རྒྱལ་ཡོངས་འབྲུག་གཞུང་། སོ་ནམ་དང་ནགས་ཚལ་ལྷན་ཐག་ཞགས་ཚལ་དང་གློང་ཁ་ཞབས་ཏོག་ལས་ཁུངས།

Royal Government of Bhutan
Ministry of Agriculture and Forests
Department of Forests and Park Services
Divisional Forest Office
Paro

FOREST MANAGEMENT PLAN

FOR

SELELA FOREST MANAGEMENT UNIT

Prepared By:
Sherab Jamtsho
Forestry Officer

AUTHORITY FOR PREPARATION, REVISION AND APPROVAL

PERIOD OF THE PLAN

This Plan is valid for the period of 10 years from 1st January, 2021 – 31stDecember, 2030.

AUTHORITY FOR PREPARATION, REVIEW AND APPROVAL

The authority for preparation of this Plan was given to the Divisional Forest Office (DFO), Paro, Department of Forests and Park Services (DoFPS), Ministry of Agriculture and Forests, Royal Government of Bhutan.

PROVISION FOR REVISIONS AND CHANGES

This Plan may be revised during the period when it is in effect. The Director, DoFPS has the authority to revise and approve Plan if major changes occur in the Forest Management Unit (FMU), or if new information becomes available that may have significant bearing on the implementation of the Plan. The CFO, Paro may be requested to prepare revisions and changes to the Plan for submission to the Director, DoFPS.

APPROVAL

This Plan was examined by a wide section of user groups, clients and organizations. The final version of the Plan was reviewed and technically cleared by the Head, FRMD and an environmental clearance was obtained from National Environment Commission Secretariat. It was then submitted to the Director, DoFPS, who, after further review and amendments, forwarded with his recommendation for approval to the Secretary, MoAF. The Secretary, MoAF, further reviewed and submitted the Plan to the Minister, MoAF for his approval for implementation.

Submitted for Approval:

Chief Forestry Officer
Forest Resources Management Division

Recommended for Approval:

Director
Department of Forests and Park Services

Recommended for Approval:

Secretary
Ministry of Agriculture and Forests

APPROVED

Minister
Ministry of Agriculture and Forests
Date: 08.12.21

རྒྱལ་ཡོངས་མཐའ་འཁོར་གནས་སྐྱངས་སྡེ་ཚོགས།
དཔལ་ལྡན་འབྲུག་གཞུང་།

National Environment Commission
Royal Government of Bhutan

NECS/EACD/Dzo-Paro/4001/2021/1799 **October 11, 2021**

ENVIRONMENTAL CLEARANCE

In accordance with Section 34.1 of the Environmental Assessment Act 2000, this Environmental Clearance (EC) is hereby issued to the Forest Resources Management Division (FRMD), Department of Forests and Park Services for the operation and management of the third phase of the Selela Forest Management Unit (FMU) along with the construction of 10 kilometers forest road and ropeways in the state reserve forest measuring 22,314.55 acres under Samar, Naja, Dungna & Meta Gewogs of Haa, Paro and Chukha Dzongkhags with following terms and conditions:

I. General

The holder shall:

1. comply with provisions of the National Environment Protection Act 2007, Environmental Assessment Act 2000 and its Regulation 2016, Waste Prevention & Management Act of Bhutan 2009 and its Regulation 2012 (Amendment 2016), The Water Act of Bhutan 2011 and its Regulation 2014 and Revised Regulation on the Substances that Deplete the Ozone layer and HFCs 2021;
2. ensure that operation and management of the FMU and construction of the forest road is in line with the Initial Environmental Examination (IEE) form and project documents submitted for EC;
3. ensure that Annual Allowable Cut doesn't exceed 9230 m3 (Nine Thousand Two Hundred and Thirty cubic meter);
4. ensure that no timber is extracted from the Protection Working Circles and Non-Production Working Circles;
5. ensure that local communities, properties and any religious, cultural, historic and ecologically important sites are not adversely affected by the operation and the management of the FMU and construction of the forest road;
6. restore the damage of any public or private properties caused by the operation and management of the FMU and construction of the forest road;
7. inform NECS and any other relevant authorities of any unanticipated or unforeseen chance-find of any precious metals or minerals or articles, that have economic, cultural, religious, archeological, and/or ecological importance;
8. erect a signboard at the take-off point of the main entry of the FMU stating the name of the FMU and contact address of the unit incharge; and
9. ensure that a copy of the environmental clearance is framed and displayed at the site office of the FMU.

Head, FRPIS
For Head

NEC, PO Box 466, Thimphu, Bhutan
Tel: (975-2) 323384/325856/324323/326993 Fax: (975-2) 323385
www.nec.gov.bt

II. Environmental standards

The holder shall comply with the Environmental Standards 2020.

III. Import and use of Ozone Depleting Substances (ODS)

The holder shall import and use ODS and the Hydrofluorocarbons (HFCs) as per the Revised Regulation on the Substances that Deplete the Ozone layer and HFCs 2021.

IV. Protection and management of water resources

The holder shall:

1. ensure that establishment and operation of the FMU does not disrupt the water flow and pollute the water bodies; and
2. ensure that a 100 meter buffer is maintained from the major rivers and local drinking water sources and a 30 meter buffer is maintained from all the streams and springs present within the FMU.
3. except for water/river crossing infrastructures, ensure that a minimum 30 meters or 100 feet buffer is maintained at all times from the water bodies.

V. Waste prevention and management

The holder shall manage wastes generated from the establishment and operation of FMU and the construction of forest road (site office, labour camps, offices, etc.) with the application of 4R (Reduce, Reuse, Recycle, Responsibility) principle and other environmentally friendly methods of waste management.

VI. Management of excavated materials and run-off

The holder shall:

1. ensure that excavated materials generated during construction of forest road and operation and management of FMU are managed inline with the project document submitted for EC;
2. ensure that fugitive emission from the construction of forest road is managed inline with the project document submitted for EC; and
3. put appropriate measures for management of surface run-off to avoid erosion and landslides.

VII. Monitoring and reporting

The holder shall:

1. ensure that the effective day-to-day monitoring of the EC terms and conditions are carried out by the environmental unit or designated environment focal person; and
2. maintain monthly records on wastes generated and its management, stating types (industrial and general wastes), quantities and characteristics and submit to NECS annually.

NATIONAL ENVIRONMENT COMMISSION

NEC, PO Box 466, Thimphu, Bhutan
Tel: (975-2) 323384/325856/324323/326993 Fax: (975-2) 323385
www.nec.gov.bt

VIII. Implementation plan

The holder shall prepare a detailed implementation plan focusing on the implementation of terms and conditions of this EC and submit to NECS within three (03) months from the date of issue of this EC as per the reporting format attached herewith.

IX. Renewal and modification

The holder shall:

1. ensure that renewal of this EC is processed at least three months prior to its expiry along with a copy of EC and a report on the implementation of its terms and conditions as per the format attached, failing to which the applicant shall be liable for penalty as per the RECOP 2016; and
2. obtain prior approval from NECS for any modification to the existing proposal/application including but not limited to increase in production capacity, change in location of a project, change in ownership, etc.

Reservation

1. The NECS may stop the activity or impose additional terms and conditions, as may be deemed necessary; and
2. The EC shall be subject to periodic review and modifications as per Article 25 of the EA Act 2000, without any liability on the part of the Royal Government.

The holder may adopt best practices in executing these terms and conditions to avoid adverse environmental impacts.

Failure to comply with any of the above terms and conditions shall constitute an offence and the proponent shall be liable in accordance with the Environmental Assessment Act 2000 and/or existing environmental laws.

Validity:

The EC issued with validity from **October 11, 2021** until **October 10, 2026** for the operation and management of the Selela Forest Management Unit along with the construction of the 10 km forest road.

This Environmental Clearance is issued solely pursuant to the Environmental Assessment Act, 2000 and its Regulations and in no way intends to overrule or alter the provisions of any law or rules in force. The Holder of this EC shall be responsible to adhere to the requirements under other laws and the issuing authority assumes no liability resulting from non-compliance or omission of any laws or rules.

(Phento Tshering)
DIRECTOR

NEC, PO Box 466, Thimphu, Bhutan
Tel: (975-2) 323384/325856/324323/326993 Fax: (975-2) 323385
www.nec.gov.bt

LIST OF ABBREVIATIONS

%	Percent
AAC	Annual Allowable Cut
CF	Community Forest
CFO	Chief Forestry Officer
CGI	Corrugated Galvanized Iron
cm	Centimeter
DBH	Diameter at Breast Height
DFO	Divisional Forest Office
DoFPS	Department of Forests and Park Services
EIA	Environmental Impact Assessment
FMP	Forest Management Plan
FMU	Forest Management Unit
FNCA	Forest and Nature Conservation Act
FNCRR	Forest and Nature Conservation Rules and Regulation of Bhutan
FRMD	Forest Resources Management Division
GIS	Geographic Information System
Ha	Hectare
km	Kilometer
LULC	Land Use and Land Cover
m	Meter
m^3	Cubic Meter
MC	Management Circle
mm	Millimeter
MoAF	Ministry of Agriculture and Forests
NEC	National Environment Commission
NRDCL	Natural Resources Development Corporation Limited
NWFP	Non-Wood Forest Product(s)
OP	Operational Plan
RGoB	Royal Government of Bhutan
RM	Regional Manager
RME	Reliable Minimum Estimate
RNR	Renewable Natural Resources
sp.	Species
SFMU	Selela Forest Management Unit
TMB	Tree Marking Book
UIC	Unit-In-Charge
UWICER	Ugyen Wangchuck Institute for Conservation and Environmental Research
WC	Working Circle

ACKNOWLEDGEMENT

This management plan is an outcome of concerted efforts and contribution of many people, without which the plan would not have materialized. The Divisional Forest Office, Paro would like to thank Dr. Norbu Wangdi, CFO, FRMD for rendering unwavering support and for being accessible to the planners to provide technical guidance and direction while preparing this plan. An immense appreciation goes to the Unit staffs (both Division and NRDCL counterpart) of Selela Forest Management Unit for their assistance and support during data collection and information gathering.

Special thanks to Mr. Lhendup Tharchen, Chief Forestry Officer, Paro for providing immense support and guidance in the process of writing this plan. The technical advices received from the Chief Forestry Officer have helped me make this plan credible and moreover practically applicable in the field.

The author would like to thank the DoFPs, particularly Mr. Arun Rai, Deputy Chief Forestry and Mr. Dawa Zangpo, Deputy Chief Forestry and Mr. Tashi Norbu Waiba, Deputy Chief Forestry of FRMD for reviewing the plan and providing valuable comments and feedback during preparation of this management plan.

I would like thank Dzongkhag Administration, Paro, Haa and Chukha and Local Government of respective Dzongkhags and local community people for their support and valuable comments and feedbacks to address concerns and interests of local communities in this management plan

This management plan was possible because of support and valuable comments from many readers and immense gratitude are extended to all who supported in the process to bring this management plan for Selela FMU.

EXECUTIVE SUMMARY

This is the 3rd Forest Management Plan for Selela FMU. The overall structure of this management plan is as per the Forest Management Planning guidelines of Forest Management Code of Bhutan, 2004. It consists of three parts:

PART 1: GENERAL DESCRIPTION AND THE CURRENT SITUATION

PART 2: FUTURE MANAGEMENT

PART 3: IMPLEMENTATION OF THE PLAN

PART 1: GENERAL DESCRIPTION AND THE CURRENT SITUATION

- Selela Forest Management Unit which is located in western part of the country falls under the administrative block of three districts of Haa, Paro and Chukha. The Geographically the FMU is situated approximately between 27°15'25.07"N and 89°16'15.78"E and27°12'40.41"N and 89°25'49.16"E North of Haa town. The total Area of the FMU is 9155.72hectares. The establishment of Dorikha Community Forest with 97.05 ha and Papaling Community Forest with 28.27 ha has reduced total FMU area to 9030.39ha.

- The forest type in Selala FMU consists of mixed conifer (4765.68 ha), Blue Pine (2314.52ha.), Fir (1071.58 ha), Broadleaf (345.87 ha), Alpine meadows (191.80 ha), Alpine scrubs (74.12 ha), Shrubs (270.30 ha), Khamzhing (105 ha) and build up and Snow and Glacier 10.56 ha and 6.10 ha respectively. And as evident, majority of the FMU area has mixed conifer forests (52%), followed by blue pine (25%) and fir (11%) and followed by 12 % other

- In total, there are five villages within the FMU. The FMU falls within the administrative boundary of Sama Geog, Haa Dzongkhag, Naja Geog under Paro Dzongkhag and Meta and Dungla Geog under Chukha Dzongkhag. Animal Husbandry and Agricultural farming are the main livelihood activities of people living nearby FMU

- The general terrain of FMU ranges from moderate to steep landscape. The elevation of FMU ranges from 2200m at the bottom valley to 3900 m at the ridge top. The average monthly rainfall is approximately 62 mm. Precipitation in the form of snowfall occurs in the winter.

- The commercial AAC of last Management Plan was fixed at 8885 m^3 and local use was 3000m^3 standing volume. The total commercial timber harvested for last 10 years is 72646.07m^3 and rural volume is 22865.12m^3 in Standing Volume. This shows that commercial extraction is undercut by 16,213.99 m^3 of total AAC for ten years and rural extraction was undercut by 13,786.01 m^3.

- A total of 41.08km of forest road has been constructed in FMU during the last two Plan periods. The road network has immensely benefitted the localpeople of Lamjogang, Dorikha and Koina villages. The construction of 10 km forest road in thin plan period will benefit local people of Bempu, Papa and Chazhi village

PART 2: FUTURE MANAGEMENT

- ***The overall goal of this management plan is to manage the Forest Resources within Selela FMU on a multiple use, sustained yield basis for the production of timber, fuel wood& non-wood forest products, conservation of watershed, wildlife and environment.***

- To facilitate the planning, implementation and recording of activities, FMU is divided into blocks and compartments. There are four blocks viz Tegola, Selela, Holela and Chhepji which are further divided into compartments. Total of 34sub-compartments is identified for sustainable utilization of resources and planning

- FMU has been divided into four Management Circles, which allows different areas to be managed and evaluated separately, and increases the ease of management and implementation. The Management Circles has been identified, using forest function mapping and they are **Protection**, **Production** and **Non-Production** Management Circle. The objectives for each Management Circles have been identified and the Production Management Circles have been further divided into Working Circles so that the objectives tailored to the type of stand being harvested and managed. The objectives for each Management Circles have been listed in a logical framework along with the Management Options and responsibility for easy reference by implementers and monitoring agency.

- The total area for Protection Management Circle is 3680.57 ha, Production Management Circle is 5162.68 ha and Non-Production Management Circle with 187.14 ha.

- The Production Management Circle has been further grouped into Working Circle as Fir Working Circle, Mixed Conifer Working Circle, Blue Pine Working Circles and Broadleaf Working circle based on Land Use Land Cover, 2016.

- The total AAC for this management plan is fixed at **9230 m^3** in standing form of which **6790 m^3** standing volume or **23.55 ha** clear cut equivalent, whichever is achieved earlier, for commercial use. For rural use total of **2440 m^3**is allotted for this plan period

- The prescribed Silvicultural System for the commercial harvesting is Group Selection System. Group openings will be created in the stand allowing optimum quantity of light to reach the forest floor and creating conducive micro climatic conditions for seed germination and establishment of seedlings. Criteria for opening the groups and laying out annual coupes are given in detail in the Plan. For Local/Rural use, Single Tree Selection System is prescribed.

- The prescribed Silvicultural System for the commercial harvesting is the Group Selection System with natural regeneration in Mixed Conifer Working Circle and Seed Tree System in Blue Pine Working Circle. Group openings will be created in the stand allowing optimum quantity of light to reach the forest floor and creating conductive micro climatic conditions for seed germination and establishment of seedlings. Criteria for opening the groups and laying out annual coupes are given in detail in the Plan. For local use area, single tree selection system will be used.

  Allocation of AAC

Standing Vol (m^3)	Allotted to
2440 m^3	Local Use: Local villagers and general public for rural house construction
6790 m^3	NRDCL: To meet the commercial timber demand in the market

- In collaboration with NRDCL, the Divisional Forest Office, Paro carried out detailed EIA for FMU. Using a series of environmental criteria outlined in the Environment Assessment Act, 2000 and adopted by the National Environment Commission, the recommended guidelines have examined to ensure that the practice within FMU meets the requirement. The environment statement includes the effects of previous activities within the FMU along with recommended mitigation measures for future actions.

- A ten-year financial forecast has been prepared for the FMU summarizing the total costs, revenue and royalties for NRDCL and treasury (via CFO) for the plan period. The forecast is a projection based on the plan prescriptions and may not reflect the actual workings during the plan period.

PART 3: IMPLEMENTATION OF THE PLAN

- The CFO, Paro will be responsible for the implementation of this management plan and he will be assisted by the Forest Management Planner, Unit In-charge and other Unit staffs.

- FRMD, DoFPS, will be responsible for providing technical support and evaluation of FMUs as per timing prescribed in the Forest Management Code of Bhutan

- A rolling biennial Operational Plan will be prepared by the Unit In-charge in consultation with the CFO, Paro and NRDCL counterpart to facilitate the timely implementation of this management plan.

- FMU-level Management Committee chaired by CFO, Paro has been established to assist in objective setting and to ensure the smooth implementation of the Management Plan. The FMU-level Management Committee is comprised of the stakeholders of the FMU and each member has an equal right to say in the recommended management and implementation of the FMP. Planned activities to achieve the FMU management objectives will be discussed in the FMU-level Management Committee meetings.

