5.5.4.7 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.

5.5.4.8 Fire protection: The areas of Kamrup West Forest Division are prone to fire due to heavy biotic pressure and due to deciduous nature and the dry climate. Fire caused damage to the forest specially regeneration, forest growth, ground flora, soil organisms and the soil productivity. Prevention of fires and effective control of fires as prescribed in the plan is essential for forest development. The leaf litter on the ground and highly combustible under growth of grasses etc. catch fire and spread instantly. In summer high speed of winds spread fire easily before it could be brought under control. Fire line with appropriate width as per the guide lines shall be maintained and patrolled by fire watchers.

5.5.4.9 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.

5.5.4.10 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 West Division 20734.977 hectare (30.44%) of forest land are under encroachment. However the figure is inclusive of the areas inhabited by Schedule Tribes and other forest dwellers. Population increase and requirement of land for agriculture and settlements besides greed of land hungrys are the main cause of encroachment. The problem aggravated because of apathy and laxity of forest staffs. Morale of frontline Staffs had gone down because of the fact that even after assaulting number of staffs including Range Officer of Protection Squad, no punitive action was taken against timber smugglers and offenders. The morale of staffs is so ruined that, except few, staffs do not 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 West 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 Regulation 1891 is a normal duty of the Forest Department, which should be carried out regularly by the Department as and when required subject to availability of logistic support. The procedure laid out in the The Assam land and revenue Regulation'1886 together with Section 434 of IPC and Section-7, 24, 25, 59, 61 and 66 of Assam Forest Regulation 1891(Amendment) Act1995 shall be followed.

2. All external boundaries shall be demarcated with concrete pillars. All sensitive and important boundaries and wherever disputes are there, be surveyed and concrete pillars be laid immediately. Multi-strand concertina (Razor) 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.

Table 5.5.4.10 Status of encroachment in various Reserved Forests

Sl. No	Name of Range	Name of R.F	Area of R.F. (in Ha)	Encroached area (in Ha)	Nature of Encroachment	Previous action taken to	Logistic support	To be evicted every year
1	Loharghat-Kulsi	Barduar	7235.94	1460.63	Dwelling Houses, Agriculture, Horticulture, Educational & Cultural Institutions by Local committee	Eviction was carried out during the year 2002, 21.10 KM2. But reoccupied.	Trucks, Balero, Sumo, Type vehicle, Excavator, Daily labours, Elephant, Temporary Camp etc.	250 Ha Carrying out eviction in illegal human habitation taking support from Civil administrative Department including Police, Magsistrate etc.
2	Loharghat	Mataikhar	1684.34	20.00				
3	Loharghat	Mayang	2139.21	136.37				
4	Kulsi	Kulsi	1855.12	1169.00				
5	Bamunigaon	Milmillia	1853.91	446.30				
6	Bamunigaon	Chhaygaon	1294.21	673.90				
7	Bamunigaon	Khuksi Sikratura	1019.63	57.70				
8	Bamunigaon	Melaghat	362.61	15.16				
9	Bamunigaon	Dumpara	193.44	20.96				
10	Bamunigaon	Simla	126.26	13.00				
11	Bamunigaon	Gohaingurung	125.46	209.10				
12	Bamunigaon	Dudhkuri	98.34	9.93				
13	Bamunigaon	Dimali	52.61	9.20				
14	Bamunigaon	Ghoraputa	47.75	22.00				
15	Bamunigaon	Dhaniagaon	36.42	11.62				
16	Singra Range	Moman	3211.25	1240.10				
17	Singra Range	Jarikhuri	1249.25	617.00				
18	Singra Range	Luki	904.90	588.00				
19	Singra Range	Sursuria	389.72	267.00				
20	Singra Range	Taraibari	319.30	333.00				
21	Singra Range	Khatkhathi Hill	248.48	207.10				
22	Singra Range	Mugakhal	129.10	60.30				
23	Singra Range	Garubaldha	110.08	112.40				
24	Singra Range	Khurkhuri	66.17	70.91				
25	Bondapara	Gizang	3472.24	700.00				
26	Bondapara	Nampathar	1380.41	470.00				
27	Bondapara	Borjuli	1129.91	410.00				
28	Bondapara	Boradova	434.64	450.00				
29	Bondapara	Singra (part I)	379.08	106.00				
30	Bondapara	Jaipur	326.18	433.00				
31	Bondapara	Khatajuli	110.16	128.00				
32	Bondapara	Singra (part II)	95.18	148.00				
33	Bondapara	Mahipara	93.98	45.00				
34	Bamunigaon-Singra	Bagaikhas	24668.77	4653.30				
35	Bamunigaon-Kulsi	Pantan	11280.86	5421.00				
			68124.892	20734.977				

5.5.4.11 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.

5.5.4.12 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.

5.5.4.13 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.

5.5.4.14 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 West Division with supporting staff.

5.5.4.15 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.

5.5.4.16 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.

5.5.4.17 Register of habitual offenders Name & address of the offender Previous record POR No./qty/Action taken Modus – operandi Photograph if available

5.5.4.18 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.

5.5.5 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. The programme 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: 5.5.5a: Approximate Number of Pillars Proposed to be constructed

Total no Pillars to be Constructed (10 year)						
SL No	Item	Length of Boundary of All Reserved Forests (km)	No of Pillars (per km)	Total No of Large pillars required	No of Pillars existing at present in the division	Required no of pillars to be established (10 year)
1	Main Pillars	232	3	696	17	679
2	Sub Pillars	232	7	1624	55	1569

Requirement of Boundary Pillars is as per the ground configuration 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 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	-	-	-



Apart from erecting boundary pillars, strategic boundaries of Reserved Forests (i.e., which are vulnerable to encroachment) may be fenced up by heavy and permanent type fencing as in picture above.

CHAPTER 6

NON TIMBER FOREST PRODUCE (OVERLAPPING) WORKING CIRCLE

6.1 Name of the Working Circle: Non timber forest produce (overlapping) working circle. The detail map of this working circle is shown in Plate 18.1

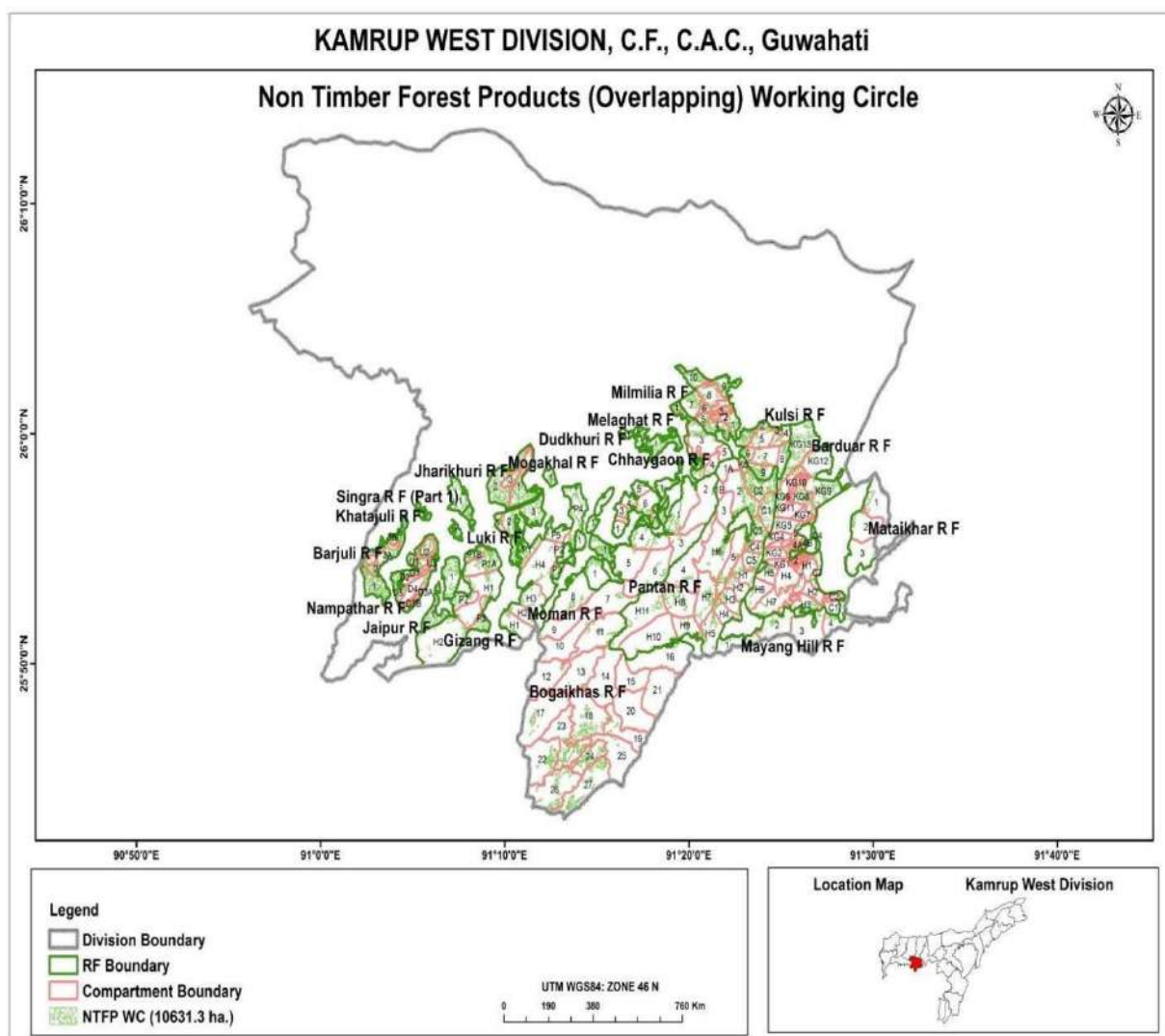


Figure 6.1. Non timber forest produce (overlapping) working circle map

6.2 General Constituents of the Working Circle: The NTFP Working Circle shall comprise largely the fringe forest areas or such other areas, which are fit for extraction of a particular NTFP at a rate that does not lead to the long term decline of the biological diversity. The forest land allotted to the Schedule tribes under the Forest Right Act may also be included in NTFP Working Circle.

6.3 General characteristics of vegetation: It is described in Sal Regeneration Working Circle and Teak Regeneration Working Circle in para 2.3 and 3.3.

6.4 Blocks & Compartment allotment of Areas: Blocks, compartment and the area to be covered in this working circle is provided in the table below totaling 48679.73 hect, out of which area earmarked for NTFP plantation is 2100.00 hect.

Table 6.4 Compartment wise forest area earmarked for NTFP Working Circles:

Name of W.S	Name Reserved Forest	Compt No.	Area in Ha	Area earmarked for NTFP plantation (Ha)
Loharghat	Mayang Hill	1	348.772	10.00
	Mayang Hill	4	360.899	15.00
	Mataikhar R F	3	579.850	10.00
	Mataikhar R F	2	546.929	10.00
W.S. Total			1836.45	45.00
Kulsi	Kulsi R F	7	337.080	20.00
	Kulsi R F	9	210.066	10.00
	Kulsi R F	8	226.925	10.00
	Kulsi R F	5	270.733	10.00
W.S. Total			1044.804	50.00
Bamunigaon	Milmilia R F	1	167.251	10.00
	Milmilia R F	4	233.744	12.00
	Milmilia R F	5	88.785	10.00
	Milmilia R F	6	87.440	10.00
	Milmilia R F	7	287.931	10.00
	Milmilia R F	8	304.381	12.00
	Milmilia R F	9	342.312	10.00
	Chhaygaon	3	544.218	10.00
	Chhaygaon	4	161.749	10.00
	Chhaygaon	5	144.675	8.00
	Khaksi Sikratura	3	101.741	10.00
	Khaksi Sikratura	7	85.120	10.00
	Khaksi Sikratura	4	142.612	12.00
	Melaghat	1	362.606	10.00
	Dumpara	1	193.443	10.00
	Dimali	1	52.610	10.00
	Dhuniagaon	1	36.422	10.00
W.S. Total			3337.04	174.00
Singra Range	Moman R F	H2	265.143	10.00
	Moman R F	H3	421.966	10.00
	Moman R F	H4	981.848	10.00
	Moman R F	P3	112.439	10.00
	Moman R F	P4	572.125	12.00
	Moman R F	P5	239.715	10.00
	Jharikhuri R F	2	638.056	11.00
	Luki R F	3	338.210	10.00
	Luki R F	1	96.861	10.00
	Taraibari	1	319.303	10.00
	Khatkhathi Hill	1	248.482	10.00
	Mugakhal	1	129.097	10.00
	Khurkhuri	1	66.167	10.00
W.S. Total			4429.412	133.00
Bondapara	Gizang R F	H1	913.762	10.00
	Gizang R F	H2	1311.594	10.00
	Gizang R F	P1B	165.349	11.00
	Gizang R F	P1A	495.480	12.00
	Nampathar R F	U2	234.442	12.00
	Nampathar R F	D5	179.089	11.00
	Nampathar R F	D4	281.499	10.00
	Nampathar R F	D2	99.648	12.00
	Nampathar R F	D1	117.242	10.00
	Nampathar R F	U1	98.632	10.00

	Barjuli R F	3B	234.548	10.00
	Barjuli R F	1	396.042	11.00
	Barjuli R F	3A	279.414	11.00
	Barjuli R F	2	165.534	11.00
	Boradova	1	434.641	10.00
	Singra (part I)	1	379.080	10.00
	Jaipur	1	326.183	11.00
	Khatajuli	1	110.160	10.00
	Singra (part II)	1	95.180	10.00
	Mahipara	1	93.980	10.00
W.S. Total			6411.499	212.00
Bamunigaon-Singra	Bogaikhas R F	1	707.733	10.00
	Bogaikhas R F	2	819.126	20.00
	Bogaikhas R F	3	483.010	25.00
	Bogaikhas R F	4	536.686	50.00
	Bogaikhas R F	5	687.551	45.00
	Bogaikhas R F	6	945.932	32.00
	Bogaikhas R F	8	815.435	35.00
	Bogaikhas R F	7	786.374	30.00
	Bogaikhas R F	9	514.044	28.00
	Bogaikhas R F	10	846.344	22.00
	Bogaikhas R F	11	889.210	18.00
	Bogaikhas R F	12	733.606	33.00
	Bogaikhas R F	13	873.423	38.00
	Bogaikhas R F	14	973.484	35.00
	Bogaikhas R F	15	550.500	36.00
	Bogaikhas R F	16	970.783	20.00
	Bogaikhas R F	17	1177.738	18.00
	Bogaikhas R F	18	1052.970	16.00
	Bogaikhas R F	19	577.223	12.00
	Bogaikhas R F	20	876.759	14.00
	Bogaikhas R F	21	839.076	16.00
	Bogaikhas R F	22	884.242	30.00
	Bogaikhas R F	23	897.741	33.00
	Bogaikhas R F	24	411.841	38.00
	Bogaikhas R F	25	863.242	50.00
	Bogaikhas R F	26	1052.631	50.00
	Bogaikhas R F	27	918.061	45.00
W.S. Total			1684.770	99.00
Bamunigaon-Kulsi	Pantan R F	K6	89.605	25.00
	Pantan R F	1A	256.851	20.00
	Pantan R F	1B	103.154	15.00
	Pantan R F	C2	478.773	16.00
	Pantan R F	C1	362.059	20.00
	Pantan R F	H11	1060.835	20.00
	Pantan R F	H9	370.482	22.00
	Pantan R F	H10	1003.323	25.00
	Pantan R F	H8	665.567	25.00
	Pantan R F	H5	493.441	30.00
	Pantan R F	H7	611.903	25.00
	Pantan R F	H4	269.769	27.00
	Pantan R F	H3	263.367	29.00
	Pantan R F	H2	266.034	30.00
	Pantan R F	H1	291.944	32.00
W.S. Total			6587.107	361.00
Kulsi-Loharghat	Barduar R F	4A	128.975	17.00
	Barduar R F	4B	77.642	15.00
	Barduar R F	5	121.013	16.00
	Barduar R F	H1	154.797	14.00
	Barduar R F	H2	197.101	28.00
	Barduar R F	H3	337.873	22.00

	Barduar R F	H4	387.433	24.00
	Barduar R F	H5	214.214	30.00
	Barduar R F	H6	345.151	15.00
	Barduar R F	H7	530.059	20.00
	Barduar R F	C1	195.204	18.00
	Barduar R F	C2	64.744	15.00
	Barduar R F	C3	183.775	17.00
	Barduar R F	C4	68.221	23.00
	Barduar R F	KG1	90.589	14.00
	Barduar R F	KG2	195.409	10.00
	Barduar R F	KG3	56.450	28.00
W.S. Total			3348.65	326.00
Division Total			48679.73	2100.00

6.5 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 Reserved 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 diverse species to maintain Forest Eco-system. The increased growth of biomass will help in carbon sequestration.

6.5.1 Other objectives of NTFP Working Circle are-

- i) Sustained use of forests through sustainable collection, harvesting of NTFP adopting sound silvicultural principles.
- ii) To involve the local communities living in and around the forest areas, in the management of resources.
- 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 intensive cultivation.
- 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 research organisations.
- vii) Initiate research on medicinal plants.
- 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.

6.6 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: Naturally occurring NTFPs