- Mid-term and Final evaluation should take place within the prescribed timing and completed as per management code.

- The FMU must have adequate technical capability and appropriate institutional set-up to implement this forest management plan

- Unforeseen circumstances may warrant deviation from plan prescriptions and in such an event, the CFO, Paro, must obtain prior written approval from the Head of the

Department. The reasons for the deviation must be fully justified by the CFO in writing and such approved deviations updated into the Management Plan during the next scheduled planning period and plan revision

	Action required by FMU plan	Responsibility
	Implementation and Review	
1	CFO Paro will be responsible for the implementation of this Management Plan, assisted by the Unit In-charge and staff.	CFO Paro
2	The FMU Management Committee chaired by CFO Paro will be maintained to ensure the smooth implementation of the Management Plan.	CFO Paro
	Monitoring and Evaluation	
1	CFO Paro will ensure that the monitoring is carried out on regular basis and in accordance to FMCB and guidelines issued by FRMD. The Forest Management Committee at Division level will be responsible for review and address any technical issues which can be address at Division level.	CFO Paro
2	Head, FRMD, will ensure annual monitoring of FMU is carried out and provide advices and recommendations to CFO, Paro for implementation	Head, FRMD
3	Head, FRMD, will ensure that mid-term and final evaluation will be executed by FRMD as per deadline outlined in the FMCB. Policy and technical regulations will be provided by FRMD to CFO, Paro.	Head, FRMD
	Operation Planning (OP)	
1	Biennial OP will be prepared by CFO, Paro, and FMU In-Charge (IC) to facilitate the timely implementation of this Management Plan**.** NRDCL will commit financial and endorse OP by the FMU Level Management Committee. The OP should be completed and submitted to FRMD as per deadline outlined in the FMCB.	CFO Paro FMU IC
2	FMU UIC will identify harvesting area based on production area prescribed by management plan and conduct operational inventory using GIS and GPS. FMU IC will determine the number of location and extend of cable lines in the compartment to be harvested annually based on average standing volume per hectare from	FMU UIC, NRDCL PIC

	operational inventory and NRDCL will lead cable line survey for operational plan	
3	Objective for each Management Circle will be met with the implementation of specific activities	FMU IC
4	Silviculture system for each Working Circle will be adhered to, following cutting cycle guidelines to ensure sustainability	FMU IC
5	The harvesting Plan set out for each Working Circle will be followed unless pests and diseases arise.	FMU IC, NRDCL RM
6	CFO Paro and the Regional Manager, NRDCL will co-operate and co-ordinate to ensure that the logging operation and the log outturn are conducted smoothly and in accordance with local and other demands	CFO Paro, NRDCL RM
7	The FMU IC will ensure that natural regeneration is surveyed as per regeneration guidelines and implement corrective actions as per guidelines.	FMU IC
8	CFO, Paro, will evaluate plantation and recommend corrective actions as per plan prescriptions to NRDCL.	CFO Paro, NRDCL RM
9	Road survey, design and construction will be carried out by NRDCL. NRDCL road engineers must follow the standards, given in Annex 4, during designing and estimating and provide supervision during construction to ensure that the environment standards are met.	NRDCL RM
	Forest Protection (Pests and diseases)	
1	Regular inspection will be conducted by the FMU staff to detect and report any pest and disease outbreaks to enable earliest possible remedial or preventive measures to be initiated	FMU staff
2	FMU IC will seek approval from DoFPS through CFO for sanitation operation of trees/stands affected by forest pests and diseases	FMU IC, CFO Paro
3	FMU IC and CFO Paro will maintain detail records of outbreak of forest pests and diseases and apprise DoFPS through CFO for record and inferences for corrective measures	FMU IC, CFO Paro
	Participatory Forest Management	
1	Records of all tree marked with geo-coordinates by Blocks and Compartments for rural/local use will be maintained by the Unit staff and furnished monthly to CFO Paro	FMU IC
2	Local communities have priority in use of forest products from the area set aside for Local use (Forest Function Socl).	FMU IC

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PART 1
GENERAL DESCRIPTION AND THE CURRENT SITUATION

GENERAL DESCRIPTION AND CURRENT SITUATION

1. LOCATION, AREA, BACKGROUND AND STATUS

1.1.Location and Extend

The Selela Forest Management Unit (SFMU) also known as Haa West FMU and is located in the most western part of the country. It lies within three administrative dzongkhags; - Haa, Paro and Chukha. The FMU is situated approximately between 27°15'25.07"N and 89°16'15.78"E and 27°12'40.41"N and 89°25'49.16"E south of Haa town (Map 1). The total Area of the FMU is 9155.72hectares. The Lonchu FMU forms its northern boundary, while the ridge between Haa, Samtse and Chukha valleys form its southern boundary. Towards west, the FMU shares boundaries with Naja and Sama Geogs starting from Tergola to Papali and Chazhi villages.

1.2. Area Statement

As per the Land Use and Land Cover map (LULC) classification, majority of the FMU area is covered by forest (Map 2). Over 52% of the land is covered by mixed conifer forest followed by approximately 25% by Blue Pine forest. The Snow and Glacier only forms over 0.07% of the total land cover (Figure 1).

Land use	Area (Ha)	Percentage
Mix conifer	4765.68	52.05
Blue pine	2314.52	25.28
Fir	1071.58	11.70
Broadleaf	345.87	3.78
Alpine Scrubs	74.12	0.81
Kamzhing	105.00	1.15
Meadows	191.80	2.09
Shrubs	270.30	2.95
Built up	10.56	0.12
Snow and Glacier	6.10	0.07
Total	**9155.53**	**100**

Table 1: Area Statement by Land Use

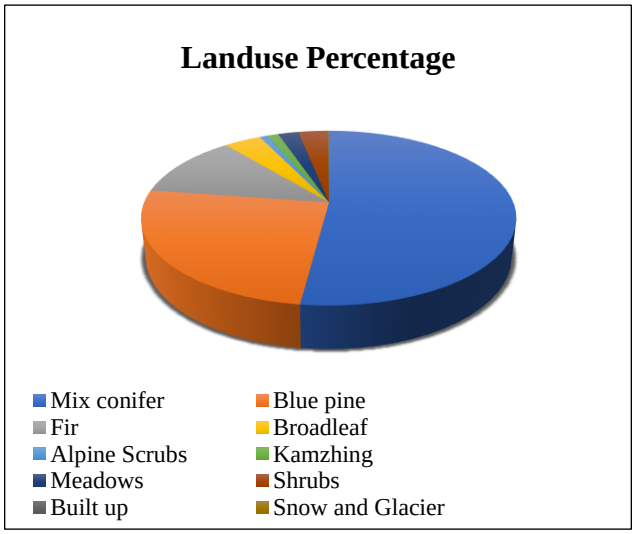


Figure 1: Figure Showing Land use by Percentage

GENERAL DESCRIPTION AND CURRENT SITUATION

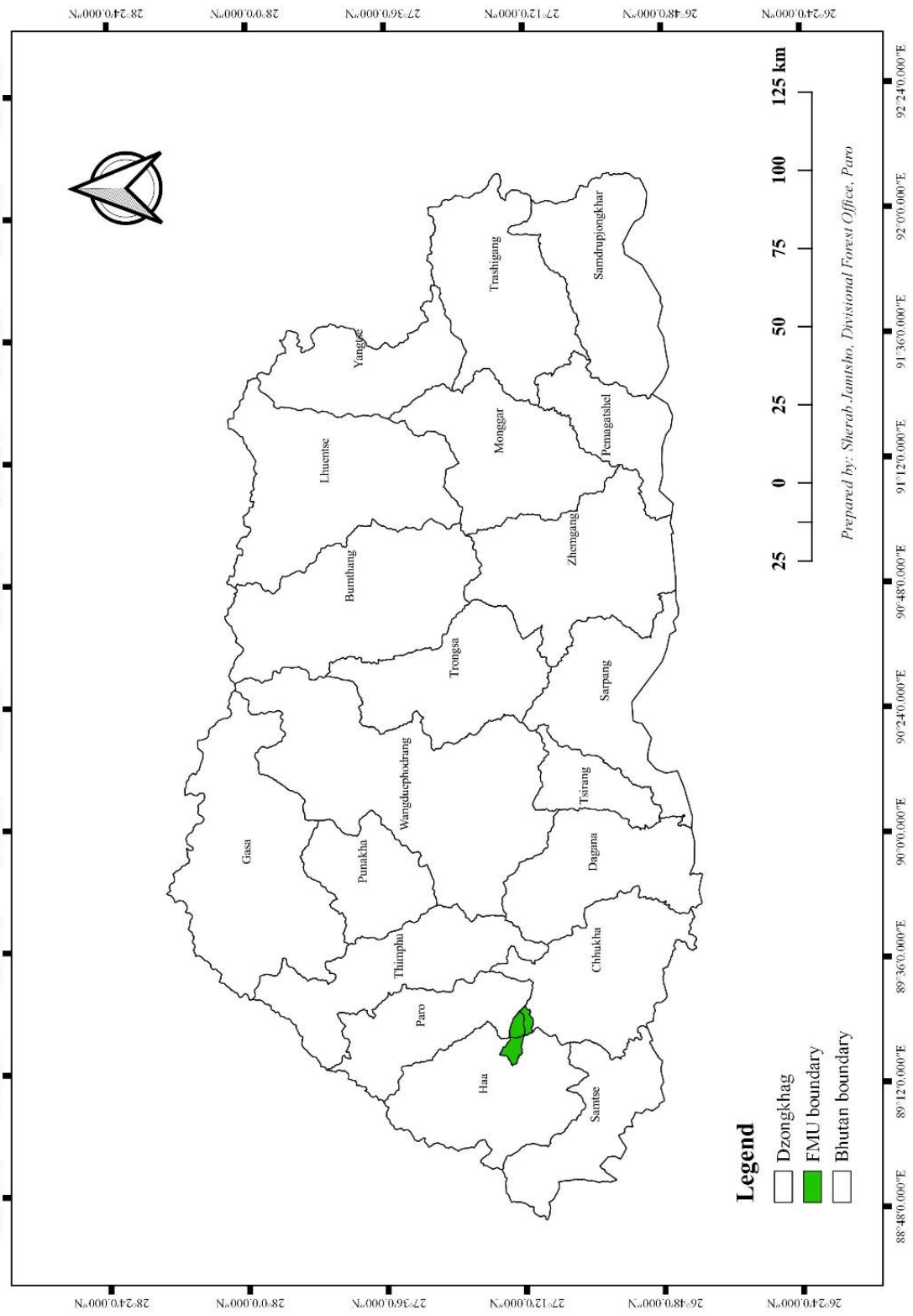
1.3.Historical Background

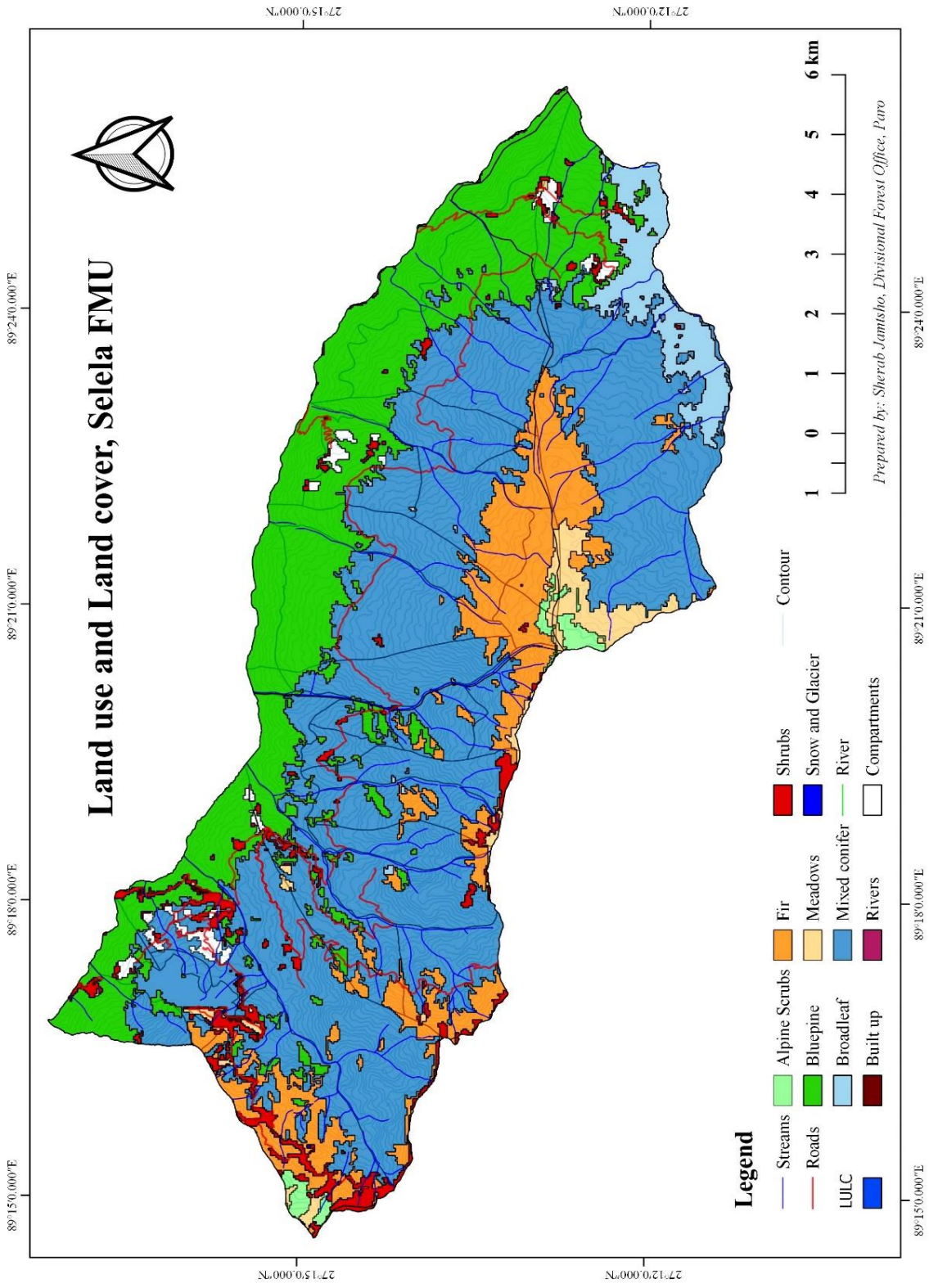
Selela Forest Management Unit is under the jurisdiction of Divisional Forest Office, Paro from the time of inception with small portion under Chukha Dzongkhag. The first management plan for SFMU was written in 1998 for the duration of ten years (1998-2008). Due to excess allocation of AAC in the previous plan the AAC had been revised in the year 2000 by FRDD. There has been no written management plan prior to 1998 and the last management plan from 1998 to 2008 is the only document for the last decade of harvesting. Before the creation of Department of Forest in the mid1950s, people from the neighboring villages of SFMU had unlimited access to the forest for their timber and firewood requirement. Felling of trees for timber and firewood was unregulated. Till 1998 there wasn't any written plan that would enable the harvesting of trees in scientific method. Timbers marked for the villagers by the FSD were on an ad-hoc basis

During the initial establishment of Selela FMU sometimes in year 1997-1998 the area is said to have rich in stock density and environmentally intact. This is mainly due to low population and few households within FMU and also the timber demand both for commercial and rural were low as compare to today's scenario. The barrier created by the nature such as Haa Chu and the steep ridges has also restricted and deterred people from illegal activities inside the FMU

The second management plan for SFMU was written in 2011 for the duration of ten years (2011-2020). The total area in allotted in second management plan was 9253.6 hectares. For this 3rdmanagement plan (2021-2030), total of 9155.72 hectares is designated as FMU.

According to the last management plan, the SFMU was divided into four blocks, which was further divided into compartments and sub-compartments, based on natural features. The silvicultural system prescribed was group selection system for the mixed conifer. In areas where opening cannot be created under group selection system single tree selection system was prescribed. The AAC for first management plan was calculated to be 20,000m^3 but it was revised in the year 2000 and the AAC was reduced to 12,600m^3 of which 8,568m^3 is NRDCLs share and 4,032m3 for rural share. The AAC for second management plan was calculated 11885.63m^3 of which 8,885.63m^3 was allotted to NRDCL and 3,000m^3 for rural allotment. In first management plan 23.14 km of forest roads follow by 10 km in second plan was constructed by NRDCL.


Trashigang
Samdrupjongkhar
Yangtse
Lhuentse
Monggar
Pemagatshel
Zhemgang
Bumthang
Trongsa
Sarpang
Wangduephodrang
Tsirang
Gasa
Punakha
Dagana
Thimphu
Chhukha
Paro
Haa
Samtse
Legend
Dzongkhag
FMU boundary
Bhutan boundary
25 0 25 50 75 100 125 km
Prepared by: Sherab Jamtsho, Divisional Forest Office, Paro


Land use and Land cover, Selela FMU
Legend
Streams
Roads
LULC
Alpine Scrubs
Bluepine
Broadleaf
Built up
Fir
Meadows
Mixed conifer
Rivers
Shrubs
Snow and Glacier
River
Compartments
Contour
1 0 1 2 3 4 5 6 km
Prepared by: Sherub Jamtsho, Divisional Forest Office, Paro
27°15'0.000"N
27°12'0.000"N
89°15'0.000"E
89°18'0.000"E
89°21'0.000"E
89°24'0.000"E

1.4.Forest Condition

Selela FMU was under commercial harvesting for the last twenty years and although scientific silvicultural systems were used, some parts of the forest especially the rural use areas are exposed. This was mainly happened due to major bark beetle sanitation operation works which was carried out in second management plan period. Good natural regeneration could be seen in the harvested cable lines and most of the regeneration consists of Hemlock species. Bamboo species colonization could also be spotted in the large openings inside commercial blocks.

The altitude of Selela FMU ranges from 2200m to 4000mamsl and the major forest type found here are mixed conifer and blue pine forests. The mixed conifer forest is composed of species like Hemlock (*Tsuga dumosa*), Blue pine (*Pinuxwallichaina*), Spruce (*Picea spinulosa*), Juniper (*Juniperus recurva*), and some broadleaf species like Maple (*Acer campbellii*), Rhododendron sp., Oak (*Quercus sp*.), etc. Around 52.05 % is covered by Mixed conifer forest, 25.28 % by Blue pine forest and follow by Fir forest of 11.70 %

1.5. Legal Status

1.5.1. Ownership

The Forest and Nature Conservation Act, 1995, defines forests as *"any land and water body, whether or not under vegetative cover, in which no person has acquired a permanent and transferable right of use and occupancy, whether such land is located inside or outside the forest boundary pillars, and includes land registered in a person's name as Tsamdrog (grazing land) or Sokshing (woodlot for collection of leaf litter)".*

All such areas are considered as Government Reserved Forest and the entire SFMU falls within this category of reserved forest, except for a small part of land classified as cultivation which are private.

1.5.2. Rights and Privileges

The right and the privileges of the local inhabitants, concerning the forest use is as per the Forest and Nature Conservation Act of 1995 and the National Forest Policy of 1994. According to the Forest and Nature Conservation Act, grazing, collection of firewood, fodder and leaf mold for

the domestic use is allowed either free or on royalty basis. Collection of firewood is permitted from only dead and fallen trees. Timber trees are issued for *bona fide* domestic use, after they have been marked by a Forest Officer and royalty has been paid. Hunting wild animals is completely prohibited in the forest.

1.5.3Grazing Rights

The local communities have the traditional rights for grazing their cattle in the forest within the forest management unit. As per the revised act (The Land Act of Bhutan,2007), it is stated that in section 235 of chapter 10, "All Tsamdro rights maintained in the Thram prior to enactment of this Act shall be deleted from the Thram. Upon deletion, the Tsamdro land shall be reverted and maintained as the Government land in Thromde or the Government Reserved Forest land in reserved areas."

Therefore, all the Tsamdros which has been registered in the name of an individual or community was given back to the Government and deemed as Government Reserved Forest. However, the Tsamdros can be leased for use as per the regulations of the government. The Forest and Nature Conservation Act, 1995, give authority to the Department of Forests, to regulate and restrict grazing anywhere in the country, in order to prevent environmental damages.

1.5.4 Water Rights

Local population within the FMU has traditional rights to use water from rivers and perennial streams for domestic purpose, such as consumption, irrigation and other uses. Tergola Chhu, Selela Chhu, Sagolumchu and Kalyana chu are the main source of water besides many small streams and creeks present within the FMU.

1.5.5 Historical Monuments and Monasteries

There are no important religious sites like Neys and old Monasteries. The monasteries present were Dorikha Gompa which is located within the Dorikha community settlement and Jatshokha Lhakhang in Chhepjap block above Papali village.

1.5.6 Proximity to Protected Areas

The SFMU does not lie in any protected areas or share the boundary. The animals may share the areas in FMU as their habitat but we have taken certain measures, by keeping certain areas as Wild life protection strictly prohibiting timber extraction. Still, we have set aside areas of ecologically sensitive as an ecology reserve. The RNR had laid a line transect in the FMU to study forest dynamic. Hence, we kept all these areas as strictly protected zones.

2. PERMANENT SITE FACTORS

2.1 Topography and Slope

In general, the terrain of the SFMU ranges from the steep to moderate landscape. It is hard to find flat areas in the FMU. In the valley bottom near the Haa-chhu the slope is very steep making it inaccessible. In the middle the terrain is moderate slope and here extraction should be carried out. The highest points are the Selela top, Tergola top and Holela top. These areas are above tree line either rocky outcrops or covered with shrubs like rhododendron spp. Major part of FMU is within 40 to 80% slope class. Slope classification was done through measure of distance between 40m contours on the 1:50,000 topographical maps. Areas that were considered over 100% were delineated on the Function Map as SP-Soil Protection where no activities can take place. Slopes that ranged from 76-100% are classified as SC-Soil Conservation where limited activities can take place.

2.2 Climate

2.2.1 Meteorological Station

The climate and meteorology information of Selela FMU is collected by the only meteorological station located at Katsho gewog under Haa Dzongkhag and Betikha under Paro Dzongkhag. The station gives the representation climate data as it is located within the Forest Management Unit.

2.2.2 Temperature

The monthly maximum and minimum temperature of Selela FMU for last 12 years collected from two different location is given in the following tables and graph.

Table 2: The maximum temperature (Betikha area) (Degree Celsius)

Years	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Max.Tempt	16.0	18.7	16.6	19.1	16.4	16.2	16.9	13.9	13.6	14.0	14.6	11.9

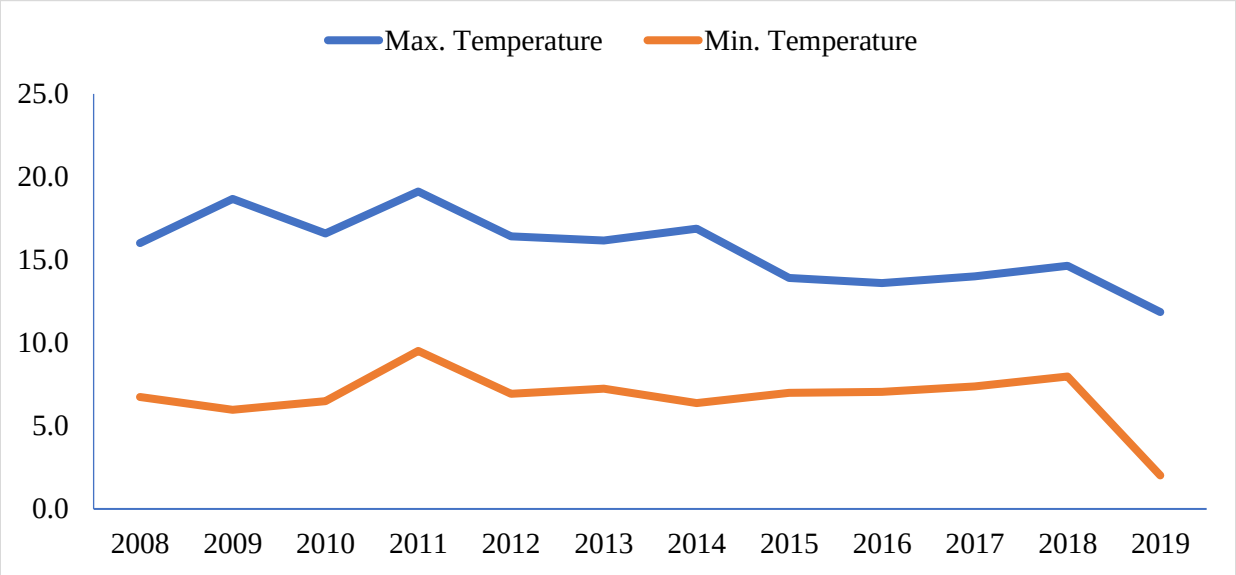
Source: Department of Hydro-Met Services, MEA Thimphu, Bhutan

Years	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Max.Tempt	17.5	18.2	17.8	16.8	16.7	17.2	16.6	15.7	16.1	15.9	15.3	15.9

Table 3: The maximum temperature (Haa) (Degree Celsius)

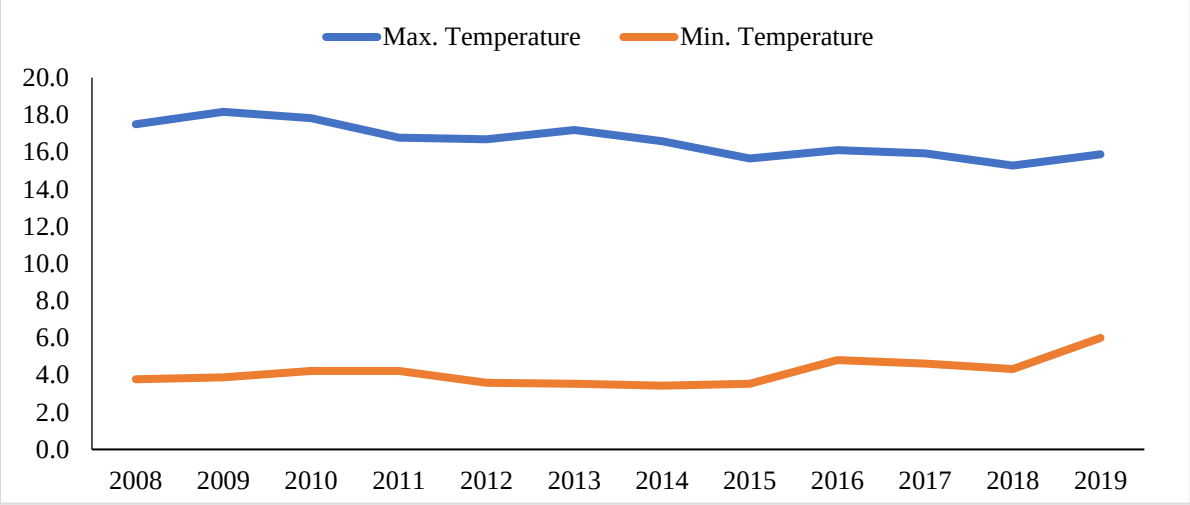
Source: Department of Hydro-Met Services, MEA Thimphu, Bhutan

Figure 4: Graph showing Average Maximum and Minimum Temperature of Betikha area



Source: Department of Hydro-Met Services, MEA Thimphu, Bhutan

Figure 5: Graph showing Average Maximum and Minimum Temperature of Haa

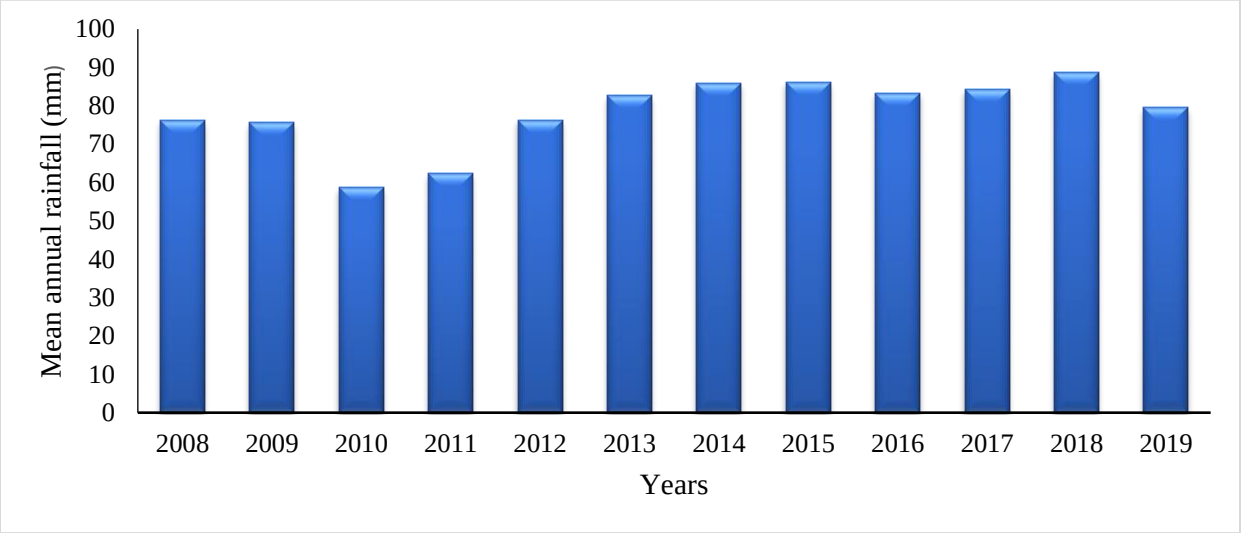


Source: Department of Hydro-Met Services, MEA Thimphu, Bhutan

2.2.3 Precipitation

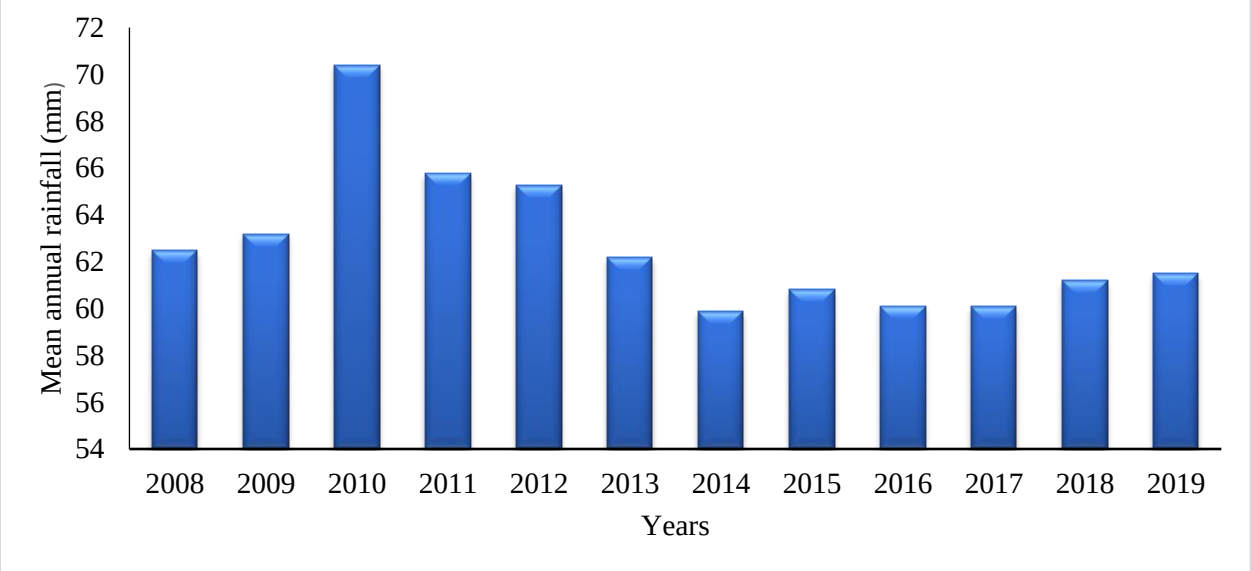
The precipitation of Selela FMU is expressed in the following graph for last 12 years. During the monsoon, the rainfall can impact the commercial harvesting and transportation of timber to depot if the road is not maintained properly. Briefly during the months of winter, the area receives precipitation in the form of snow. Although affecting mainly high elevation sites, but when snow fall is heavy the logging operation are withheld.

Figure 6: Average annual rainfall (mm) in Betikha area



Source: Department of Hydro-Met Services, MEA Thimphu, Bhutan

Figure 7: Average annual rainfall (mm) in Haa



Source: Department of Hydro-Met Services, MEA Thimphu, Bhutan

2.3 Geology and Soil

The rocks are of Gneiss Complex. The formation is characterized by migmatites and biotite-gneisses with thin bed of quartzite, quartz-mica seists, calc-silicate rocks, marbles etc. (Atlas of mineral resources of the Escap region. Vol.8. UNDP Publication) Big rocks covering huge area is not found continuously. However about 18% of the area has rocks of less than 16 square meters. Major part of the FMU has smaller stones of size less than 70*70cm.The soil is predominantly sandy loam and well drained in general.

2.4 Hydrology

Within the SFMU, there are many streams contributing to the watershed of the FMU, but the main streams are Tergola chu, Selelachhu and Sagolum chu. All the streams drain into the Haachhu directly forming its watershed. Streams on the northern side of the FMU i.e., half of the streams of Tergola block drain into Long chhu.

3. VARIABLE SITE FACTORS

3.1 Population and Demography

Selela FMU is located within the three Dzongkhags of Paro, Haa and Chukha with the majority of area under Haa Dzongkhag. In total, there are five villages that falls within the FMU, namely Dorikha, Lamjogang, Bempu, Papaling and Chazhe Village. Out of five villages, Dorikha and Lamjogang Village falls under Sama Gewog of Haa Dzongkhag and Bempu village fall under Naja Geog under Paro Dzongkhag. The Papaling and Chazhe village of Dungna and Meta Geogs is under Chukha Dzongkhg. There are 87 households with a total population of 505 residing within Selela FMU.

3.2 Agriculture and Farming System

The inhabitant residing within SFMU are mostly engaged in subsistence farming. They own dry land and engaged in agricultural farming and livestock rearing. People here in the FMU cultivate potatoes, food grains such as wheat and buckwheat, etc. the agriculture product harvested as used for family consumptions and if any surplus are sold to earn money. They only cultivate during summer season but in winter they migrate to the south (residents of Dorikha) with their cattle or for business during the orange season.

3.3 Traditional use of Forest

People residing within SFMU have been using the forest for multipurpose use since their settlement in the area. Timbers required for house construction, renovation of house and various

other reasons were extracted from the SFMU in the past. They use forest resources to construct and repair their houses, making small animal sheds, making farm implements etc. Shingles were used as roofing materials but it has been replaced by CGI sheets over the course of time. Beside the timber other forest products like firewood, fodder, etc. are also extracted from SFMU. The villagers also forest for cattle grazing.