Botanical Name	Local Name	Medicinal Use
<i>Ageratum conyzoides</i>	Gendhela bon	Bruised leaves are applied to cuts and wounds as antiseptic.
<i>Alangium chinese</i>	Sika morolia	Leaf, stem bark Decoction of leaves & stem bark is said to cure malaria
<i>Alocasia indica (Roxb.)</i>	Man kachu	Rhizome is given in abdominal pain.
<i>Alocasia macrorrhiza</i>	Bor kochu	Boiled tender leaf is said to prevent tonsillitis.
<i>Alpinia nigra</i>	Tora	Rhizome paste is used in bronchitis.
<i>Alstonia scholaris</i>	Chatiana	Latex is applied on scabies and some skin diseases. Decoction of stem bark is given in chronic diarrhoea, dysentery and malaria fever
<i>Alternanthera sessilis</i>	Mati – kanduri	Shoot Boiled and given in dysentery.
<i>Amaranthus spinosus</i>	Hati-khutura	Root juice is given in diarrhoea.
<i>Amaranthus tricolor</i>	Bishalya karani	Leaf paste is applied to cuts for quick healing.
<i>Amorphophalus paeoniifolius</i>	Ol-kochu	Tender shoots are used as vegetables, which Boiled corm is used in the treatment of piles
<i>Baccaurea ramiflora</i>	Leteku	Decoction of bark is useful in constipation. Powdered dry bark is applied on infected umbilicus of newly born baby.
<i>Bixa orellana / Mallotus philippinensis</i>	Jorot goch	Juice of the bark is prescribed for dysentery and kidney trouble.
<i>Cassia alata</i>	Khorpat	Applied on scabies and ringworm.
<i>Cassia occidentalis</i>	Medeluwa	Leaf decoction is applied on ringworm
<i>Zingiberaceae</i>	Bor tora	Rhizome paste is used as remedy for sore.
<i>Chromola odorata</i>	Bagh dhoka	Leaf paste is applied as antiseptic to cuts and wounds.
<i>Cissus quadrangularis</i>	Harjura lota	Stem paste is applied on wounds and bone fracture for quick healing.
<i>Clerodendron colebrookianum</i>	Nephaphu	Decoction of tender leaf is given to cure hypertension
<i>Clerodendron viscosum</i>	Dhopat tita	Leaves are said to cure malaria.
<i>Cordia dichotoma</i>	Bowal	Paste of bark and leaf is applied to swelling and inflammation. Powdered dry seeds are applied on skin eruptions
<i>Costus speciosus</i>	Jam lakhuti	Rhizome paste is given in jaundice
<i>Curcuma aromatica</i>	Bon-halodhi, keturi,	Rhizome paste is applied to sprains.
<i>Cyperus rotundus</i>	Keya-bon Nut grass	The extract of boiled and pounded tuber is given in stomach discomfort.
<i>Dillenia indica</i>	Ou-tenga, Elephant apple	Decoction is given in dysentery, flatulence and constipation.
<i>Erethites valerianaefolia</i>	Bon kopah	Leaf paste is applied to cuts and wounds for quick healing.
<i>Eryngium foetidum</i>	Man dhania	Leaf juice is given in flatulence and stomach trouble
<i>Ficus racemosa</i>	Mau dimoru	Boiled fruits are given in diabetes.
<i>Flacourtia jangomas</i>	Poniol, Indian plum,	Decoction of stem bark and leaves are useful in diarrhoea.
<i>Garcinia cowa</i>	Kuji-thekera	Fruit Infusion of dry pericarp is given in diarrhoea, dysentery and flatulence.
<i>Garcinia lancifolia</i>	Rupahi thekera	Same as above
<i>Garcinia pedunculata</i>	Bor thekera	Same as above

<i>Gmelina arborea</i>	Gomari	Leaf decoction is given in indigestion and flatulence.
<i>Hedyotis corymbosa</i>	Bon-jaluk	Tender shoot Decoction is given in body ache and peptic ulcer.
<i>Hibiscus sabdarifolia</i>	Tengamora	Tender shoot Decoction is prescribed in diarrhoea or dysentery.
<i>Homalomena</i>	Aromatic Gondhi-kochu	Rhizome paste is given in stomach ailments.
<i>Ichnocarpus frutescens</i>	Dudhkuri Iota	Black creeper Root juice is used in fever and diabetes
<i>Justicia adhatoda</i>	Boga-bahok leaf	Root, Powder of dry roots is applied on ulcers. Warmed juice is used as massage on lower abdomen after childbirth for uterus contraction.
<i>Lasia spinosa</i>	Chengmora	Boiled rhizome is prescribed for irregular menstruation and juice of the same is given in leucorrhoea. It also controls cholesterol deposition.
<i>Lindernia pusilla (Willd.)</i>	Gakhiroti-bon	Whole plant Decoction is given to women after childbirth to promote milk
<i>Litsea salicifolia</i>	Dighloti	Leaf decoction is given in dysentery
<i>Melia azedarach</i>	Ghora neem	Bark, leaf Paste of bark and infusion of leaves are applied in skin diseases.
<i>Mikania micrantha</i>	Japanilota	Leaf juice is given in stomach pain and dysentery. Leaf paste is applied to cuts and wounds to stop bleeding
<i>Mimosa pudica</i>	Lajuki Iota	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
<i>Murraya koenigii</i>	Narasingha	Leaf Leaf decoction is given in dyspepsia and dysentery
<i>Oroxylum indicum</i>	Bhat-ghila	Stem bark Decoction is given in sour mouth and tongue
<i>Paederia scandens</i>	Bhedailota	Tender leaf and shoot Decoction is given in dysentery, diarrhea, abdominal pains and flatulence.
<i>Phlogacanthus thyrsoformis</i>	Ronga bahok, tita phul	Flower Eaten as vegetable is useful in rheumatism, anemia and cough
<i>Sapindus mukorossi</i>	Moni-chal, ritha	Gargle in tonsillitis and pharyngitis. Seed decoction is also applied on scabies.
<i>Sida acuta</i>	Sonborial	Decoction is given in stomach Snake's tongue Root pain.
<i>Solanum indicum</i> Indian nightshade	Tita bhekuri	Fruit Eaten in curries or roasted useful as blood purifier.
<i>Spondias pinnata</i>	Amora Hog plum	Wild mango Stem bark, leaf, fruit Decoction is given in blood dysentery. Leaf juice is dropped in the ear in otalgia
<i>Streblus asper</i>	Saura	Toothbrush tree. Used as toothbrush to cure toothache.
<i>Talauma hodgsonii</i>	Borhomothuri	Stipule with bud Chewed with betel nut and betel leaf is said to strengthen gums and teeth.
<i>Vitex negundo</i>	Pochotia	Chinese chaste tree Leaf Paste is applied on scabies and decoction is given in pneumonia

6.6.1 Some other commonly found NTFPs are:-

1. Amlakhi (Fruits of *Emblca officinalis*)
2. Dhuna (Exudation of *Canarium resiniferum*)
3. Jamuk (Fruits of *Syzygium jamboos*).
4. Arjun (*Terminalia arjuna*)
5. Hilikha (*Terminalia chebula*)
6. Bhomora (*Terminalia balerica*)
7. Bhatghila (*Oroxylum indicum*)
8. Sarpagandha(*Rauwolfia serpentine*)
9. Satmul (*Asparagus racemosa*)
10. Curcuma aromatica (Ban-haldi),
11. *Emblca officinalis* (bel),
12. *Eugenia jambolana*(Loha-jam),
13. *Holarrhina antidysentrica* (Dudhkuri)
14. *Hydnocarpus kurzii* (Chalmugra),
15. *Litsea cubeba* (Mejankuri),
16. *Phlogocanthus thysiflorus* (Titaphul),
17. *Piper longum* (pipoli),
18. *Saraca indica* (Asoka),
19. *Wedelia calandulacea* (Mahabhringraj,
20. *Zinziber officinalis* (Ada)
21. Pods of *Sterculia alata*)
22. *Cinogyne dichotoma* (Patidoi)
23. Laham bark
24. *Adhatoda vasica* (Bahak Tita)
25. Honey

Medicinal plants: *Bhedailata, Dhekia, Kochu, Kathalu, Manimuni, Jamlakhuti.*

Orchids: *Rhyncostylis retusa, Aerides odoratum, Aerides multiflora, Papilionthe teres (Bhatou phool), 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 daily needs,
- ii) Local health practitioners,
- iii) Cottage industries,
- iv) Petty sellers,
- v) Dhobi or washer man.

6.6.1.5 Constraints:

- i) Absence of fixed price for NTFP,
- ii) Absence of marketing facilities,
- iii) No standard procedure for collection or harvesting,
- iv) Involvement of middlemen,
- v) Ring formation at the time of tender cum auction sale,
- vi) Lack of processing units,
- vii) Ignorance of people about the availability of local resources.

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, including medicinal. Fruits may be allowed to be collected with the restriction as in case of *Syzigium Jambos*. 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 indigenous species of NTFPs shall be propagated and cultivated as multi crop system beneath the forest species with due silvicultural prescriptions.

6.6.4 Harvesting and Yield

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, 2012 the 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 particularly, 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 allotted under protection working circle with the exception of the cases provided under Forest Right Act.
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 the society/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 for closure.
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 sent to the concerned Range Forest Officer for safe custody. Range Forest Officer in turn will give regular report in this regard to Deputy Conservator of Forests.
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. The tribal 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 such species.

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.

Table 6.7 : Species of Bamboo available in Assam

Sl no	Vernacular Name	Botanical Name	Status
1	Saru Bijuli	<i>Baambusa assamica</i>	Commonly cultivated, culms are used as handicrafts, fishing rod and for erecting fence.
2	Bhaluka banh	<i>Bambusa balcooa</i>	Widely cultivated and nowhere found in wild state. It is probably the best and strongest species for building purposes.
3	Kotoha banh	<i>Bambusa bambos</i>	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	<i>Bambusa multiplex</i>	Indigenous to China but now available in throughout the state. Frequently cultivated as hedge .
5	Makal banh	<i>Bambusa nutans</i>	Naturally occurring in the state. Flowering sporadic ,occasionally gregarious. Use in construction.
6	Jati banh	<i>Bambusa tulda</i>	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	<i>Bambusa pallida</i>	Cultivated in the plains of Assam. It is used for house building , handicraft, mat etc. Flowering sporadic.
8	Kalachi banh	<i>Bambusa vulgaris var. Wamini</i>	Cultivated throughout Assam as ornamental. So far flowering is not known for this taxon.
9	Haladhia banh	<i>Bambusa vulgaris var. vittata</i>	Cultivated throughout Assam as ornamental. Flowering sporadic and rare ,does not set seeds.
10	Kako banh	<i>Dendrocalamus hamiltonii</i>	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	<i>Melocanna baccifera</i>	Cultivated all over Assam. It is used prefabricated walls called tarja, 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.