3.4 Grazing

From the information received from Gewog RNR Office, it was found that there are about 400 cattle and 17 horses owned by the people residing within CFMU. The local cow herders mostly practice migratory grazing. During the winter, the cow herders move their cattle to the warmer places in the month of October and November and return during the summer months of April and May. However, livestock rearing being one of the main occupations of people, there is higher chances of increase in livestock population which ultimately creates pressure on the nearby forest. In order to reduce the grazing pressure on forest, introduction of improved varieties of livestock and awareness to the people may be looked upon by relevant agencies.

3.5 Wildlife

Going across the length and breadth of the FMU we have met with various signs left behind by the wild animals. Fresh footprints of the Himalayan black bear and Leopard pug mark in the vicinity of the cattle sheds and stories of cattle lost to the wild beast shows human wildlife conflict. Sometimes cattle are also lost to the wild dogs. Pellets of sambar and barking deer are also common. Wild boars are considered as wild pest by the local people and even deep inside the forest, soils moved by them were a common sight.

Sambar (Cervus unicolor)
Barking deer (Muntiacusmuntjak)
Wild boar (Sus scrofa)
Himalayan Black Bear (Selenarctos thibetanus)
Leopard (Panthera pardus)
Wild dogs (Cuonalpinus)
Monkey (Rhesus sp.)
Grey Langur (Presbytis entellus)
Blood Pheasant and various other fauna and avi-fauna.

3.6 Forest Fire

Until now there is no record of forest fire in SFMU. Thus, the fire is not regular phenomenon within the SFMU. However, since the major portion of forest, round settlements, is Blue Pine, extra vigilance is required to be exercised by the Unit staff.

3.7 Pest and Diseases

The Eastern Himalayan spruce bark beetle, *Ips schmutzenhoferi*, is a serious pest of *Picea spinulosa* and *Pinus wallichiana* in Bhutan. In Selela FMU major chunk of bark beetle sanitation operation was carried out between 2014 and 2018. Total of 665 number of trees equivalent to 2953.47 m^3 in standing volume from 51.72 ha of land were operated to avoid further spreading.

In most of the infested stands, mortality of trees was observed in the patch form and this could be because of root-to-root contact of the fungus. To our understanding, stands would have infested by bark beetles after weakening the trees with damage to the root system by root rot. The other probable causes of beetle outbreak could be because of poor management and harvesting practices.

With incidents of outbreak of spruce bark beetle over past years, there are possibility of pest and diseases outbreak any time during this plan period. Therefore, periodic monitoring to detect any outbreak of pest and diseases should be conducted by FMU and NRDCL. Immediate reports should be made to concern CFO and seek approval for immediate sanitation from head of the Department.

3.8 Non-wood Forest Product

In Bhutan, non-wood forest products (NWFPs) form the major source of peoples' livelihood in the rural communities. NWFPs play an important role in the daily lives and overall well-being of the Bhutanese people especially among the rural farming community; for instance, they are a major source of off-farm income, food, medicinal and aromatic products, fodder, fiber, and also used for local construction materials. NWFPs often are a safety net for poor people in the off-farm season and/or whenever needed as a food security measure. NWFPs offer a lifeline for many rural Bhutanese households. Bamboos and mushroom are some of the most commonly used NWFPS and used mostly for self and domestic purposes. They also collect *Paris polyphylla* for their medicinal value and very few individuals of Selela FMU have now started selling some

of the NWFPs like mushroom although the amount is very small. Many varieties of mushrooms are found and collected by the local population within the FMU, mostly for self-consumption. Matsutake mushroom (Sangayshamu) are also collected from the blue pine forested areas.

Rhododendron species, Junipers and Artemisia were also valued by the local residents to be burned as incense. Pteridophytes like Fern and conifers like Blue Pine needles were said to be used for composting manure to be used in farms. Stones and sands are other useful NWFPs. There are many other NWFP species found within the FMU area which are used as NWFP whose various properties are valued by locals and put into use. Some of the NWFPs found in the FMU are grouped as per their uses and are listed accordingly in the following tables

Particular	**Uses**
Bamboo	Mat, fences
Daphne	Paper making
Mushroom (variety)	Food
Berry *(Rubus spp*)	Fruits eaten
Berbaris spp.	Dye
Holboellia latifolia	Fruits eaten
Rhododendron spp.	Medicinal value
Viscum nepalensis	Medicinal value

Table 4: Non-wood forest product and their uses

3.9 Mineral Extraction

Minerals had not been extracted from the SFMU till now and should not be allowed even in the future for the aesthetic sensitivity of the area.

4. ECOLOGY

4.1 Floral Association

The altitude of FMU ranges from 2000m to 4000m above sea level and vegetation is dominated by conifer forest. The forest type for FMU has been grouped into Blue pine, Mixed conifer, Fir and Broadleaf forest as per land use land cover, 2016.

Blue pine growth is eminent at the lower altitudes either in pure stand or mixed with other species like *Quercus semicarpefolia, Populas ciliate, Betula utalis, Picea spinulosa*, and *Tsuga Dumosa.*

Mixed conifer forest mostly comprises of *Picea spinulosa* and *Tsuga dumosa* at the lower altitude. At the higher altitude, Spruce and Hemlock are mixed with other species like *Taxus baccata*, Juniper species, *Cupressus sps, Rhododendron sps, Larix graffithiana* and other species.

The fir forest is seen at upper portion of the FMU and this forest favor dense under storey where abundant growth of Rhodendron sps and other shrubs are usually seen

Upper canopy: Spruce (*Picea spinulosa*), Hemlock (*Tsuga dumosa*), Fir (*Abies densa*), Blue pine (*Pinus wallichiana*)

Middle canopy: Juniper (*Juniperus recurva*), Rhododendron sps, Oak (*Quercus semecarpifolia*), *Acer cambellii, Betula alnoides, Populus ciliate,* and other species

Shrubs:*Rosa laevigata, berberis sps*, etc.

Ground cover: *Aconitum sps, Thalictrum foliolosum, Potentilla sps, Eleagnus parviflora, viola sp, Senecio sp, Aster albescense, Rubus sp, Rumex hastatus, Causinia thomsonii, Gerenium wallichianum* and lot other

4.2 Fauna

During stock inventory, wildlife was also recorded during the first and second management plan periods. During the transect walk in the FMU, some of the animals and birds were directly spotted and many data regarding wildlife was recorded through indirect signs. Some of the animals and birds found in the are listed below

Table 5: List of Wild Animals

Common Name	Scientific name
Himalayan Black Beer	*Selenarctos thibetanus*
Sambar deer	*Cervus unicolor*
Barking deer	*Muntiacus muntjak*
Wild boar	*Sus scrofa*
Wild dog	*Cuon alpines*
Leopard	*Panthera pardus*
Musk deer	*Mos chhuschrysogaster*
Jungle cat	*Felis chaus*

Himalayan yellow throated marten	*Martes flavigula*
Three stripped palm squirrels	*Funambulus palmarum*
Pine marten	*Martes martes*

In order to protect the musk deer in SFMU, detail field survey to identify its main habitat is recommended in near future

Table 6: Birds found in Selela FMU

Common Name	Scientific Name
Monal Pheasant	*Lophophorus impejanus*
Blood Pheasant	*Ithaginis cruentus*
Spotted Nutcracker	*Nucifraga caryocatactes*
Yellow-billed Blue Magpie	*Urocissa flavirostris*
Kalij pheasant	*Lophura leucophaeus*
Large billed crow	*Corvus macrorhynchos*
Yellow-billed chough	*Phyrrocorax graculus*
Green backed Tits	*Parus monticolus*
Blue-fronted Redstart	*Phoenicurus frontalis*
Blue-whistling Thrush	*Myophonus caeruleus*
Grey-sided Bush Warbler	*Cettia brunnifrons*
White throated laughing Thrush	*Garrulax albogularis*
White tailed nuthatch	*Sitta himalayensis*
White capped redstart	*Chairmarrornis leucocephalus*
Plumbeous redstart	*Rhyacornis fuliginosa*
Alpine swift	*Apus mulba*
Hoopoe	*Upapa epops*

5. SILVICULTURAL ASSESSMENT

5.1 Present Forest Types

The main forest types of Selela FMU are;

Blue pine

Blue Pine is mostly found around the settlements and now started invading the open areas. The blue pine stand is at the new stand initiation stage and old growth is only in small patches. It occurs both in pure and mixed with oak, poplar and Acer. In the upper region, it is also found mixed with Hemlock.

Mixed Conifer

Mixed conifer is found all across the middle portion of the FMU. This forest type is dominated by Hemlock, Spruce and Fir. Hemlock mostly occurs in association with Blue Pine and Spruce.

Fir

Fir forest in Selela FMU is confined to the upper ridges up to the tree line and occurs mostly as pure stand, but it is also found mixed with Spruce and Hemlock. The dense canopy provides environment for luxuriant under story of Rhododendron and other shrubs. Most of the Fir at the higher elevations is over matured old growth stand. But protection should be given the first priority as on the steep and high-altitude regions regeneration of Fir is very low hence harvest should be confined to suitable site conditions. And also, invasive nature of the broadleaf species such as rhododendron hampers the regeneration of economically important species like Fir.

Mixed Broadleaf (Hardwood)

Mixed broadleaved starts from the valley bottom right from the Haachhu with the growth of Oak, Betula, Acer, Populus etc. Throughout the FMU Broadleaved spp. occurs mixed with conifers. After the Fir zone Rhododendron forms a pure stand.

5.2 Past Silvicultural Treatment

The Silviculture systems that were to be used were Group Selection System for mixed conifer, Seed Tree System for blue pine and Single Tree Selection System for rural allotment. This was to be carried out using cable crane logging system. Thinning was also to be carried out in the Blue pine stand to improve the individuals. Natural regeneration was to be the main source of stocking supplemented with artificial regeneration in the area absence of natural regeneration for sustainability. Four working circles were established in the previous management plan, four regular and one overlapping. They were:

Regular Working Circles:

1. Blue Pine Working Circle
2. Mixed Conifer Working Circle
3. Fir Working Circle

Overlapping Working Circle:

1. Non-wood Working Circle

5.3 Plantation

Since 1993, forests in the FMUs have been managed under Management Plans. While the primary objective is sustainable forest management to ensure sustainable production and supply of timber for urban and rural consumers, the FMUs are also mandated to manage the non-timber forest resources as well as the protective functions of forests. From the standpoint of sustainable timber production, the forests cut along the cable line corridors and in the patch, openings are to be reforested through natural regeneration supplemented by artificial planting.

For this plan period total of 37.46 ha of land was bought under artificial plantation from the total clear-cut area of 176.33 ha (Table 7). This shows that in conifer areas there is good natural regeneration along the cable line corridor and bark beetle sanitation areas. Further, survey to study plantation establishment status were conducted for plantation areas which are more than five years old. The survey was carried out in line with Guidelines for Monitoring and Evaluation of Plantation and Forest Nursery,2019. The average planation survival percentage of five years old of five sites was 77.4% which falls in very good (VG) category (Picture1). With this the plantation sites were qualified to evaluated as established and 10 years regeneration was added for existing rotation period for AAC calculation.

Block/ Compartment	Cable Line No	Geo- coordinates	Year of Plantation	Plantation area planned(ha)	Plantation area implemented (ha)	Plantation Survival Percentage
Tegola block	Cable line 1 & 2	27°15'29.27"N 89°17'59.30"E	2010	2.74	2.74	67
Tegola	Plot no VII	27°15’09.2” N 89°17’52.3” E	2011	2.84	2.84	78
Tegola	Plot no X	27°15’00.3” N 89°17’15.2” E	2013	4.82	4.82	75
Selela	XI	27°15’00.9” N 89°17’22.0” E	2014	4.70	4.70	78
Tegola	XVIII	27°14’59.0” N 89°18’29.6” E	2015	1.20	1.20	89
Tegola/Selela	Selela 2016/1	27°15’01.6” N 89°17’21.1E	2016	4.46	4.46	51
Tegola/Selela	Tegola & Selela	27°15’31.1” N 89°17’17.2” E	2017	8.53	8.53	65.5
Tegola Block	Plot no 1 & 2	27°15'17.81"N 89°16'44.12"E	2018	2.87	2.87	75
Selela Block	Plot no 1,2 & 3	27°14'46.31"N 89°19'32.20"E	2019	3.15	3.15	72
Selela Block	Plot no 1 & 2		2020	2.15	2.15	70
				37.46		

Table 7: Plantation areas and survival status

6. SOCIO-ECONOMICS

6.1 Common Source of Income

According to the information collected from Geog Agriculture Extension Officer, the main sources of income for the local communities within SFMU are agriculture and livestock rearing. The majority of local communities are farmers having individual landholdings. The main cash crop grown by the local communities is potato. Other vegetables like Beans, Cabbage, Raddish, etc. are grown in small quantity for family consumption. Selling of Potato and livestock products are the only source of income for the local communities within the SFMU.

7. CURRENT TIMBER DEMAND AND SUPPLY

The timber needs for the rural communities residing within the FMU is being met from Tegola and Cheppji rural block. The timber needs are mainly for rural house construction, renovation of rural house, cattle shed construction, fencing of farm lands and flag poles. Even the rural firewood demand for the locals is being met from same area.

For commercial timber use, the total AAC prescribed during the plan period was 88,850 m^3 in

Picture1: The plantation sites along the past operated cable lines and sanitation areas which are in established stage

standing form. The total timber harvested from FMU over period of previous management plan period was 72,646.08 m^3, which is about 81% against prescribed AAC.

Table 8: Commercial timber extracted from the Selela FMU 2011-2020

Sl. No.	Year	No of cable lines	Standing Volume (Commercial)	Volume (Road)	Volume (Sanitation)	Volume (Others)	Total Volume (m^3)
1	2011	8	8626.11	0	0	0	8626.11
2	2012	9	8888.00	0	0	0	8888.00
3	2013	15	8886.00	0	0	0	8886.00
4	2014	8	5438.13	0	0	0	5438.13
5	2015	8	5218.73	2440.99	537.711	0	8197.43
6	2016	9	0	802.304	3133.108	122.82	4058.232
7	2017	9	4409.47	0	0	46.38	4455.85
8	2018	12	4370.74	1013.87	91.20	218.00	5693.81
9	2019	14	7092.60	0	0	0	7092.60
10	2020	9	10546.486	561.429	0	202.00	11309.915
Total Volume		**101**	**63476.266**	**4818.593**	**3762.019**	**589.2**	**72646.077**

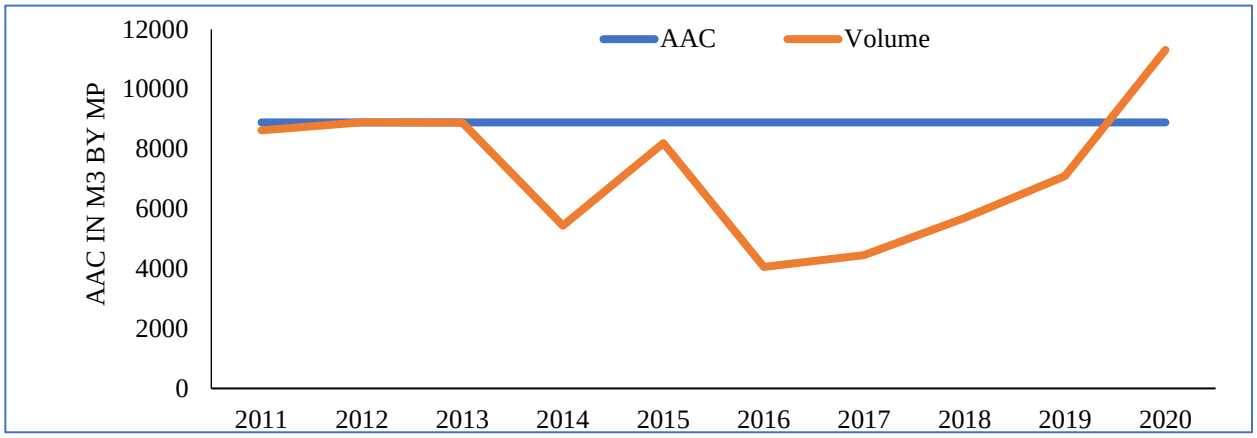


Figure 8: Commercial timber demand and supply over period of previous FMP

The total AAC over 10 years period for local use was 30,000 m^3 in standing form. However, only 76% of timber was allotted to rural applicants Haa, Paro and Chukha. The total timber volume extracted to rural applicants is 22,865.12 m^3, which is about 76% against the prescribed AAC. The highest timber allotted from FMU was for people of Sama Geog follow by Naja and others.