6.6.7 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 long seeding 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.

6.6.8 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.

6.6.9 Preparation of nursery bed: Seeds are usually sown in standard nursery beds (10 m x 1.2 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.

6.6.10 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.

6.6.11 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 %.

6.6.12 Plantation Management:

Production of field planting stock of bamboo species through two noded culm cutting with macroproliferation 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 be 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.

6.7 Silvicultural System

The silvicultural system to be followed here will be selection system.

6.7.1 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 rains subsequent to bamboo harvesting. In case of underplanting 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.

6.7.2 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 convenience.

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 Series 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.

6.7.3 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.

6.8 Harvesting: Harvesting should be done under strict supervision of the Department.

6.8.1 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.

6.8.2 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 upto 1.5 meter distance will be completely removed.

iv) The whole area will be strictly protected from fire and grazing.

6.8.3 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.

6.8.4 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.

6.8.5 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.

6.8.6 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.

6.8.7 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

6.8.8 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: FSI data on Bamboo

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.

6.9 Associated Regulations and Measures: 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.

6.10 Cultivation of Agarwood (*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 brought under cultivation of Agar trees.

Aquilaria malaccensis locally known as Xasi or Agar, acts as a world class perfumery fixative and is highly sought after and priced by European perfumers for making their best grade scents. It acts as a stimulant, cardiotonic, carminative, aphrodisiac, alternative anodyne, antidiarrheal, antiasthmatic, 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 20°C to 28°C and relative humidity around 80%. It grows over sandy loam and slightly acidic soils.

Propagation Material: Seeds.

Nursery Technique:

Raising Propagules: Seeds mature during July-August. It loses viability soon. Thus seeds are sown within a week of collection. Raising seedlings in poly-bag is preferred. Seed germination is more than 80%.

Propagule Rate and Pretreatment: 4500 plants/ha are required.

Planting in the Field:

Land Preparation and Fertilizer Application: Before transplanting of seedlings, land should be thoroughly ploughed and harrowed to bring it up-to a good tilt. FYM @ 20 t/ha may be applied at the time of land preparation supplemented with NPK @ 60:60:40 may be applied in split doses. The fertilizer level is increased with age from 3rd year onwards.

Transplanting and Optimum Spacing: Seedlings when attain a height of 30-40 cm should be transplanted in the field during rainy season (April-June) at optimum spacing of 3X 3 meter.

Intercropping System: Annual or biennial medicinal herbs viz. *Andrographis paniculata* (Kalmegh), *Withania somnifera* (Ashwagandh), *Rauwolfia serpentina* (Sarpagandha), *Bacopa monnieri* (Bhrami), *Piper longum* (Pippali) etc. may be cultivated as catch crops till the trees attain growth.

Inter-culture and Maintenance Practices: Spading and simultaneous weeding at 90 days after transplanting is required.

Irrigation Practices: Rainfed plantation.

Weed Control: Hand weeding is done after 90 days of transplanting, thereafter Gramoxone @ 0.5 kg/ha may be applied when necessary. Glycel @ 1.5 kg/ha may be applied to eradicate weeds.

Disease and Pest Control: Attack of *Heortia vitessoides* is observed during May-August. This causes defoliation of whole tree. Application of Thiodan @ 2 ml/lit at 15 days interval during infestation is found to control the pests effectively.

Harvest Management

Agar-wood develops a peculiar, persisting strong odour because of infestation by a fungal identified as *Zeuzera conferta*, it penetrates the hard wood, through wounds, injury or borers. All attempts to induce artificial infestation have failed; it is a natural phenomenon. It develops black patches and stores resinous oil which is separated through distillation of the woody chips. This oil has high value in medicine and perfumery industry.

Crop Maturity and Harvesting: Time of harvesting depends on disease infestation in hard wood. Agar is regarded as a pathological product formed as result of infection. Black patches in the bark indicate occurrence of infection and can be used for harvesting hard wood to commercial use.

Post-harvest Management: Wood chips or chips powdered mechanically without generating heat are soaked in water for 2-3 days and transferred to stainless steel vessel which is part of a distillation unit. The distillation is done for 30-36 hours. Oil and water is collected in a separator and stored. The oil and water ratio in the condenser is kept low on account of the high boiling point. Oil is stored in closed container preferable in Aluminum bottles.

Chemical Constituents: The woody chips have an essential oil commonly known as Agar oil from 0.8% to 2.2% in fungal infested wood of 8-50 years old plant. The wood contains hexadecanoic acid (25.0%), pentadecanoic acid (6.7%) and oleic acid (4.9%); other constituents range from 0.1 to 2.1%.

Yield and Cost of Cultivation (Hectare): This oil is exceptionally costly.

Treatment prescribed: Areas allotted under JFMC Working Circle and NTFP Working Circle will be selected for Agarwood cultivation. 30 % of such area shall be brought under Agarwood cultivation under JFMC agenda. Regeneration expenditures, as in other JFMC plantation, shall be borne by Forest Department. Protection of the Crop shall be done by the JFMCs. Sharing of harvested crop shall be as per norms of the JFM.

Table: 6.12: Year-wise activities to be undertaken in NTFP Working Circle:

Year-wise activities	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
NTFP Plantation = 2100 hectares	210	210	210	210	210	210	210	210	210	210
NTFP Maintenance = 5040 hect.	-	210	420	630	630	630	630	630	630	630
Bamboo Plantation = 850 hectares	85	85	85	85	85	85	85	85	85	85
Bamboo Maintenance = 2040 hect	-	85	170	255	255	255	255	255	255	255

CHAPTER 7

Wildlife Management and Biodiversity Conservation (Overlapping) Working Circle

7.1 Name of the Working Circle: Wildlife Management and Biodiversity Conservation (overlapping) working circle.

7.2 General Constituents of the Working Circle: The National forest policy 1988 aims at conserving the natural heritage of the country preserving the remaining natural 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 each 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. Reserved 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 encompassing all the Reserved Forests of the division. These areas are favoured by Asiatic Elephants and there are reported cases of man animal conflict, accidental deaths.

7.2.1 : Blocks and Compartment allotment Areas: This Working Circle includes whole of 68176.692 hect of Forest land of the division.

7.3 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.

7.3.1 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 ensuring 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 Reserved Forests and create habitat fragmentation.
- (10) To initiate researches on the faunal diversity and their habitat.
- (11) Generate adequate publicity measures for conservation of wildlife.

7.3.2 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.

7.4 General Condition of Flora and Fauna:

7.4.1 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 *Michelia baillonii*, *Gmelma arborea*, *Lagerstroemia parviflora*, *Shorea robusta*, 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 *Schima wallichii*, *Bombax ceiba*, *Lagerstroemia parviflora*, *Chukrasie tubularis*, *Albizia lebbek*, *Stereospermum personatum*, *Albizia procera*, *Terminalia chebula*, *Sterculiavillosa*, *Gmelma arborea* etc. Medium sized trees species that forms middle storey and includes *Bauhinia acuminata*, *Holarrhaena antidysenterica*, *Phyllanthus embetica*, *Syzygium cumini*, *Garcinia peduncalata* etc. In some areas, the middle storey is occupied by bamboos called *Dendrocalamus hamiltonii*, *Bambusa pallida*, *Bambusa baccoa*, *Bambusa tulda* and other species that occur in great profusion in damp locations especially along perennial streams and nalas. In the lower slopes, *Coffea bengalensis*, *Clerodendrum serratum* *Phlogocanthusthrysiformis* etc occurs under loose canopies. Ground cover is predominated by different species such as *Chromolaena odorata*, *Phyllanthus fraternus*, *Justicia simplex*, *Paederia foetida*, *Costusspeciosa*, *Sida cordifolia*, *Desmodium spp.*, different types of grass and sedges such as *Panicum sp.*, *Carex sp.*, *Cyperus spp.*, *Oplismems burmanii*, *Eragrostris lamella*. Climbers are frequently found and most commonly species are *Clematis cadmia*, *Smilax macrophylla*, *Thunbergiagrandiflora*, *Argyreia speciosa*, *Myriopleron externum*, *Combretum decandrum*, *Cissampelospareira*, *Dioscorea alata* 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*, *Blechnum sp*, *Adiantum phillipensis*, *Palhinhaea cemua*, *Pteris sp.*, *Lygodium Jlexuosum*, *Helminostachys zeylanica*, *Pyrrosia rtuda*, *Drymnaglossum helerophyllum*, *Asplenium sp.*, *Dryneria quercifolia* etc. are also found to occur. In regard to epiphytes, different orchids such as *Bulbophylhim careyanum*, *Rhyncostylis sp.* etc., are found to occur in different host plants.

7.4.2 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 (*Trachypithe cuspileatus*), Assamese Macaque (*Macaca assamensis*), Rhesus Macaque (*Macaca mulata*), Leopard (*Panthera pardus*), Barking Deer (*Muntiacus muntjak*), Indian Mongoose (*Herpestes javanicus*), Wild Boar (*Sus scrofa*) etc.

The fresh 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 West Division is the prime abode of River Dolphin. Kulsi River is a breeding ground of this highly endangered species. 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 West 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.

7.4.3 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 the native indigenous species in terms of nutrient, space and different resources. As a result, different exotic species such as *Lantana camara*, *Chromolaena odorata*, *Mikania 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.

7.5 Legal position: The areas under this Working Circle are within Reserved Forests legal status of which is "Reserved Forest" constituted under Assam Forest Regulation 1891. The Kamrup West Division is spread over a geographical area of 1344.25 sq. km. with a forest area of 681.25 sq. km comprising of 36 (35+1) Nos. of R.Fs and PRF. All legal matters are dealt with the following Regulations/ Acts/Rules applicable-

- Assam Forest Regulation 1891 (Amendment) Act'1995
- Wildlife (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

7.6 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 Reserved 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.

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

7.7.1 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 do not 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.

7.7.2 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.

7.7.3 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 fringe villagers.

7.7.4 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:

7.7.4.1 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 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 the area. 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.

7.7.4.2 Fruit and fodder plantations: Plantation of elephants favourite fruit plants like *Dilena* spp., *Syzygium* spp., *Guajava* spp., *Artocarpus* spp., *Mangifera* spp., *Tamarindus* spp., *Embllica* 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.

7.7.4.3 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 wildlife habitat.

7.7.5 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.

7.7.5.1 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

7.7.5.2 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.

7.7.5.3 Control measures

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

7.7.5.4 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).

7.7.5.5 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 energizer got defected, some hostile and unscrupulous person connected direct 230-250V 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.

7.7.5.6 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.

7.7.5.7 Citizen Engagement for Awareness In Dealing Man Animal Conflict:

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.

7.7.5.8 General care to be taken:

- 1) Vaccination of cattle near the fringe villages needs to be done regularly and awareness camp & animal health camps need to be conducted with the help of Veterinary doctors regularly.
- 2) JFMCs need to be activated & awareness to be given on protection to wildlife.
- 3) Provision of funds to public for construction of solar electric fencing around their agricultural fields will help to reduce the human-animal conflict.
- 4) 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.

- 5) Construction of watch towers & posting of staff on 24 hours duty during most vulnerable periods.
- 6) 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.
- 7) A detailed elephant track/movement map covering the entire elephant movement area within the Kamrup West 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.

7.8: 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

7.8.1 : 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.

7.8.2 : 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.

7.8.3 : 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.

7.8.4 : 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:

7.8.5 : 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.

7.8.6: 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.

7.8.7 : 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.

7.8.8 : 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!

7.8.9 : 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

7.8.10 : Strategies for biodiversity conservation:

- Biodiversity use and conservation education.
- Integrated health care.
- Agroforestry.
- Afforestation.
- Cottage industry.
- Communities 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, leaves which are used to develop cottage industries. Some of the important forest resources used for cottage industries are Bamboos (*Dendrocalamus strictus*, *D. hamiltonii*), Lokhta (*Daphne papyracea* and *D. bholua*), Munj grass (*Saccharum bengalense*), Sabai grass (*Eulaliopsis binata*).
- 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-ecosystems.
- Highly diverse plant species shall be maintained in the village area.

9. 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.

7.9 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 forest has been emphasized in several contexts and before the year 2000 mainly on a local basis (e.g. Guevara *et al.* 1998, Harvey and Haber 1999). Small forest patches and trees that do not fall under the current forest definition play an increasingly important role, particularly in tropical landscapes, and should be incorporated in regional forestry and natural resource development programs.

Trees outside the forest were addressed as an important resource in the global forest assessments of FAO for the first time in FRA 2000 (Forest Resources Assessment Programme). However, it had not been included in the general data collection part but as one of a series of special studies (FAO FRA

2001a). FAO dedicated a volume of its forestry journal *Unasylva* to trees outside the forests (*Unasylva* 200) where there is also a paper addressing issues of large area assessments (Kleinn 2000).

In November 2001, FAO convened an Expert Consultation on TOF (Sadio, *et al.* 2002), titled “Enhancing the contribution of trees outside forests to sustainable livelihoods”, where a number of key observations and recommendations were made. An overall observation was that the information base being insufficient and scarce in most regions and that, particularly with respect to management options there are still open questions, geographically differing in character but many of them practically everywhere.

Suggestions:

- Prior to year 2000 TOF were not assessed in the global forest resource assessment (FAO 2000) and the interaction between these categories need to be further investigated. People's participation is a key factor in the sustainable management of TOF. Group consensus should be encouraged in decision, making and also to avoid possible conflicts.
- Research should be undertaken to identify such production systems for TOF that are efficient, ecologically sustainable and financially viable. This includes the development of planning tools, including decision support systems that assist producers to cope with climate variability. With a proper management of inputs, the productivity of the lands involving trees outside forests can be increased many fold.
- Agro-forestry should be looked upon as a means for improving the socio-economic conditions of the rural poor and should be the main plan of integrated rural development programme. In order to increase fuel, timber, and forage production agro-forestry programmes should be adopted on a large scale, this would include rural woodlots for the rural areas. Such programmes should be time-bound and target-oriented. People participation is a critical factor of success of such programmes.

Table: 7.9: Year-wise activities to be undertaken in Wildlife Management and Biodiversity Conservation (overlapping) working circle

Year-wise activities	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Habitat enrichment: Regeneration of various fruit, fodder species = 750 hect.	75	75	75	75	75	75	75	75	75	75
Maintenance of Plantation =1800 hect (750 x 3 Yrs)	-	75	150	225	225	225	225	225	225	225
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

CHAPTER 8

General financial forecast and financial plan of operation

8.1 Revenue Collection: Except in thinning operation, in Sal and Teak Regeneration Working Circles, no harvesting prescription is given in the Working Plan. The expected revenue collection from the thinning operations are shown as under:

Table 8.1 a: Expected revenue collection from thinnings operation of Sal regeneration working circle

No.	Detailed Item of Work	Qty (Nos.)	Rate (Rs)	Amount (Rs)
1	Sale of poles extracted during thinning in the 5 th year	25,000	5	1,25,000.00
2	Sale of poles extracted during thinning in the 6 th year	45,000	10	4,50,000.00
3	Sale of poles extracted during thinning in the 7 th year	75,000	10	7,50,000.00
4	Sale of poles extracted during thinning in the 8 th year	75,000	23.9	17,92,500.00
5	Sale of poles extracted during thinning in the 9 th year	20,000	23.9	4,78,000.00
6	Sale of poles extracted during thinning in the 10 th year	20,000	23.9	4,78,000.00
	TOTAL			40,73,500.00

Table 8.1b :Expected revenue collection from thinnings operation of Teak regeneration working circle

No.	Detailed Item of Work	Qty (Nos.)	Rate (Rs)	Amount (Rs)
1	Sale of poles extracted during thinning in the 5 th year	25,000	5	1,25,000.00
2	Sale of poles extracted during thinning in the 6 th year	55,000	10	5,50,000.00
3	Sale of poles extracted during thinning in the 7 th year	95,000	10	9,50,000.00
4	Sale of poles extracted during thinning in the 8 th year	75,000	23.9	17,92,500.00
5	Sale of poles extracted during thinning in the 9 th year	20,000	23.9	4,78,000.00
6	Sale of poles extracted during thinning in the 10 th year	20,000	23.9	4,78,000.00
	TOTAL			43,73,500.00

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 2021-2022 to 2030-2031.

Total activity area consolidating all compartments = 28546.22

Area earmarked for Sal regeneration = 4281.93 hect. Say 4300 hect

Table 8.2.1: Proposed estimate for Sal regeneration. W.C. for the period of 2021-2022 to 2030-2031.

No	Detailed Item of Work	Qty (Ha)	Rate	Amount
1	Regeneration of Sal in	4300	52528.00	22,58,70,400.00
2	Maintenance of Sal Plantation	15650	18864.00	29,52,21,600.00
	Total			52,10,92,000.00

II. Proposed estimate for Teak reg. W.C. for the period of 2019-2020 to 2028-2029.

Total activity area consolidating all compartments = 24777.25 hect.

15% Area earmarked for Sal regeneration = 3716.59 hect. Say 3750 hect

Table 8.2.2 : Proposed estimate for Teak reg. W.C. for the period of 2019-2020 to 2028-2029.

No	Detailed Item of Work	Qty (Ha)	Rate	Amount
1	Regeneration of Teak in	3800	52528.00	19,96,06,400.00
2	Maintenance of Teak Plantation	11400	18864.00	21,50,49,600.00
	Total			41,46,56,000.00

III. Proposed estimate for JFMC Working Circle**i . 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.

Table 8.2.3.i: Proposed estimate for JFMC Working Circle

Sl.No.	Detail item of works	Mandays
1.	Nursery development	2462
2.	Sapling raising – 1,00,000 saplings wil be produced per nursery / JFMC	22,308
3.	Maintenance (lumpsum)	507
4.	Total	25,277

ii . JFMC Plantation –**Table 8.2.3. ii: Proposed estimate for JFMC plantations under Joint Forest Management working circle in Kamrup 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

Table 8.2.3.iii: Proposed estimate (Rs. in lakhs) for JFMC plantations under Joint Forest Management working circle in Kamrup Division for the period of 2021-2022 to 2027-2028.