Table 9: Rural timber supplied from the FMU in the year 2011-2020

Block/ compartment	Year of operation	Rural AAC of the FMU (m^3)	Total Standing volume supplied (m^3)	Balance rural AAC of the FMU (m^3)
Tergola 1a & 1b	2011	3000.00	1841.68	1158.32
Tergola 1a & 1b	2012	3000.00	2616.00	384.00
Tergola 1a & 1b	2013	3000.00	900.00	2100.00
Tergola 1a & 1b	2014	3000.00	1398.00	1602.00
Tergola 1a & 1b	2015	2500.00	1082.78	1417.22
Tergola 1a & 1b	2016	3000.00	762.35	2237.65
Tergola 1a & 1b	2017	2701.71	689.76	2011.95
Tergola 1a & 1b	2018	3000.00	2219.48	780.52
Tergola 1a & 1b	2019	3000.00	5599.82	-2599.82
Chhepjii1	2020	3000.00	5755.25	-2755.25
Total		**29201.71**	**22865.12**	

Figure 9: Rural timber demand and supply for last ten years

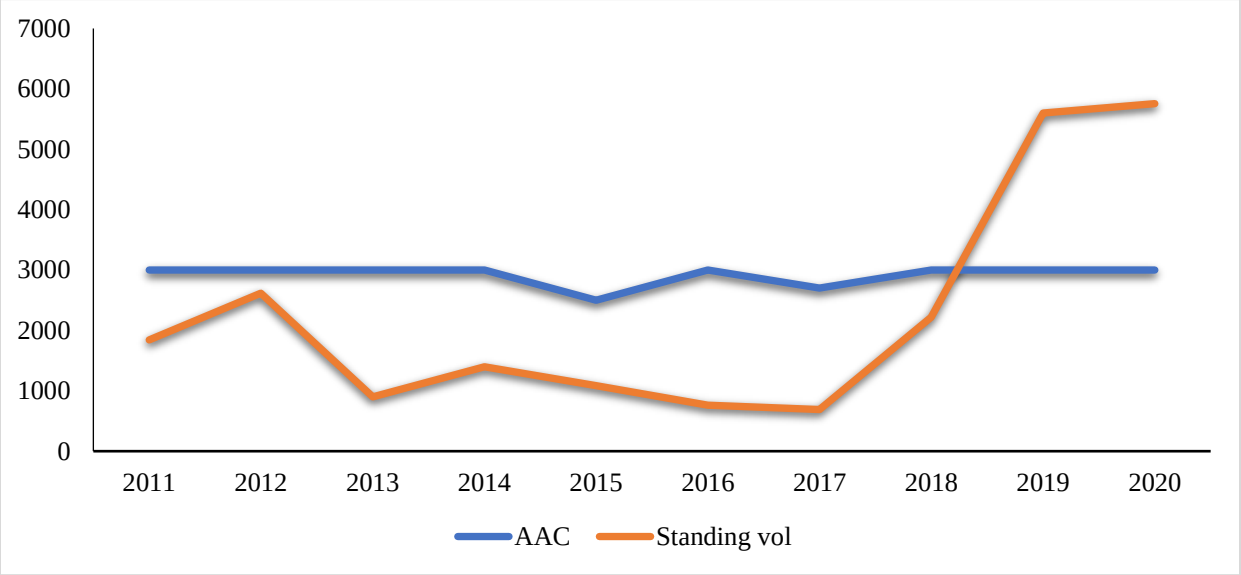


Table 10: Royal Timber supply from Selela FMU, Haa During 2011-2020

Sl. No.	Volume	Shinglep	Chams	Tsims
1	1137.64	0	80	0
2	700	0	80	0
3	676	0	88	
Total	**2513.64**		**248**	

Table 11: Other raw materials supplied from the FMU

Sl. No.	Year	Firewood (M^3)	Sand (T/L)	Bamboo (Nos.)	Leave mould (T/L)	Stone (T/L)
1	2011	272	39	0	1	0
2	2012	32	0	3300	0	0
3	2013	104	0	2500	0	0
4	2014	40	0	2500	0	0
5	2015	48	2	3000	2	31
6	2016	0	38	1500	4	10
7	2017	0	0	1000	0	22
8	2018	0	0	300	0	0
9	2019	0	0	0	0	30
10	2020	0	0	0	0	0
Total		**496**	**79**	**14100**	**7**	**93**

8. ORGANIZATION AND ADMINISTRATION

8.1 Organization

The Selela FMU is under the jurisdiction of Divisional Forest Office, Paro and is directly administered by the CFO Paro supported by FMU Unit In-charge and other field staffs. Operational planning will be developed and written by the FMU management, with input and assistance of CFO Paro.

8.2 Health and Safety

In the environmental statement of the National Environmental Commission health and safety had been given a high priority. As stated in the environmental statement and the consultant report of WWMP, Paro, harvesting and extraction method have been identified as the areas of most concern and needs to be addressed.

NRDCL is taking up the implementation part of the forest management; the issue needs to be addressed by the implementers. At present health and safety measures are poor and sometimes absent altogether. Site specific risk assessment seems necessary if not Generic Risk assessment.

The major risk involved in the forestry operations are:

- Harvesting
- Transportation

The safety measures can be initiated with little or no expenditure to ensure the health and safety of the field staffs. Below are the few recommendations to minimize hazards in the field;

- Ensure chain saws equipped with full functioning chain breaks.
- Always ensure feller to keep two tree lengths apart while felling.
- Explain the dangers of falling timbers and overhead cable lines.
- Stack timbers in the same direction stack not too high.
- Never climb or approach the log pile from the bottom of the slope.
- Always dismantle a stack from the top rather than from the bottom.
- Keep two products length while stacking mechanically.

It is recommended that the NRDCL to initiate long term safety measures and its improvement that would one day become a mandatory at any costs.

8.3 Record keeping

Maintenance of record in the FMU office was identified as concern. Some important information was lost, otherwise would be very useful for the planning and management purposes. The Unit Office shall maintain the records of all the activities within the FMU as per the record-keeping format reflected in the Forest Management Code of Bhutan, 2004 and other guidelines issued by the Department.

9. INFRASTRUCTURE, TRANSPORT AND EQUIPMENT

9.1 Road

Almost all the settlements within the FMU are now connected with forest roads and farm roads. During second management plan of the FMU, 10 km forest road was constructed by NRDCL from Selela block to Holela block. In first management plan about 23.149 km of forest roads and 17.94 km of farm roads had been constructed by NRDCL and Dzongkhag in the last ten years and it helped a lot to the residents of Lamgigang, Dorikha and Koina villages. Farm road are connected in villages of Bemphu, Papali and Chazi. National high way of Haa-Samtse had been constructed and passes through the FMU right from Dorikha to Tergola Top. Roads helped the people of the area to in many ways, from moving of their goods in and out of their villages, travelling and even people use the road for extraction of rural timber.

9.2 Buildings

There are no Offices or staff quarters built inside the FMU. The FMU office is based in Haa Range compound. It will enhance the efficiency to implement management plan if better infrastructure were provided to FMU, such as office building and staff quarters.

9.3 Transport

SFMU does not have any mode of transportation facilities to monitor the activities going on in the FMU. FMU staff are either using their private vehicle or traveling in lorry during site visits. The FMU monitoring is hampered to greater deal due to lack of transportation facilities at their disposal

9.4 Equipment

The FMU had received many essential office and field equipment in the past. Most of the old office and field equipment are obsolete and some are out of service and thus, impeding the successful implementation of the management plans. The concern agencies must issue office and field equipment from time to time to avoid impediments to the FMU staff. FMU should be equipped with updated equipment and human resources to ensure sustainability of the FMU.

10. EVALUATION OF PREVIOUS PLAN (2010-2020)

The past harvesting activities and other associated activities in Selela Forest Management Unit was guided by the Forest Management Plan prepared in line with the Forest Management Code of Bhutan, 2004. It is important to evaluate the past management plan to review and study whether activities are carried out in line with the management plan prescription. Revisiting the areas and the plan would help identify areas for improvement or those aspects which has been overlooked. The required remedial measures can be accordingly incorporated in the new plan. The past plan is reviewed for its goals and objectives and evaluated for the on-field activities carried within the FMU.

10.1 Review of Goals and Objectives

Forest management plan for FMU was written to manage the environment, wildlife, soil, water and timber. This plan tries to tie together all the aspect of sustainable utilization of forests resources, involving stakeholders and the local people in the FMU. A brief review of the Goals

and Objectives of the last management plan, to define where activities have been focused are documented below:

Goal

To manage the forest on a multiple use, sustained yield basis for the production of timber, fuel wood and other forest products and for watershed, wildlife and environmental protection

Although, the goal of managing forest on a multiple use, sustained yield basis for the production of timber, fuel wood and other forest products was not achieved completely, however it was observed that, the activities implemented in last plan period has focused towards achieving this. As the goal is usually considered as a long-term objective of the management, it is unlikely to consider that it should be achieved in the short period of time. The sustainability aspect of the goal has been taken care properly while implementing the activities in the FMU.

Objectives

To ensure sustainable supply of timber, fuel wood and other forest resources.

The AAC for commercial harvesting in the last plan was set at 8886 m^3, which totals to 88860 m^3 for period of ten years. As per the data obtained from the Unit Office, the actual commercial harvesting during the last plan period was 72,646.08 m^3. And similarly, for Rural the total AAC allocated was 3000 m^3 which is equivalent to 30,000 m^3 in ten years. From this total 22,865.12 m^3 of timber were allotted for rural use. Therefore, both commercial and rural timber harvesting was found to be as per the prescription and has not exceeded for ten years.

Other forest resources like sand; NWFPs, Bamboos, etc. were also supplied from the FMU. No annual harvesting limit was fixed for NWFPs. NWFP harvesting in the FMU must be done based on prescribed management prescription in the future management plan for major NWFPs. Management prescription for important NWFP species should be identified and prioritized and management plans must be developed in close consultation with Social Forestry and Extension Division of the Department.

To protect forest from encroachment, fire, grazing and other illegal activities to conserve and enhance wildlife habitats and biodiversity.

This objective has been prescribed under the protection management circle.

As per the field records maintained by FMU Unit In-charge and field observations, there is no evidence of encroachment into FMU area. In the previous plan period, FMU has protected 3057.07 ha as wildlife habitat protection, 5734.56 ha as soil protection, about 239.59 ha as local water supply protection and Riparian reserve of 671.75 ha. Total of 179.55 ha has been identified as Ecosystem reserve area. Although there were some incidents of cable lines being installed inside reserve areas but no major disturbance was observed. Therefore, UICs are recommended to strictly prohibit any commercial nor rural marking inside reserve in future. For this plan the due to FMU boundary realignment the reserve areas are reduced to 176.81 ha. The reserve plot will be used for to study ecology and aesthetic value of undisturbed forest in future.

To involve local people in the management of forest by providing employment opportunities and raising awareness programs.

Although, all the technical works are being contracted to the eligible business firms, the firms hire the local people as laborer to carry out the works within the FMU. This way, it helps in creating employment opportunity for the local people and the social mandate of the FMU is also being achieved. Moreover, two community forests were also established within the FMU which is aimed at giving opportunity to the local people to manage resources for themselves and also to carry out interventions to improve the forest cover and conditions. The local people were also involved in the management of FMU through FMU level meetings in which their opinions and suggestions are being incorporated for proper management of the Unit.

10.2 Review of Harvesting Activities

The harvesting is done with a fixed skyline and gravity cable system. This has helped to reduce the impact on soil and other environmental impact. Because of skyline system, impact from road construction was reduced. In the previous plan period, outbreak of spruce bark beetle has damaged spruce and blue pine trees in FMU. Total of 665 number of trees equivalent to 2953.47 m^3 in standing volume from 51.72 ha of land were operated to avoid further spreading. The total clear-cut equivalent from cable line alone was 89 ha followed by bark beetle sanitation of 51.72 ha and road construction 23.05 ha. The total clear-cut equivalent area for previous was 163.77 ha.

10.3 Review of Road Building Activities

In previous plan period, about 51.35km of road was constructed side the FMU area. The farm road construction was highest with 25.35 km followed by Haa-Samtse national highway of 16.5km. The Forest Road constructed by NRDCL was about 9.5 km in last ten years. The road construction alone has contributed around 23.05 ha to clear cut equivalent area. The road network has benefitted the local people residing both within and outside the FMU. NRDCL should keep annual budget provision for proper maintenance of forest road to keep road in good condition for transportation of timbers and management of FMU in this plan period.

PART 2

FUTURE MANAGEMENT

PART 2: THE FUTURE MANAGEMENT

11. Introduction

Bhutan's forest policies have been particularly progressive and invaluable in the protection of the country's rich natural resources. Bhutan nationalized its forests in 1969, then approved a National Forest Policy in 1974 that set a goal of maintaining 60% of the land under forest cover in perpetuity, creating a framework for scientific management of the forests, and providing for the restoration of degraded land.

The Royal Government of Bhutan (RGoB) is committed to the principles and practice of sustainable forest management and to achieve such management, sound policies along with comprehensive approach, appropriate legislative and governance framework is important. The national forest policy, 2011, envisaged sustainable management of Bhutan's forest resources and biodiversity and the RGoB has adapted a firm national policy requiring the preparation and implementation of scientific management plans to produce a wide range of social, economic and environmental goods and services and fulfil social, economic, ecological and cultural needs of the present and future generations. It is important to understand our forest resource dynamics from what has already occurred and useful to take a look at what is likely to occur in near future. The constitution of the kingdom of Bhutan mandated to retain at least 60% of the country under forest cover for all times to come.

11.1 Forest policy

1. From the time immemorial, Forest has been important resource with policy requirement of management plan for State Reserve Forest land focusing on sustainable utilization of forest products and ecosystem services. Several principles have been considered while framing the National Forest Policy and some of these are equity and justice in terms of access, optimal utilization, conservation of forest resources and its ecosystem services.
2. Contribution of forest products and services for poverty reduction through integrated approach.
3. Deregulation and devolution through people centered forest management practices and decision making.
4. Application of good science and indigenous knowledge through integrated research and development in all aspects of forest planning and management
5. Allowing imports of logs and sawn timber to enhance availability of timber materials within the country while export of round logs and sawn timber shall not be allowed to encourage value-addition.

11.2 Goals

The overall Goal of Selela Forest Management Plan is to:

'*Manage forest on a multiple use, sustained yield basis for the production of timber, fuel wood, non-wood forest products, and conservation of watersheds, wildlife and environment'.*

In order to support this long-term goal, FRMD will have to assess every thematic element of Sustainable Forest Management (SFM). The elements include extent of forest resources, biological diversity, forest health and vitality, productive and protective functions of forest resources, socio-economic functions and legal, policy and institutional framework through monitoring and evaluation framework for FMUs. The Divisional Office, Paro, will have to process for evaluation of FMU to the DoFPS through FRMD.

11.3 Objectives

The objectives of Selela FMU have been divided under the management circles and the working circles set up for the ease of implementation. Three management circles have been identified, **Protection, Production and Non-Production** with objectives listed below. This allows different areas to be managed and evaluated separately. Some of the same objectives may occur under different management circles.:

Protection Management Circle

- To conserve water catchment areas by maintaining buffer zones and not harvesting timber;
- To prevent from forest fire, grazing and other illegal activities
- To allow low-impact collection of Non-Wood Forest Products on sustainable basis through some regulations
- To conserve and protect wildlife habitats and biodiversity areas by not interfering any anthropogenic interventions
- To raise awareness on biodiversity and natural forest to local communities and stakeholders
- To respect sanctity of religious places and to protect historical sites

Non-Production Management Circle

- To maintain and improve the forest condition to retain its multiple value

- To conserve and protect biological diversity by regulating function maps of FMU
- To manage and regulate grazing for livestock
- To conserve the water catchment areas by keeping buffer zone and not harvesting timber;
- To conserve and enhance biodiversity and meet the local demand for NWFPs

Production Management Circle

- To meet local requirements, as priority, for timber, fuel wood and other forest products on a sustainable basis
- To manage the commercial timber production on sustainable basis
- To protect the forest from fire and illegal activities and grazing in regeneration areas
- To create local employment opportunities
- To improve health and safety standard of the workers
- To conserve water catchment function
- To maintain biodiversity within the production area

11.4 Management based on Forest Function

11.4.1 Introduction

Forest function mapping is defined as grouping of different potential uses of forest. The different forest potential includes soil conservation, watershed conservation, habitat for flora and fauna and resource based for many kinds of human needs. Forest function in general are not based only on subjective human demands, they are significantly and objectively limited by site condition of individual forest stand. For this reason, categorization of every forest stand into different forest function is mainly based on the dominant site, forest type, accessibility, slopes, flora and fauna present. However, some forest function represents a certain exception to this rule and these functions are designated on the basis of social or certain group importance.

Forest Management Code of Bhutan,2004, describe that forest function defines for all the forest area within the FMU ecological, environmental and social functions and as such serves to balance the often-diverging interest of commercial logging, local forest use and nature

conservation. For effective management of forest, it is essential to map all the different forest functions. Forest function map provides the information on the total commercial operable area identifies which areas have to be reserved for local use and provides the management planner and the implementer with information on management restrictions for particular areas.

Section 5 of Management Plans and Section 21 of establishment of Protected Areas of the Forest and Nature Conservation Act of Bhutan 1995 provides the legal backing for forest function planning. The objectives of forest function planning for this management plan are:

The main objectives of forest function planning for this management plan are:

- To define, for a particular area (FMU), different environmental and social functions of the forest and depict them on the map
- To identify production, non-production and protection forested areas and accordingly implement activities
- To provide a tool for a management planner for balancing the requirement of nature conservation, environment protection, social forestry and commercial timber production and also to provide spatial information required to compute the sustainable AAC.
- To provide the FMU In-charge with information on the location of different forest function in order to specify the required management prescriptions on the ground and to control their implementation.

11.4.2 Function Groups

The functions used in this management plan are listed in the table below. Some of these groups include functions that differ only in the degree of intensity of their management prescriptions.

Table 12: Different Forest Function used in this Plan

Code	Function Group (Bold) and Functions
S	Soil ConservationFunctions
SC	**Soil Conservation**
SP	**Soil Protection**
W	Water and Watershed Conservation functions
WRR	**Riparian Reserve Protection**
WSh	**Watershed Conservation**
N	Nature Conservation

Soc	**Social Function**
SocL	**Social (Local Use Only)**
SocRS	**Religious Site Protection**
RB	Road Buffer

11.4.3 Mapping Forest Functions

The criteria used to prepare forest function map for Selela FMU is given in the table 9 below. In this table, information for some criteria is not available or cannot be mapped at the scale used for planning. These criteria are indicated in italics. When Operational Plans are prepared new detail is to be collected and these criteria should be implemented.

Table 13: Criteria for mapping Forest Functions

Function Group and Codes	Criteria for Mapping
Soil Conservation	**SP:** Very steep areas (slopes above 45º), areas unstable and sites prone to landslides and areas with indications of severe erosion. **SC:** Steep areas (slopes of 25-45º), areas with indication of slight to moderate erosion; exposed sites (ridges, etc.)
Water and Watershed Conservation	**WSh:** catchment areas of watercourses on steep slopes and on poorly drained areas; other sites serving as water retention areas or water sources **WRR:** areas within 30m along all perennial streams, water logged area and swamps
Nature Conservation	**WNP:** Alpine areas, Red Panda and Musk Deer territory, ecosystem of high conservation value. **NWC**: Areas identified as biological corridors and all areas rich in wildlife, both in species and in number.
Social Function	**SocL:** area close to or accessible to settlement or village, the areas traditionally used with definite boundaries. **SocRS:** Lhakhangs/Gornpas, Chortens and other religious sites.
Road Buffer	**RB:** 200m uphill and 100m downhill for motorable public road, 30m uphill and 10m downhill for unstable forest road.

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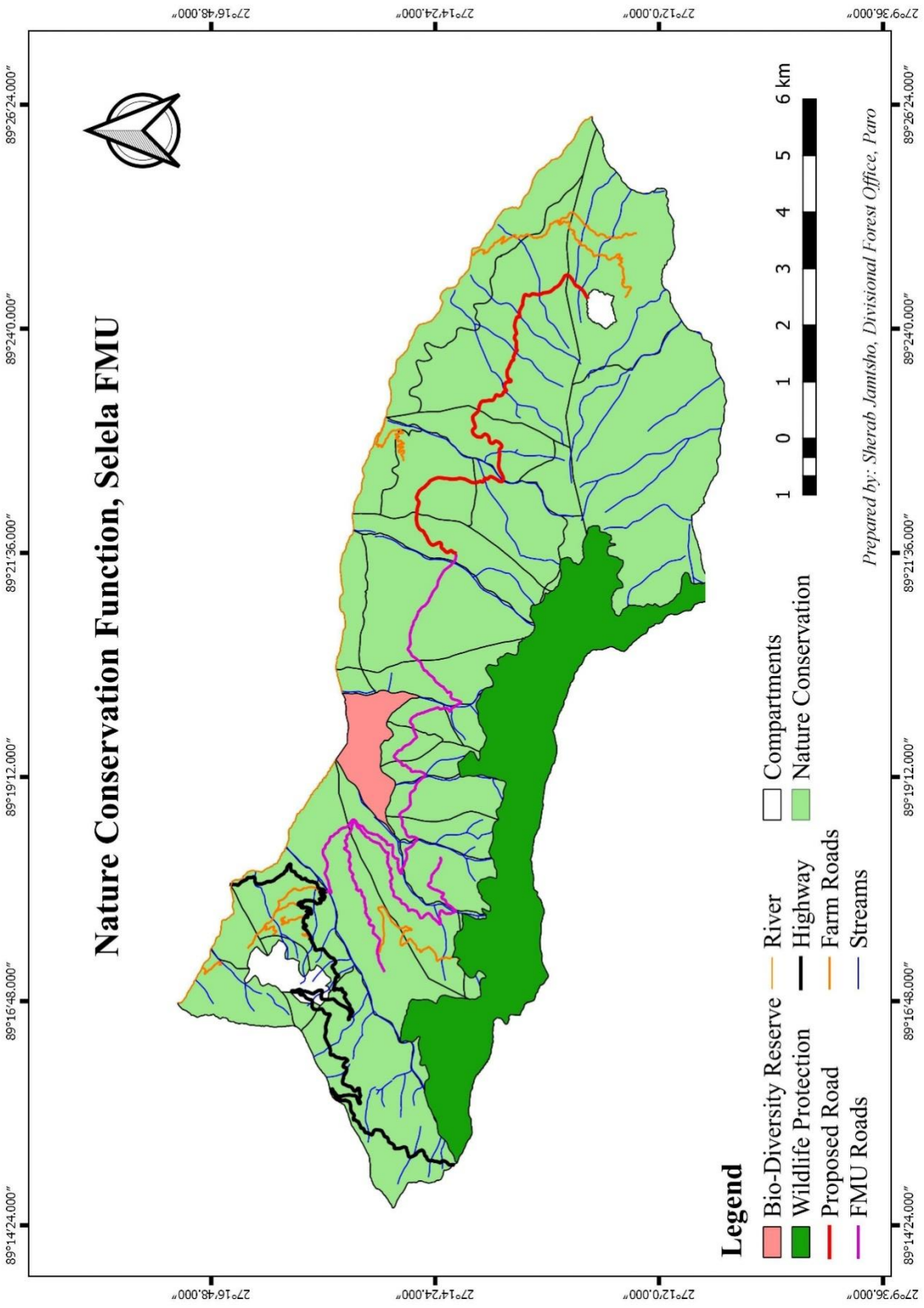

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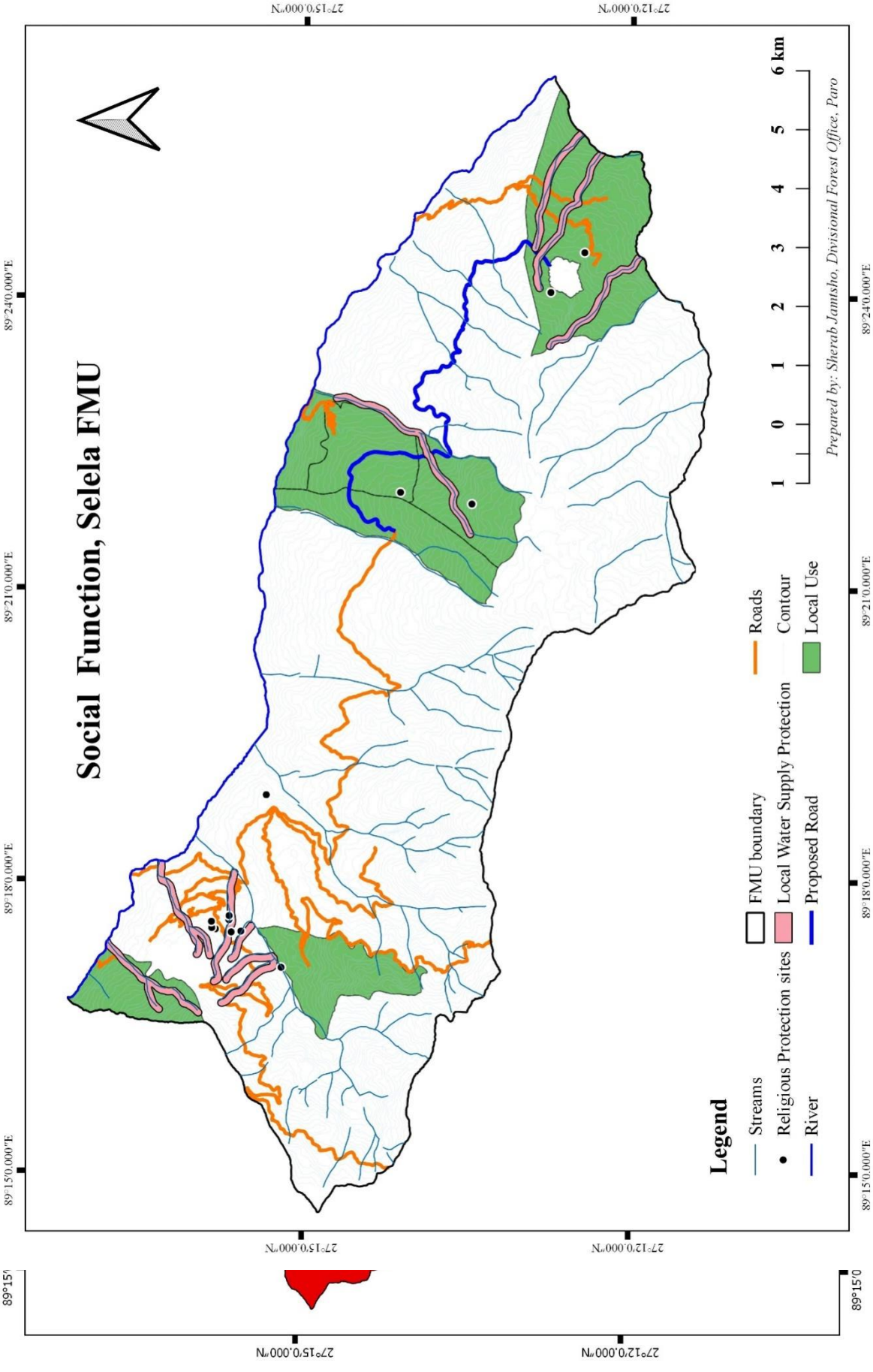

11.4

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The specific restrictions to be applied to forest in various categories are summarized in Table 14. These restrictions should be applied in conjunction with the objectives set for each Management Circle.

Table 14: Forest Function Restrictions

Code	Function	Restriction on Commercial Use	Restriction on Local use
SP	Soil Protection	No commercial use	No tree felling, minimize human interference
WRR	Riparian Reserve Protection	No commercial use	Only collection of NWFP; no *tsamdo*; no *sokshing*
RB	Road Buffer	No commercial use	No tree felling
WLS	Local Water Supply Protection	No commercial use	Low impact use only; no cattle grazing
SocRS	Religious Site Protection	No commercial use	Only use which do not disturb sanctity of place
SocL	Social (Local Use Only)	No commercial use	No restriction
SC	Soil Conservation	No clear cutting; no conversion into plantation; extension of rejuvenation periods	Low impact local use; no intensive cattle grazing
WSh	Watershed Conservation	No clear cutting; no conversion into plantation, minimize disturbance to understorey vegetation	No intensive cattle grazing; low impact local use
SocLC	Social (Local cum Commercial Use)	Low impact commercial use	No restriction
RB	Road Buffer	No commercial use	No tree felling

12. QUANTITATIVE RESOURCE ASSESSMENT

12.1 Forest Management Inventory

The first management plan inventory for Selela FMU was carried out in 1993by Forest Resource and Management Division FRMD (then FRDD). Later in 2005 sample inventory was carried to revise AAC. Subsequently 2ndplan revision inventory works were executed in 2008 and plan was got approved in 2010. Forest management inventory for this 3rd plan revision was started from 1st October 2019 to Jaunary, 2020. The standard FMU inventory technique was used with data being collected for the trees >10 cm DBH (OB) from circular plot of 12.62 regeneration from 3.57 m

radius. The data obtained from the forest management inventory was analyzed using statistical software called 'R'. A total of 368 plots were laid with plot distance of 500m throughout FMU area. The inventory was designed with target sampling error of +/- 10 % and the coefficient level of 95%. The general objective of the inventory was to provide essential background information for revising the Selela Forest Management Plan. More specifically the objectives of the inventory were:

- To study the changes in growing stock
- To provide relatively accurate overview of the growing stock and regeneration potential of natural forest in the area, according to major forest types
- To give an overview of the general site characteristic of the natural forest, in terms of soil, non-green vegetation and the use by local population
- To provide an indication of timber quality in different forest type
- To furnish essential data on tree height to enable construction of local volume table for main species

12.2 Forest Management Inventory Results

The summary of the inventory results is shown in the table below

Table 15: Summary of Inventory Results for overall FMU area

Parameters	Results	SE %	Reliable MinimumEstimate (RME)
Total Inventory area (Ha)	8919.15	NA	NA
Number of Plots	368	NA	NA
Total number of trees	1151943	9.95	1071825
Number of trees per Hectares	125	6.95	117.04
Total Basal area	196913	14.90	167567.99
Basal Area(m^2) per Hectares	21.5	14.90	18.29
Total growing stock (m3)	2995268	11.84	2640394.1
Volume(m^3) per hectares	327.101	11.84	288.34

***SE= sampling error (95% confidence level)**

13. AREA ORGANIZATION

13.1 Spatial Organization

Selela FMU working circle is divided into four blocks and 34compartmentsto facilitate field staff on identification of boundaries and make more reliable way of recording information for management purposes. The blocks and compartments have been demarcated according to prominent natural drainage, terrain/ridges, etc. Selela FMU has been divided into four blocks: Chhepji, Tegola, Holela and Selela blocks.

Table 16: Block, Compartments and Sub-compartment Information

Blocks	Compartments	Sub-Compartments	Area (Ha)	Total area (Ha)
CHHEPJ	1	x	620.05	**1903.37**
	2	x	1283.32	
SELELA	1	a	302.55	**1943.53**
	1	b	267.44	
	2	a	270.72	
	2	b	137.68	
	3	a	212.16	
	3	b	170.73	
	4	a	54.75	
	4	b	63.95	
	4	c	140.79	
	4	d	145.95	
	5	x	176.82	
TEGOLA	1	a	171.15	**1940.95**
	1	b	68.56	
	2	a	276.16	
	2	b	25.69	
	2	b	22.73	
	3	x	588.51	
	4	x	788.13	
HOLELA	1	a	234.29	**3241.91**
	1	b	26.05	
	2	a	519.32	
	2	b	103.10	
	2	c	244.75	
	2	d	65.18	
	3	a	90.24	

	3	b	231.69	
	3	c	242.54	
	3	d	91.74	
	4	a	202.00	
	4	b	80.73	
	5	a	356.57	
	5	b	753.71	
Total	**34**	**-**	**9029.76**	**9029.76**

There is no change in Compartment and sub-compartments boundaries. However, with establishment of Papaling Community Forest the areas of compartments and sub-compartments is reduced for Chhepji block.

13.2 Determining Operable Area

To make sure that the available resources within FMU area is utilized on sustainable way, the Selela FMU will be manage of multiple purpose. The multiple uses of forests are generally protective, climatic, productive, scientific, recreational, etc. but while managing a unit area of forests, all such purposes cannot be equally harmonized. One purpose has to take precedence over other. The area for commercial and rural forestry activities are those that are left after areas for other critical functions were identified and mapped out, using GIS and inventory information. The functions that take precedence over commercial and rural forestry activities are

- Soil protection areas (slope greater than 100 %)
- Soil conservation
- Riparian buffers and zones
- Religious site protection
- Private registered land
- Road buffers
- Barren areas

13.3 Organization into Management Circles and Working Circles

The function mapping was used to delineate three broad management circles for BFMU: Protection, Production and Non-Production Management Circles. Management Circles in SFMU are divided into Protection, Production and Non-Production. Protection Management Circle includes soil protection, religious areas and stream and road buffers. Production Management Circle includes all areas where harvesting can occur. This Management Circle includes the Working Circles where harvesting will take place. Non-Production area is all the remaining area in the FMU, including private and cultivated land, non-forest areas

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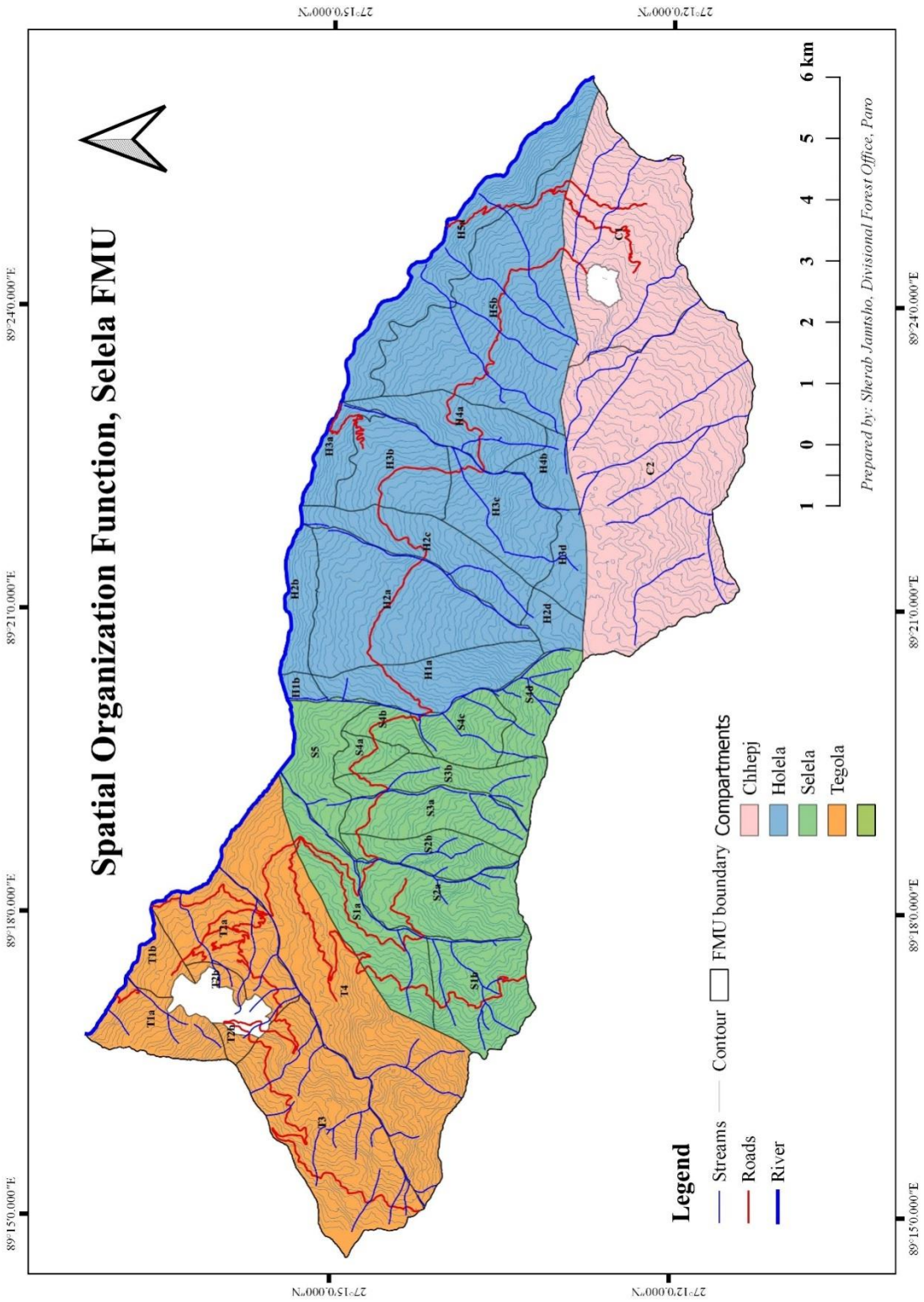


Table 17: Area Statement for Management Circles and Working Circles

Management and Working Circles	Area (Ha)
Protection Management Circles	
Soil protection	1948.94
River buffer	60.45
Local Water Supply Protection	255.56
Streams	626.25
Road buffer	686.05
Religious sites	35.76
Wildlife protection	1486.76
Drainage	207.88
Bio-diversity reserve	176.81
Non-Production Management Circle	
Private/Cultivated Land	138.30
Non-forested areas	452.48
Production Management Circle	
Mixed Conifer Working Circle	2812.38
Blue Pine Working Circle	1581.6
Fir Working Circle	460.29
Broadleaf Working Circle	308.42

13.4 Management Circles

13.4.1 Protection Management Circle

The Protection Management Circle is an area under protection where no commercial activities can take place. The Protection Working Circle is the sum of all protection functions such as soil protection, riparian reserve protection, religious site protection, wildlife protection, Bio-diversity reserve, road and stream buffer and local water supply protection. Total of 3680.57hawhich is around 40% of total area has been identified as protection management circle. In the previous plan, the total protection area was 3660.01 ha. The increase in protection areas for this plan period was resulted from the buffering of multiple road networks which were constructed in the last ten-year plan period. However, it is necessary to identify streams areas during Operational Inventory and treat them accordingly. In this working circle, no commercial activities can take place. However, removal of trees shall be considered in the following cases upon technical recommendations from DoFPS:

I. Epidemic out-break

II. On silviculture reasons

Note: *Here function overlaps. Like water protection overlaps with soil protection and major stream buffer which is known as Riparian reserve protection overlaps with local water supply protection*

The management objectives and options for this circle are briefly given below.