Sl.No.	Detail item of works	Rate	Amount (Rs)
1.	Creation of Plantation – including land preparation, pit digging, manuring , watering and maintenance 2100 hect	52528.00	11,03,08,800.00
2.	Maintenance =1500 hect.	18864.00	2,82,96,000.00
3.	Total		13,86,04,800.00

C. JFMC Training and awareness programmes –**Table 8.2.3 c : Proposed estimate for JFMC training and awareness programme under Joint Forest Management working circle Kamrup West Division for the period of 2019-20 to 2028-29.**

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

Table 8.2.3 d . Proposed estimate for 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 Forest Protection Working Circle

Table 8.2.4 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

Table 8.2.4 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

V. Proposed estimate for NTFP Working Circle:

Table 8.2.5 : Creation of Various NTFP Plantation

No	Detailed Item of Work	Qty (Ha)	Rate	Amount
1	Regeneration of various NTFP species	2100	52528.00	11,03,08,800.00
2	Maintenance of Plantation	1250	18864.00	2,35,80,000.00
	Total			13,38,88,800.00

VI. Proposed estimate for Wildlife Management W.C.

Table 8.2.6 a: 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

Table 8.2.6 b :Plantation of fruit, fodder species

No	Detailed Item of Work	Qty (Ha)	Rate	Amount
1	Regeneration of various fruit, fodder species	750	52528.00	3,93,96,000.00
2	Maintenance of Plantation	1000	18864.00	2,35,80,000.00
	Total			5,82,60,000.00

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 and Forests:

- (i) Change in Silvicultural system
- (ii) Clear felling of natural forest
- (iii) Formation of new felling series; and
- (iv) Large scale felling due to natural calamities.

For all major deviations with respect to prescriptions where sanction of the MoEF is mandatory, an explanatory note along with the request for regularization has to be sent by PCCF (HoFF) to RAPCCF (MoEF). In case, where there is difference of opinion between the PCCF (MoFF) and RAPCCF (MoEF), the former will refer the matter to DG F&SS (MoEF), whose decision shall be final. The PCCF (HOFF) will countersign the deviation statement for reporting to the MoEF (para 132 of National Working Plan Code-2014). The following format for deviation statement should be used:

Sl. No. of deviation	Control book, name, form, No.page	Year.....		Division.....	
		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 be used.

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 Working Circle.

9.5 Fire Protection: There are as such no significant damages from fires, however the following miscellaneous regulations are necessary to ward of forest fires:

- i) Annual maintenance of fire lines to be done in the January through vegetation clearing from fire lines.
- ii) Fire risks should be notified by the DFO to the staff for necessary preventive measures.
- iii) Entry of people inside the forests for extraction of MFP should be regulated.

The territorial staff should maintain cordial relations with the local people to garner their support in case of fires and other eventualities. The Divisional Forest Officer should visit the fire- affected areas immediately after it comes to his knowledge and should submit a report to the Conservator of Forests giving all the detail of occurrence of fire, causes of fire and damage occurred to the crop with remedial measures for the future.

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 be ensured.

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 the nurseries:

- i) Seeds of Sal from identified geotagged mother Trees should be used. In case of other species seed from reliable seed orchards should be used.
- ii) Production through vegetative means like root, stem, shoot cuttings, tissue culture, tree improvement techniques, cloning, rhizomes to raise the planting stock.
- iii) For bamboos, cuttings, rhizome multiplication method should be used to raise qualitative seedlings. To minimize the cost of transportation of seedlings to the field in the difficult terrain situations, seedlings should be raised in the root-trainers which give sturdy seedlings with high root-shoot ratio.

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 quarrying in stone mahals may be in operation adhering all the formalities. It should be ensured that in no way there are any environmental and ecosystem disturbances and its services degradation/deterioration through stone quarrying activities.

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 formalities. It should be ensured that in no way there are any environmental and ecosystem and its services degradation / deterioration through sand mining activities.

9.11 Fishery Mahals: All fishery mahals should be geotagged, inspection carried out and fishing adhering all the formalities / norms may be in operation in the fishery mahals. It should be ensured that in no way there are any fish biodiversity losses and introduction of exotics fishes and any environmental and ecosystem and its services degradation / deterioration through fishery mahal activities.

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 working circle.

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 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 labeling the products that come out of such units. In principle, consumers can encourage the manufacturers to use more and more of these certified raw materials. By actively rejecting or shunning material coming out of unsustainable logging or poaching, consumers could theoretically put pressure on the primary producers themselves to clean up their act and adopt sustainable ('green') practices. Thus the undesirable practices that are resulting in deforestation the world over will be eliminated.

Measures for Forest Certification shall be taken in next Working Plan.

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. Deen Dayal 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 Fasal Bima Yojana (PMFBY)
5. Livestock insurance Scheme
6. Micro Irrigation Fund (MIF)
7. Assam Farmers' Credit Subsidy Scheme (AFCSS),
8. Assam Farmers' Interest Relief Scheme (AFIRS)
9. Assam Farmers' Incentive Scheme (AFIS).

Animal Husbandry & Veterinary department:

1. Chief Minister Samagra Gramya Unnayan Yojana' also referred as Assam Milk, Meat & Egg Mission society (AMMEMS-CMSGUY).

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.

CHAPTER 10

MONITORING, 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 Management and Biodiversity Conservation is provided in this chapter. The control forms shall be prepared and submitted annually to the Conservator of Forests with a copy to the Working Plan Officer on the 1st of January for scrutiny and obtaining sanctions of deviations, if any.

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 be used.

Silvicultural Control Form: For control of all silvicultural operations such as subsidiary cultural operations, cleanings, burnings etc., Form No. 2 shall be used.

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 be used.

Wildlife Management and Biodiversity Conservation Control Form: For improvement of wildlife habitat and conservation and preservation of biodiversity, Form No. 4a, 4b & 4c shall be used.

Plantation Control Form: For any plantation block, gap, regeneration natural and assisted Form No. 4a, 4b & 4c shall be used.

The DFO territorial will annually make entries in his copy of the control forms and send them, together with the deviation statement in triplicate to the Head, territorial circle. After the entries have been checked and approved, the Head, territorial circle will first get his copies completed and then send it in two copies to the concerned WPO. The latter will then complete his copy and finally return the DFO's set for deposit in the latter's office till next year. The WPO will send the deviation statement with appropriate justification in four copies to the CCF/APCCF (RE&WP) for recommendation to PCCF (HoFF) for sanction. After the sanction, one copy each will be sent to the WPO, Head, territorial circle and the DFO territorial for their record and the CCF/APCCF (WP) as the case may be, will retain the fourth copy for his set of control forms. The control forms should be submitted by the DFO territorial to the Head, territorial circle by October and the latter should send them to the WPO concerned by December each year (para 129 of the National Working Plan Code- 2014).

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 maintained in the registrar. The compartment history along with a

thematic map will include the operations, silvicultural operations, and any other operations in the compartment as prescribed in the working circles.

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 complicity at any level, the controlling officers should inspect the following documents during inspection and enter signed observations.

- i. Annual Plan of Operations (APO)
- ii. Plantations Journals
- iii. Nursery Registers
- iv. Measurement Books
- v. Divisional Note Book
- vi. Fire Control Forms
- vii. Beat Book

Annual Plan of Operations: An annual plan of operations should be prepared by the Divisional Forest Officer based on the prescriptions and operations to be carried out as per the provisions of the Working Plan. It should be approved by the Conservator of Forests.

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 maintained in the registrar. The compartment history along with a thematic map will include the operations, silvicultural operations, and any other operations in the compartment as prescribed in the working circles.

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 maintained in the registrar. The compartment

history along with a thematic map will include the operations, silvicultural operations, and any other operations in the compartment as prescribed in the working circles.

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 office monthly.

Divisional Note-Book: The Divisional Forest Officer should maintain a note-book in which the following information shall be recorded.

- a) Flowering of important tree species.
- b) Seeding of important tree species including geocoordinates of mother trees
- b) Gregarious flowering of bamboos.
- c) Climate-rainfall and temperature experienced during this year and its effect of the forest crop.
- d) Pests and diseases noticed in the crop, treatment and result thereof.
- e) Growth date of trees collected during the year.
- f) Labour related problems faced during the year.
- g) Market trend of forest produce.
- h) Working of JFM committees.
- i) Any other major important issue from the forest management point of view.

Fire Control Form: The record of forest fires should be maintained without any bias. The details of area burnt with sketch, cause of fire, date of fire, time of fire, date and time of control, damage and financial loss will be recorded. The copy of the fire report should be sent to the Conservator of Forests.

Deviation statement: To exercise control over progress of various operations at the end of each financial year, the prescriptions of the working plan will be compared with the actual operation done in the field on felling, silvicultural operations and miscellaneous works and any excess or short fall shall be recorded giving reasons for deviation and sanction of the competent authority shall be obtained as per the details given in the Miscellaneous Regulations.

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 following information:

- c) Beat map
- d) Detail of forests in the beat
- e) Copy of boundary register of forests
- f) Duties of Forest Guard
- g) Legal status of the forest area with notifications
- h) Abstract copy of the relevant sections of the Indian Forest Act, 1927; Wildlife (Protection) Act, 1972; Forest (Conservation) Act, 1980 and vernacular translation thereof.

- i) List of buildings, roads, paths, fire-lines in the beat
- j) List of plantations raised during the past 10 years
- k) Record of water table at various places in the area

Registers and Records: The following updated (till last financial year) register and records will be maintained by the Division:

- i) Compartment histories
- ii) Fire records and registers
- iii) Register of Boundary Pillars
- iv) Register of Rights and Concessions
- v) Record of forest produce harvested
- vi) Free grants
- vii) Register of land transferred to other departments under FC Act.
- viii) Register of soil and water conservation works
- ix) Register of rotational grazing
- x) Register of invasive species e.g. Lantana eradication
- xi) Register of wildlife management may include detailed record of human wildlife conflicts that includes data on human casualties and injuries, loss of domestic animals and crop damage and compensation paid etc.
- xii) Register of Government buildings that includes log of the repairs and addition (if any) undertaken in the building.
- xiii) Register of registered saw-mills in the Division.