Table 18: Protection Management Circle

Management Objectives	Management Options	Responsibility
To conserve water catchment functions and watershed values of FMU	Minimal intervention	All parties
To protect and conserve biodiversity	Involve local people in protection and conservation Avoid disturbance Promote research	All parties Divisional office Divisional office
To meet local needs for NWFP on sustainable basis	Resource assessment Regulate harvesting on sustainable basis	Divisional office
To create awareness of the important biodiversity area	Meeting with public /field visits Research.	Divisional office
To protect the forest from grazing, fire and illegal activities	Involve local people in participatory planning process	Divisional office
To respect the sanctity of religious places	Non-intervention	All parties

13.4.2 Non-production Management Circle

The Non-production Management circle includes areas where production is not economic or feasible. It generally comprises of non-forest areas, settlements and agricultural/private registered areas. The total area under non-production management circle is 452.48ha. Comparing to the last management plan, the non-production area is reduced by 480 ha. The Non-production areas in last plan was mapped out using Land use land cover 1995 and for this plan period updated version of Land use land cover 2016 was used for mapping Non-production mapping. The following points were some of contributing factor for area reduction: The areas which were under non-production category in LULC 1995 were updated into Fir zone and shrub category in LULC 2016. The production areas were also mapped as non-production areas and some of SRF

land areas were also mapped as non-production in previous plan. After verifying all those nitty gritty errors, the area got reduced in this plan period.

The management objectives and options are described below, but the most important objectives are to regenerate the poor regenerated or blank areas and improve existing forest condition.

As principle of equity and justice has been considered as one of the principles for formulation of national forest policy and managing forests responsibly and sustainably requires a balanced approach encompassing economic, social and environment, limited developmental activities may be allowed inside the non-production working circle with less significant impact on the FMU to support local livelihoods. The activity has to pass through the relevant environmental Acts and Rules, and other necessary applicable laws.

Table 19: Non-production Management Circle

Management Objectives	Management Options	Responsibility
To meet local needs for collection of NWFP	Apply management guidelines and involve community for monitoring	Divisional office
To maintain and improve the forest condition	Follow plan prescriptions Silviculture operation	NRDCL& Divisional office
To manage grazing for livestock	People's participation through workshops and sensitization Fodder tree plantation and local involvement	Divisional office /Geog administration Divisional office
Environmental conservation	Environmental concern is to be taken into consideration while activities are implemented	NRDCL/ territorial

Note: Lead agency is the first agency listed

13.4.3 Production Management Circle

The Production management circle is the area map out from remaining area after critical functions were identified and identified and consequently grouped into protection and non-production and production working circles. The production management circles cover a total area of 5162.68ha which is 56.38% of total FMU area. However, with the assumption that while laying out cable lines in the FMUs, for harvesting timber, there always would be some patches of inoperable areas due to small rock crags running across the main slope or minor ridges that limits gravity system cable lines. The exact operable areas of the FMU would be affected to a great

extent, due to the above-mentioned reasons. Therefore, for the Selela FMU, it is assumed that 10% of the gross operable area would be inoperable. With the net reduction of 10% from total gross operable area the total net operable area for Selela FMU is fixed at 4646.41 ha for this plan period. In the last plan, the total gross operable area was 5017.5 ha. However, with the net reduction of 30% for Mixed conifer and 20% each for Blue pine and Fir, the net operable reduced to 3828.6 ha. The reason for area increases in production management circle in this plan period is mainly due to incorporation of non-production areas and few protection zones into production areas. Based on the intensive ground truthing findings the areas which were suitable for timber extraction both for rural and commercial were put under production management circle.

The Production management circle is divided into two working circles and management options and objectives are described for each in subsequent sections.

To define, assess, monitor and report progress on sustainable forest management, the sustainability of this working circle should be Science-Based that would provide measurable evidences. As the management circle also contain rich biodiversity because of stable and good stands, the production forests, therefore, need to be managed for more than just timber production, but also for objectives such as biodiversity conservation, environmental services, including carbon capture and storage. Management perspectives need to embrace the larger landscape, not be focused simply at the stand level. In this working circle. To retain management circle as a unit of sustainability for timber production, developmental activity should not be encouraged for individual vested interest or benefits. This is to sustain working circle for not only perpetual production of timber and conservation of biodiversity, but also for carbon capture and storage by avoiding reduction of production area and safeguard from unwanted disturbances, which may impact social and economic as well as environmental dimensions of forestry. This is also to include the important function of forests and trees outside forests to store carbon and thereby contribute towards the achievement of commitment on climate change. Forest Management Code of Bhutan, 2004, also recommend that FMUs be retained as the principal unit for sustained yield

CFO, Paro, should create an appropriate section with competent forestry officer under Division to look after all the matters related to FMUs and facilitate CFO in reviewing and ground truthing

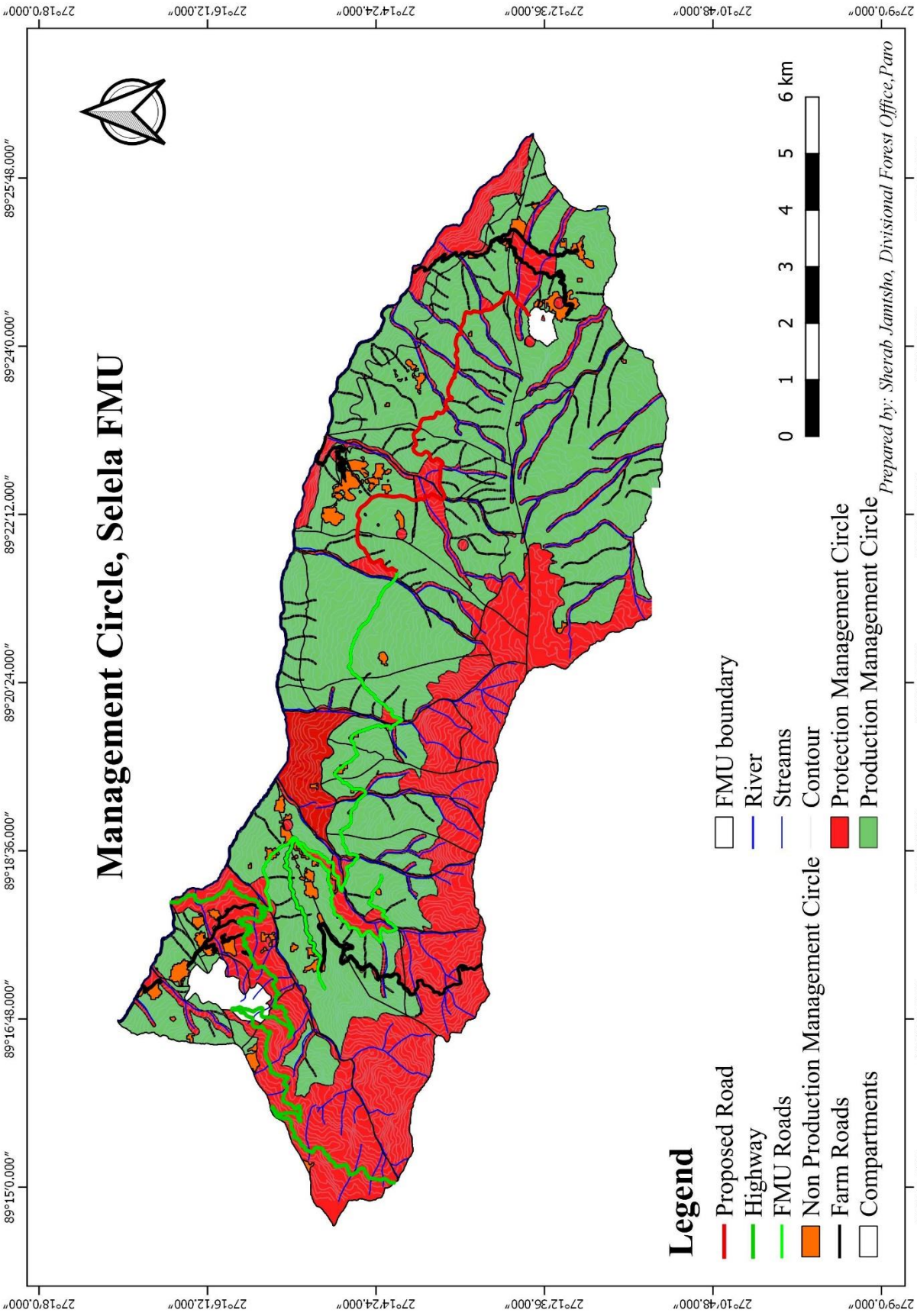
of any proposals of land lease and allotment or for any developmental activities within FMU. In case the proposal area for any developmental activities falls inside the production working circle and it is of national interest and benefits, CFO will apprise the Department for perusal for further action. Any activity within production management circle has to pass through the relevant environmental Acts and Rules, and other necessary applicable laws

Table 20: Production Management Circle

Management Objectives	Management Options	*Responsibility
To meet local need for timber and other forest produce on sustainable basis	Priority must be given to nearby local people and then to other Geogs	Divisional office/FMU UIC
Manage commercial timber production on sustainable basis	Scientific and systematic harvesting	NRDCL/ Division
Enhance and improve forest condition and productivity	Suitable silviculture operation, adapt research findings and re-forest harvested areas	NRDCL/ Division
Create employment	Preference to local people and involve them	NRDCL/ Division
Maintain biodiversity within production area	Document, research and field visit	Divisional office

**Note: Lead agency is the first agency listed*

THE FUTURE MANAGEMENT



13.4.4 Non-Wood Forest Products Management Circle (Overlapping)

Non-Wood Forest Products (NWFPs) are important source of income for improvement of rural people's livelihoods. However, unregulated collection of NWFPs may not only surpass the production potential of NWFPs in the forest, but would also cause genetic erosion in the wild in near future. Certain NWFPs would be also serving as food materials for wild animals and unsustainable collection would reduce food materials in the wild and cause wild animals crossing into agriculture field in search of food, thereby causing human-wildlife conflict. NWFPs should be assessed with available guidelines for resource availability and accordingly prescribe for sustainable management. FRMD in collaboration with SFED should look into the possibility of developing methodology for calculating AAC for important NWFPs inside the FMU area. FMU in-charge should make use of available references developed by SFED for assessing NWFPs and then regulate supply during this plan period for sustainability. Removal of NWFPs from Selela FMU with intend of research and commercialization utilization by any individual or parties should, in this plan period, be guided by Biodiversity Act of Bhutan to conserve value of genetic materials/resources and ensure there is access and benefit sharing to resource provider.

The Management Circle shall overlap with all other Management Circles, including Protection, Non-Production and Production Management Circles, which constitutes the entire FMU area. The overall objective of this management circle is to manage the NWFPs in Lon Chhu on sustainable basis, and monitor the impact of collection.

13.5 Management of Production Working Circle

The working circles have been created on the consideration of stands requiring similar silvicultural treatment. For this plan period, the production management circle has been divided into four regular working circles and the working modality of each working circles differs. The three working circles are:

I. Fir Working Circle
II. Mixed Conifer Working Circle
III. Blue pine Working Circle
IV. Broadleaf Working Circle

The objectives, management options, responsibilities, monitoring and evaluation and silvicultural systems specific to each working circle is given in the following table

THE FUTURE MANAGEMENT

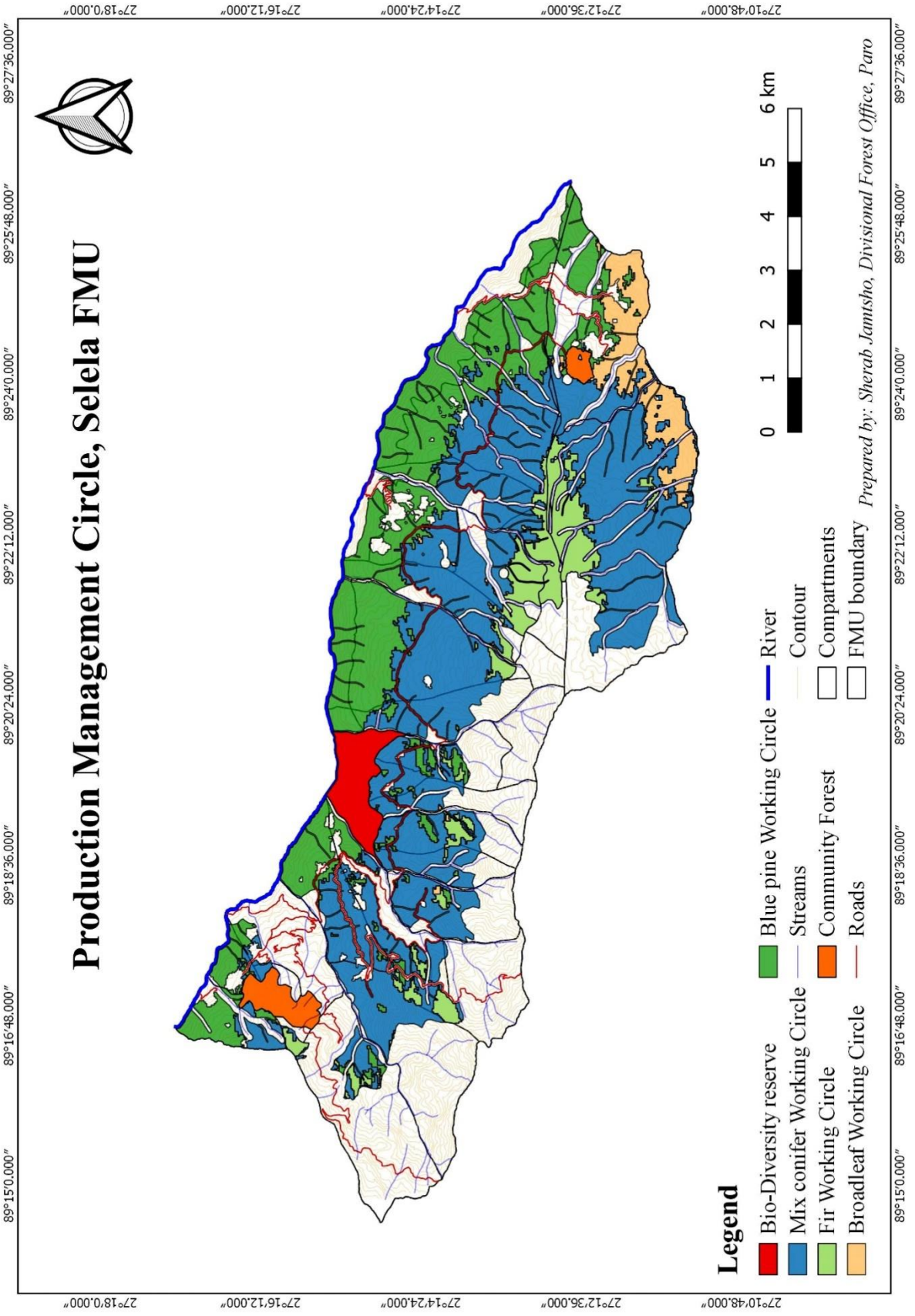


Table 21: Mix-conifer Working Circle

WORKING CIRCLE: MIXED CONIFER	**Area: 2812.38Ha**			
Management Objectives	**Management Options**	***Responsibility**	****Monitoring**	**Silvicultural systems**
To meet local requirement as a priority, for timber, fuel wood and other forest products on a sustainable basis	Allow closely monitored and controlled marking of trees	Division office	Division	Single Tree Selection System Applied for Local Use Only for rural tree marking
To manage the commercial timber production on sustainable basis	Use appropriate logging and Silviculture method Ensure cable-line lay out allows inter line logging Operate entire cable line Encourage cleaning of entire cable lines If natural regeneration fails, area should be reforested	Division/ NRDCL Division/ NRDCL Division/ NRDCL NRDCL	Division Division Division Division	Cable lines will be laid to their full capacity. Cable corridors will be no more than 4m wide. Group opening will not exceed 0. 15ha.The distance between the cable lines will not less than 60m and between groups along cable line will not less than 50m.
To enhance and improve forest condition and productivity	Ensure that all barren and past harvested areas are restock with suitable native species Use appropriate logging and silvicultural method Monitor on the attack of pest and disease	NRDCL/ Division NRDCL/ Division Division	Division Division Division	All merchantable trees >10cm DBH will be felled. Dead, dying, malformed and diseased tree will be felled by priority. Opening can be irregular shapes and should be based on terrain

	Involve local communities Use FULL CABLE LINE LENGTH in Beetle attacked areas Create favorable conditions for regeneration and growth	NRDCL/ Division NRDCL/Division NRDCL	NRDCL Division Division	features and stand condition. Damage to residual tree must be minimized
To protect the forest from overgrazing, fire and other illegal activities	Control over grazing, fire and other illegal activities through participation and dialogue and acceptable fencing	Division	Division	
To create local employment	Encourage contractors to hire worker locally Provide proper training prior	NRDCL/ Division NRDCL	NRDCL NRDCL	
To maintain biodiversity within the production area	Low impact Silviculture system	Division/ NRDCL	Division	
To conserve the water catchment functions	Minimal intervention Abide by stream buffer regulation	Division/NRDCL NRDCL/Division	Division Division	
To continually improve health and safety standards	Provide training to contractors Promote awareness in the local community	NRDCL Division	Division Division	

All objectives will be evaluated annually by the FMU Level Management Committee.
Lead agency for responsibility is the agency listed first.
All objectives and activities will be evaluated during the mid-term and final review.