Annual Inspection: Annual inspection of DFO territorial office by CF/CCF and Range office by DFO territorial is mandatory within three months of completion of financial year to have checks on annual statements in control forms and deviation statements and maintenance of registers and records.

CHAPTER 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 Para-2.6.7	Sal Regeneration Working Circle	Regeneration (Natural) ANR supported by artificial regeneration Total activity area consolidating all compartments = 28629.00 hect. Area earmarked for Sal regeneration = 4300 hect	Area earmarked for Sal regeneration = 4300 hect
		Silvicultural operation Cleaning and Thinning in Periodic Block I,II,III and IV Operations in Periodic Blocks is in Para 2.6.7	28629.00 hect area shall be covered
		1 st weeding = May/June 2 nd weeding = July/August 3 ^{rs} weeding = September Pressing and Control burning = Late October to early November	4300 hect
		Raising of Sal polypot seedling for vacancy filling 10,00,000	Polypot seedling 10,00,000
2.6.12.2		The area intended to be undertaken for regeneration must be fenced with permanent nature of fencing with chain link fencing 2.0 meter high supported by concertina (rajar wire) coil and multi strand fencing. The posts being placed closely 2 meter apart with RCC 150mm 150mm pre stressed or MS 75mm x5mm angle posts (Base should be of Concrete). While erecting 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 area 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 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. 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 debris 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, firelines 4 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 seedlings strips and

		seedling patches. 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 debris. All inflammable materials should also be burnt together with debris. 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 remainder part of dry season. 11. The operations outlined under item no. 5,6,7,8 & 9 along with repairs/renewals of fencings are to be repeated during 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 3rd 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, along with 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. These 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.	
Part 2 Chapter 3 Para 3.6.7	Teak Regeneration Working Circle	Silvicultural operation Cleaning and Thinning in Periodic Block I,II, and III Operations in Periodic Blocks is in Para 3.6.7	19057.00 hect.
		Creation of Nursery for 3800 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
		Regeneration plantation of Teak in	Area earmarked for Teak

		Kamrup West Division during the Working Plan period to cover at least 20% of area of Teak Regeneration Working Circle	regeneration = 3800 hect. Requirement of stumps= 3800x 2600/hect = 98,80,000
		Weeding: 3 rain weedings in 1 st & 2 nd year 2 weedings in 3 rd & 4 th year It should be ensured that the plantations are established at the end of 5 th year.	Area to be covered =3800 hect.
3.6.11		vi. First mechanical cum silvicultural thinning at the 10th year by retaining about 50% of the total trees by marking the stems silviculturally in the alternative diagonals. vii. Second mechanical cum silvicultural thinning at the 20th year by retaining about 30% by marking the trees silviculturally in the alternate lines. viii. First silviculture thinning at the 30th year (leaving about 15% of the balance trees). ix. Second silviculture thinning at the 40th year (leaving about 7.5 % of the balance trees). Third silvicultural thinning at the 50th year by operating balance 7.5% of the trees. - 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 species 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 = 2100 hect Maintenance 1500 hect	Plantation = 2100 hect Maintenance 1500 hect
		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, Ethni cuising,night halt at cottages etc.	5 units.
4.6.13		10. Raising of grafted fruit plants in forest areas, nearby fringe villages. 11. Raising of fast growing timber yielding species such as Azar, Tita sopa, Kadam, Bandordima, Hatipoliya, etc. endemic to the division. 12. Raising of firewood species - Kadam, Simalu. 13. Development of nurseries for local forest species with technical guidance from the forest department. 14. Training on bamboo and cane based skill development training for providing employment opportunities. 15. Developing participatory catchment area treatment plans in area under Kamrup West division along the catchment of those <i>suti's</i> (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. 16. Developing medicinal plants saplings and its plantation on their homesteads. 17. 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).	
4.6.14		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 least quarterly. ii) NTFPs to be collected and sustainably harvested from forest fringe areas under the JFMC and shall be sold by the concerned JFMC. iii) Continuous efforts should be made to create and sustain the JFMC	

	movement by creating required awareness among the people and the staff through training programmes. 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 be cultivated. v) JFMC areas to practice minimum tillage, organic formulations. 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 micro plans. vii) System of rice intensification ensures higher productivity with optimum utilizing the resources, may be promoted in JFMC cultivated paddy fields to increase productivity. viii) Establishment of biogas plant as an entry point activity based on the microplans. ix) JFMC plantation assistance will be released as per the standard government norms, funder norms based on the survival of the plants. 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 followed strictly. 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 land resources. xiii) JFMC members may be consulted in choosing the species to be planted, keeping due regard to the biodiversity of the area and silvicultural suitability. 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 this process. 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 other departments. xvi) Soil and land development works may be undertaken in forest areas. Water harvesting structures may be constructed for soil and water conservation and fisheries. 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 other areas. xviii) Whereas, demand of planting trees on private land is increasing, the JFMC members may be allowed Social Forestry benefits on their individual land. 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 planning devices. xxi) The JFMC members should have a meeting place. A community hall may be constructed for use of the JFMC members. 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 Conservation Act. 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 that extent.	
		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 their jurisdiction. 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) Act 1980.	
Part 2 Chapter 5	Forest Protection (Overlapping) Working Circle	Intensive protection measures will be taken for protection, Strengthening the forest protection squads/ personnel with modern equipments, logistics, vehicle and manpower.	Procurement of vehicles, logistics, construction of barrack, watch-tower etc.
		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 allotment net area under encroachment shall be worked out and eviction plan will be implemented.
		Boundary pillars (Main pillars 1 every 1 kilometer 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	Boundary pillars a) A) Main Pillars = 679 b) Sub pillars = 1569 c) Creation of barriers including rajor-wire permanent fencing etc. to check biotic interference
5.5.3		(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.	
Part 2 Chapter 6	Non timber forest produce (overlapping) working circle	g) NTFP Plantation = 210 hectares c) NTFP Maintenance = 1500 hect. h) Bamboo Plantation = 850 hectares d) Bamboo Maintenance = 2550 hect	i) 2100 hectares j) Maintenance = 1500 hect k) 850 hectares l) Maintenance=2550 hect
6.6.6		1. No NTFPs will be allowed to collect from the areas allotted under protection working circle with the exception of the cases provided under Forest Right Act. 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 the society/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 for closure. 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 sent to the concerned Range Forest Officer for safe custody. Range Forest Officer in turn will give regular report in this regard to Deputy Conservator of Forests.	

		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 the agreement. 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. The tribal 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 such species.	
Part 2 Chapter 7	Wildlife Management W.C	Habitat enrichment: d) Regeneration of various fruit, fodder species e) Maintenance of Plantation f) Maintenance of Water hole	750 hect. 1000 hect 10 nos
		h) Formation of Anti depredation Squad and equip with logistics i) Purchase of vehicle j) Engagement of Kumki Elephant k) Construction of watch towers l) Digging of Elephant proof trenches m) Erection of elephant (battery/solar) fence n) Awareness campaign	h) As shown in detailed estimate. i) Total 10 Bolero SUV and 5 Mini trucks j) 2 Kumki Elephants during elephant depredation season. k) 10 Watch towers l) Total 50 kms m) 50 km n) 80 programmes
7.7		7.7.1 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 do not percolate to the bottom line and remain inaccessible from the reach of such poor people. Forest Department may play a pivotal role liaising 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. 7.7.2 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. 7.7.3 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 fringe villagers. 7.7.4 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: 7.7.4.1 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 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 the area. 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. 7.8.4.2 Fruit and fodder plantations: Plantation of elephants favourite fruit plants like <i>Dillenia</i> spp., <i>Syzygium</i> spp., <i>Guajava</i> spp., <i>Artocarpus</i> spp., <i>Mangifera</i> spp., <i>Tamarindus</i> spp., <i>Emblica</i> spp., <i>Eugenia</i> spp., etc. in wildlife area; plantation of fodder species like <i>Musa</i> spp.

	<i>Bambusa</i> spp., <i>Bauhinia</i> spp., <i>Andropogon</i> spp., <i>Buchanania</i> spp., <i>Cassia</i> spp., <i>Croton</i> spp., <i>Dioscorea</i> spp., <i>Eragrostis</i> spp., <i>Eugenia</i> spp., <i>Ficus</i> spp., <i>Lagerstroemia</i> spp., <i>Saccharum</i> spp. Is prescribed. 7.8.4.3 Development of Nesting Sites: To provide suitable nesting places to birds, seed sowing of <i>Ficus</i> 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 wildlife habitat. 7.7.5 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. 7.7.5.1 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 7.7.5.2 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. 7.7.5.3 Control measures Measures for controlling man-elephant conflict has been divided into two categories, viz. the short-term measures and the long-term measures. 7.7.5.4 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).

7.7.5.5 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 Salona area of Nagaon Division. After the battery and energizer 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.

CONTROL FORM NO. 1 BAMBOO HARVESTING

Provision of working plan											
Year	Locality to be exploited				Results of operation					Comparison balance + No - No.	Remarks
	Forest	Compt.	Area (Ha)	No of culms to be removed	Year of working	Balance brought forward No of culms	Forest	Compt.	No. of culms felled		

CONTROL FORM NO. 2 SILVICULTURAL OPERATIONS

Provision of Working Plan									
Year	Para of W.P.	Locality		Nature of Operation	Results of Operation			Cost Amount spent (Rs.)	Remarks
		Forest	Comptt.		Year of operation	Locality of operation			
						Forest	Comptt.		

CONTROL FORM 3 NON TIMBER FOREST PRODUCE

Year	Para of W.P.	Locality		Area (ha)	NTFP to be harvested	Results of Operation				Comparison		Remarks
		Forest	Comptt.			Year of harvesting	Locality		Area (ha)	NTFP harvested	Excess (+)	
							Forest	Comptt.				

CONTROL FORM NO 4a WILDLIFE MANAGEMENT & BIODIVERSITY CONSERVATION

Ref: Para Area to be taken up for habitat improvement
Annually and improvement planting of fruit trees and fodder species

Control Year	Plantation centre	Prescribed	Marked	Remark

		RF &comptt.	Area	RF &comptt.	Area	

Total running excess/ deficit in area at the end of the year of commencement of the plan

..... (±)

hectares.

CONTROL FORM NO. 4b

Wildlife Management & Biodiversity Conservation

Ref: Para Map of the area planted

Control year	RF &Comptt.	Plantation centre	Area of under planting	Blank area Planted

Scale 1 : 16,000

N.B:

1. Map of the Compartment to be traced from stock map and the area over which under planting is done and other blank area where fresh plantation is created should be plotted in this centre form.
2. Area treated in past year under same prescription if falls in same comptt. should also be shown.
3. One form to be used annually for each compartment.

CONTROL FORM NO. 4c

Wildlife Management & Biodiversity Conservation

Ref: Para Weeding, maintenance, ANR to be continued in subsequent years till plantation is established.

Control year	RF &comptt. No.	Plantation centre	Year of creation	Area of plot	Item of Subsidiary operation			Remarks
					Prescribed	Executed	Month	

N.B : One form to be used for all plots (other than plot of year) in a Compartment each year.

CONTROL FORM NO. PI**PLANTATION AND REGENERATION RECORDS****PLANTATION FORM**

General instruction One set forms to be maintained for each plantation centre and these should be loose bound between two hard-covers so that additional sheets can be added from time to time. Some of the forms relate to the whole centre and some for individual plots as detailed below:

Form no. P I a one form for the whole centre

Form No. P I b To the scale map for whole centre. Individual plots need not be shown here.

Form No. P I C..... To the Scale map showing individual plots in the centre. Now plots to be added and plotted as soon as plantations are created. One form for whole centre.

Form No. P II a One form for the whole centre.

Form no. P II b..... One form for the whole centre

Form no. P III a..... To be maintained for each individual plot.

Form No. P III b To be maintained for each individual plot.

Form No. P III C To be maintained for each individual plot.

FORM NO. P I a

Name of plantation centre

Division.....

Reserve

Range

Block

Beat

Compartment No.

Situation

Aspect and slope

Soil

Brief description of

Forest type

Top Story

Mid Story

Under growth

Ground Cover

Sources of labour

Supply – Villages

Approximate number
 Of daily labours
 Available in different
 Periods
 General Remarks

FORM NO. P.I b

Name of plantation centre Division.....
 Reserve Range
 Block Beat
 Compartment No.

SITUATION MAP

Scale 1 : 16,000

N.B : The position of the centre should be shown in this map with reference to the nearest Beat office, Range Office, inspections Banglow. Location of roads, river, compartment / Block/ Reserve Boundaries should also be indicated in the Map.

FORM NO. P.I C

Name of plantation centre Division.....
 Reserve Range
 Block Beat
 Compartment No.

PLANTATION CENTRE MAP

Scale 1 cm – 50 meters

N.B : The map will be shown the individual plots with plot No. and year of creation recorded on the body of each plot. Nearest Compartment boundaries are also to be shown in the map. Now creations are to be plotted and added each year.

FORM NO. P.II a

Name of plantation centre

Year in which plantation

Reserve

commenced in the centre

Block

Division.....

Compartment No.

Range

Beat

AREA STATEMENT

Year of Creation	Plot No.	Area attempted in hectares	Species	Area failure/Successful			Remarks
				Year of assessment	Failure in ha.	Successful in ha.	
1	2	3	4	5	6	7	8

N.B :

1. In column 1 the calendar year in which planting / sowing etc. of a plot were done is to be filled in.
2. Column 1 to 4 should be filled in during the first year of a plantation plot. As soon as new plots are taken in hand in the centre. These columns should be filled in.
3. Column 5 to 7 are to be filled at the end of 5th year of each plot.
4. In remarks column reason for failure and sanction no. writing off failures should be entered.

FORM NO. P.II b

Name of plantation centre

Year in which plantation

Reserve

commenced in the centre

Block

Division.....

Compartment No.

Range

Beat

SUMMARY OF EXPENDITURE AND REVENUE

Year	Expenditure (₹) of the year from Commencement						Revenue (₹) of the year			Progressive total of revenue (₹)
	Creation	Upkeep	Total	Creation	Upkeep	Total	From seeds	From seedlings	Total	

N.B :

1. Col. 1 should preferably be the calendar year.
2. In Col. 2 cost of creation of the plot of that calendar year inclusive of seed cost nursery cost and first year's tending should be entered.
3. Col. 3 will show the cost of tending, thinning etc. of previous year's plots incurred during the particular calendar year of column 1.
4. Col. 5, 6, 7 will reflect the progressive total of column 2,3,4 respectively from year to year.

FORM NO. P.III. a

Name of plantation centre

Division.....

Reserve

Range.....

Block

Beat.....

Compartment No.

Year of creation.....

Area (Hectares)

Brief description of :

Type of plantation

Method of Formation

Species

Quantity of seeds / number of stumps

Number of transplant used

Spacing

Category of labour

Inter-culture of field crops (if any)

Fencing

Financial year	Date of work	Brief summary of works	Extent of area covered by the item of work	Cost in ₹		Cost in terms of unit of daily labours ₹		Remarks
				Free labour converted to ₹.	Cash paid labour in terms of ₹	No. of free labours	No. of paid labours	
1	2	3	4	5	6	7	8	9

N.B :

1. This form is to be maintained plot by plot. Additional sheets to be added as soon as new area taken in hand.
2. All items of work including cost of seed collection, nurseries etc. for the particular plot should be entered in this form and hence entries are to start prior to the year of creation of the plot.
3. Form to be filled up immediately on completion of a particular item of works.

FORM NO. P.III. C

Plantation centre Plot No..... Year of Creation
.....

Reserve Block.....

Compartment No. Division

Range Beat

PROGRESS OF HEIGHT AND DIAMETER / GIRTH GROWTH

Species	Age at which measurement recorded	Height (in meter)		Diameter/girth (in centimeters)		Remarks
		Maximum	Average	Maximum	Average	

N.B :

1. For the purpose of measurements void trees growing along the edges of the plot in the open. Measure a few groups of stems selected at random of property at fixed intervals along the rows of plots. The maximum would be the topmost dimension found during such measurements of groups and the average is to be worked out in the usual way.
2. From end of the 1st to 4th year of the plot only height measurement are to be recorded annually from the end of 5th year onwards record height / diameter of Girth measurements at periods intervals (say 5 years)
3. One form to be maintained for each plot, end to be opened as soon as plot is created.

FORM NO. P.III. C

Plantation centre Plot No. Year of Creation
.....

Reserve Block Compartment No.
.....

Division Range Beat of the plot Area (in
ha.).....

Analysis of cost per hectare upto the end of 10th year

Sl. No.	Item of work	Total cost (₹) for the entire plot		Total Cost (₹)	Remarks
		Cost of materials (₹)	Total No. of daily labour		

1. Seed collection
2. Nurseries
3. Clearance of site
4. Burning
5. Staking / Lining
6. Hoeing / site preparation
7. Sowing/ Dibbling/planting
8. Fencing
9. 1st year's fire –protection measure
10. Repeat item 9 and 10 for 2nd to 10 year add

Clearing in the 6th year and thinning in the appropriate year.

N.B.:

1. One form to be maintained for each plot and posting carried out at the end of each financial year.
2. In remarks column enter quantity and type of materials used.

PLANTATION JOURNAL**General Instruction :**

One bond Register with serially numbered pages to be maintained for each center. First page to provide an index showing plot No. year of creation and reference to page nos. in which the plot appears. A Map showing the location with GPS Co-ordinates in KML,GPX Format to be attached including Google Spread sheet and a Trace Map not in scale.

Entries to be effected for each plot in the form of abstract of information furnished in the plantation Forms.

Sufficient blank pages to be left out between two plots for the purpose of future entries.

Proforma could be as follows.

LEFT- HAND PAGE OF THE REGISTER

Name of plantation center Division Plot
No. Reserve Range Year of
Creation Block Beat
Compartment No. Area (in Ha.)
Species
Type of Plantation Method of Formation
Quantity of seeds/number of Spacing
Stumps or transplant used field –crops raised (if any)
Fencing

Brief summary of work done	Month 7 year in which done	Cost.
1. Seed collection /Nurseries	₹	
2. Cost of the creation of the Plot including first year's tending And fire-protection.....	₹	
3. 2 nd year's tending and fire protection etc.		₹

(Removal due to disease/windfallen/decay (if any) to be entered in red ink and photographs to be attached)

RIGHT HAND PAGE OF THE REGISTER

Remarks by the Inspecting Officer.

Noting