Table 22: Fir Working Circle

WORKING CIRCLE: Fir Area: 460.29 Ha				
Management Objectives	**Management Options**	***Responsibility**	****Monitoring**	**Silvicultural systems**
To meet local requirement as a priority, for timber, fuel wood and other forest products on a sustainable basis	Allow closely monitored and controlled marking of trees	Division office	Division	Single Tree Selection System Applied for Local Use Only for rural tree marking
To manage the commercial timber production on sustainable basis	Use appropriate logging and Silviculture method Ensure cable-line lay out allows inter line logging Operate entire cable line Encourage cleaning of entire cable lines If natural regeneration fails, area should be reforested	Division/ NRDCL Division/ NRDCL Division/ NRDCL NRDCL	Division Division Division Division	Cable lines will be laid to their full capacity. Cable corridors will be no more than 4m wide. Group opening will not exceed 0. 1ha.The distance between the cable lines will not less than 60m and between groups along cable line will not less than 50m.
To enhance and improve forest condition and productivity	Ensure that all barren and past harvested areas are restock with suitable native species Use appropriate logging and silvicultural method Monitor on the attack of pest and disease Involve local communities	NRDCL/ Division NRDCL/ Division Division NRDCL/ Division	Division Division Division NRDCL	All merchantable trees >10cm DBH will be felled. Dead, dying, malformed and diseased tree will be felled by priority. Opening can be irregular shapes and should be based on terrain features and stand condition. Damage to residual tree must be

	Use FULL CABLE LINE LENGTH in Beetle attacked areas Create favorable conditions for regeneration and growth	NRDCL/Division NRDCL	Division Division	minimized
To protect the forest from overgrazing, fire and other illegal activities	Control over grazing, fire and other illegal activities through participation and dialogue and acceptable fencing	Division	Division	
To create local employment	Encourage contractors to hire worker locally Provide proper training prior	NRDCL/ Division NRDCL	NRDCL NRDCL	
To maintain biodiversity within the production area	Low impact Silviculture system	Division/ NRDCL	Division	
To conserve the water catchment functions	Minimal intervention Abide by stream buffer regulation	Division/NRDCL NRDCL/Division	Division Division	
To continually improve health and safety standards	Provide training to contractors Promote awareness in the local community	NRDCL Division	Division Division	

All objectives will be evaluated annually by the FMU Level Management Committee.
Lead agency for responsibility is the agency listed first.
All objectives and activities will be evaluated during the mid-term and final review.

Table 23: Blue Pine Working Circle

WORKING CIRCLE: Blue pineArea: 1581.6 Ha				
Management Objectives	**Management Options**	***Responsibility**	****Monitoring**	**Silvicultural systems**
To meet local requirement as a priority, for timber, fuel wood and other forest products on a sustainable basis	Controlled marking of trees Systematic thinning	Division Division	Division Division	Thinning/single tree selection The young Blue pine stands will be worked under thinning/selection in rural blocks. Marking trees will depend on the number of stems per hector, age or size class and spatial distribution. Dead, dying, malformed and diseased trees will be thinned on priority basis
To manage the commercial timber production on sustainable basis	Encourage use of small diameter wood Promote commercial harvesting	NRDCL NRDCL/Division	NRDCL Division	**Seed Tree System** For cable harvesting, felling areas of 1000m x 30m can be logged, leaving 20-25 trees/ha as a seed source. Harvesting line must not run directly downhill. Lines must be 90m apart to allow 2 interlines operation. On exposed or sensitive sites harvesting must leave 40-50 trees/ha & all understory vegetation.
To enhance and improve forest condition and productivity	Mark trees for rural use as planned thinning exercise NRDCL to commercially thin stand Use appropriate logging and silvicultural methods Restock logged or barren areas Create favorable condition for regeneration and growth	Division NRDCL/Division Division/NRDCL NRDCL NRDCL/Division	Division Division Division Division Regeneration	

	Involve local communities for planting and restocking activities Use stand tending techniques, such as bush clearing and spacing Harvest all areas regardless of financial return	NRDCL/Division NRDCL NRDCL/Division	survey Division Division Division	Seed tree must of good form, not over matured & representative of existing stand. In mixed stand equal distribution of seed tree must be left
To protect the forest from overgrazing, fire and other illegal activities	Control over grazing, fire and other illegal activities through participation and dialogue and acceptable fencing	Division	Division	
To create local employment	Encourage contractors to hire worker locally Provide proper training prior	NRDCL/ Division NRDCL	NRDCL NRDCL	
To maintain biodiversity within the production area	Low impact Silviculture system	Division/ NRDCL	Division	
To conserve the water catchment functions	Minimal intervention Abide by stream buffer regulation	Division/NRDCL NRDCL/Division	Division Division	
To continually improve health and safety standards	Provide training to contractors Promote awareness in the local community	NRDCL Division	Division Division	

All objectives will be evaluated annually by the FMU Level Management Committee.
Lead agency for responsibility is the agency listed first.
All objectives and activities will be evaluated during the mid-term and final review

Table 24: Broadleaf Working Circle

WORKING CIRCLE: BROADLEAFArea: 308.42 Ha				
Management Objectives	**Management Options**	***Responsibility**	****Monitoring**	**Silvicultural systems**
To meet local requirement as a priority, for timber, fuel wood and other forest products on a sustainable basis	Allow closely monitored and controlled marking of trees Promote use of discarded timber	Division Division	Division Division	**Single Trees Selection: For Rural Tree Marking** There is only small chunk of Broad leaf species distributed inside the local use area and contributes only minimum percentage to the overall local AAC. Moreover, as per recent trend of commercializing blue pine trees from private registered land, most of blue pine stands seems to be inside local use area. There is less demand on broadleaf species for timber by local people and merging broad leaf with conifer stratum would not only compromise sustainability of blue pine and other conifer species inside Government Reserved Forest Land of FMU, but would also surpass from the actual availability of blue pine and other conifer timber in the plan
To enhance and improve forest condition and productivity	Use stand tending techniques Work with local communities for planting/restocking activities Harvest dead, dying, dried and diseased trees to ensure creation of space for natural regeneration, by creating favorable conditions for regeneration and growth	Division Division Division	Division Division Division	
To protect the forest from overgrazing, fire and other illegal activities	Control over grazing, fire and other illegal activities through participation and dialogue and acceptable fencing	Division	Division	
To maintain biodiversity within the production area	Low impact Silviculture system	Division/ NRDCL	Division	
To conserve the water catchment functions	Minimal intervention Abide by stream buffer regulation	Division/NRDCL NRDCL/Division	Division Division	

				period.
To continually improve health and safety standards	Provide training to contractors Promote awareness in the local community	NRDCL Division	Division Division	

Note: All objectives will be evaluated annually by the FMU Level Management Committee during the Mid-term and final Evaluation

13.6 Implementing Management Working Circle

To implement the principle of sustainable forest management and to make resources available and affordable to general public, the concept of Forest Function Mapping has been used in this Plan to delineate between forest and different land use inside Selela FMU. This will be supplemented further through annual operational planning process whereby information will be collected in detailed through inventory and discussions with stakeholders, local communities and NRDCL. However, even when this more detailed data is collected, the requirement remains to locate individual Forest Function on the ground so that the prescription and the objectives can be implemented. However, function maps have been prepared indicating the boundaries of the Forest Functions to facilitate FMU while overseeing implementation of management plan.

Therefore, the Unit In-charge will have to use shape files of FMU using GIS and Google Earth besides maps to the best of his/her ability. Areas should be observed using various means prior to going to the field. Once in the field visual observation within the operable areas should be able to provide the needed information. For example, stream buffer will occur in all the perennial streams and steep slopes should be measured and observed for soil protection or conservation. The forest function maps will be updated accordingly as per the field observations.

13.7 Bio-Diversity Reserve

An ecological reserve which was established inside Selela block, compartment S5 during the inception of Selela FMU. Initially the reserve has total area of 179 ha but in this plan period due to FMU boundary realignment, the areas has been reduced to 176.81 ha. The reserve is located between forest road and Haa-Chu. It is situated on a rather steep ground above the Haa-Chu. It has great variety of aspects and forest types. Lower parts are very steep and mostly inaccessible.

Access will be limited to those individuals who desire to study and enjoy the ecology and aesthetic value of undisturbed forest. Strict protection will be enforced against any encroachment, harvesting of wood and non-wood forest products, cutting of any type of vegetation, and against any other disturbance of the area. However, during the 3rd plan review it was observed that few cable lines were installed inside the reserve area. The finding was presented to FRMD during plan presentation and it was decided by committee that since there are no major disturbance, the review committee advised to maintain the reserve area.

14. YIELD REGULATION AND HARVESTING

14.1 Determining of Annual Allowable Cut (AAC)

14.1.1Introduction

Principle of sustainability is widely accepted as one of back-bone of forest management in which management mainly focuses on sustainable utilization of forest resources in perpetual. The concept has evolved from the basic consideration that the later generation may derive forest resource benefits same as present generation. The principle of sustained yield ensures the stability and continuous supply of raw materials to the industries, and meets the social and domestic needs of the people.

Sustained Yield management allows harvesting of forest resources in a way by which annual cut and other losses of timber do not exceed the average annual growth and assures continuity of harvest, indefinitely, without impairment of the productivity of the soil. Sustain Yield Calculation is expressed as Annual Allowable Cut (AAC).

14.1.1 Increment Based AAC

In a perfectly structured normal forest, it should be possible to sustainably cut annual increment each year. Unfortunately, this method relies heavily on the growth data for which in Bhutan we do not have permanent sample plots to ascertain the data. Further, currently forest growth in Bhutan is not perfectly structured and there is so much varied in natural growing stock. Example at present in Fir zone the increment trend is in negative this is mainly due to over exceeded rate of decay over growth. In long term, increment should increase as over mature stands are replaced by younger stocks, but it will be many decades before this second growth is available for harvest. In the meantime, there is an over-mature growing stock and too little and unreliable increment data to use in determining AAC, therefore increment based AAC's is not suitable for Bhutan.

14.1.2 Area based AAC

Area based AAC requires less inventory data but this can be implemented in an even distribution of volume over the forest, which is not the case in the natural forests of Bhutan. An area based AAC would indicate difficulties for NRDCL in practical planning and operational viability as actual volume brought to market would vary dramatically year to year.

14.1.3 The Most Appropriate AAC Method

A wide range of formulae and calculation approaches are available with both advantages and disadvantages which can be argued. Whilst it is difficult to define a clear best method for country, there is a strong believe for standardization around a fairly simple and robust single methodology. The method which is used for the calculation of AAC in Selela FMU is based on combination of area, volume and rotational age of species.

The method has been applied to calculate AAC in all Working Circle added together to calculate total AAC of the FMU. The AAC is calculated for different working circle since there is different rotation age used for different working circle, it is necessary to calculate AAC for each working circle first and add up to obtain total AAC of FMU. However, it should be noted that AAC for each working circle should not be the basis for annual harvest in the field due to the fact that one cable line may cross more than one working circle if it is laid to the maximum length. This will also enable the implementer to lay the cable lines to the maximum length and make the best use of available production area

The following method is used for calculating the AAC:

$$\text{AAC per Working Circle} = \frac{\text{Net Operable Area}}{\text{Rotation}} * \text{Average Standing Volume per Ha}$$

14.1.4 The Calculation of AAC for Selela FMU

Net Operable Area

The total operable area was identified using QGIS 3.0.0 with GRASS 7.4.0. All areas having a slope > 45º has been classified as Soil Protection, which accounts about 1948.94 ha. In addition, prescribed buffer areas for rivers and streams, forest road and religious sites have also been included within the Protection Management Circle. Further those production forest areas which are not likely to be harvested for timber production owning to its remoteness and located on top of the ridges have also been excluded from Gross Operable Area. In previous plan, 30% of gross area was reduced for Mix conifer and for Blue pine and Fir 20% of gross areas was reduced to produce final commercial net operable area for commercial production areas. However, in this plan period10% of gross area was reduced to calculate net operable areas. The 10% reduction was applied because it has been observed that in most of the FMUs, the total operable area

cannot be always subjected to harvesting. Within the mapped area there can be small rocky terrain, water bodies and other conservation areas which often prevent harvesting operations. This occurs mainly when the cable lines are being laid out. Beside this, Group Selection System almost inevitably leads to some patches of mature timber being left in later phases due to the presence of new regeneration and the damage that total removal of that over-storey would cause, thus, losing more areas for harvesting. In such challenging terrains of Bhutan, exact geometric-shape group layout is rarely possible. Due to the above inevitable fact, around 10% of area from the gross operable area has been reduced to calculate the net operable area from commercial Working Circles and Rural use. This prescription mandates the Unit In-charge and NRDCL to properly utilize the available production areas so that the area can be sustained for future harvesting operations. Any deviations from the prescribed cable line layout should be approved by the Department prior to implementation

Table 25: Calculation of Net Production Area

Forest Types	Gross Operable Area (Ha)	Calculation	Net Production Area (ha)
Commercial			
Mixed conifer	2216.27	In order to calculate the net production area, 10% from commercial gross operable area was reduced	1994.64
Blue pine	1166.81		1050.12
Fir	327.28		294.55
Broadleaf	131.72		118.54
Total	**3,842.08**		**3,457.87**
Rural use			
Mixed conifer	596.11	In order to calculate the net production area, 10% from Rural use gross operable area was reduced	536.49
Blue pine	414.79		373.31
Fir	133.01		119.70
Broadleaf	176.69		159.02

Total	**1320.6**		**1158.72**
Grand total	**5162.68**		**4646.41**

*** Therefore, the Net operable Area for Selela FMU for this plan period is at 4646.41 ha.*

Rotation and Regeneration Period

The reliable increment data for Bhutan is still very limited and therefore rotation age for Mixed conifer is assumed at 155 years and 165 years for Fir. Further, considering regeneration period as important factor for calculating rotation length, 15 years of regeneration period has been added to rotation age of mixed conifer forest and 10 years to Fir Forest. As a result, the rotation age for Mixed conifer and Fir is fixed at 165and 180 year respectively. The assumed rotation length for Blue pine which grows at relatively lower altitude is 110 years. Therefore, the rotation age for

Blue pine is kept at 110 years and regeneration period of 10 years has been added. The assumed rotation length in mixed broadleaf forests is 100years(including the 10 years minimum regeneration period). For Local Use, the rotation length is also kept at 100 years and the harvesting will be done by Single tree selection System. The assumed rotation lengths for the calculation of AAC in Selela FMU are:

Table 26: Rotation period for different tree species

Forest Types	*Assumed Rotation period (Years)*	*Regeneration period (Years)*	*Total Rotation period (Years)*
Mix conifer working circle	155	10	165
Blue pine working circle	110	10	120
Fir working circle	165	15	180
Broadleaf working circle	100	10	110

Average Standing Volume

The mature average standing volume is derived from management forest inventory data statistically analyzed using “R”. The sampling error and RME for each stratum is given below. The forest management inventory of Selela FMU is designed based on the entire forest type and not based on individual stratum. Therefore, the average standing volume obtained from the

analyzed data is kept same irrespective of stratum. Hence, the average standing volume for all the strata for Selela FMU is327.101m^3/ha with a standard error of 11.84%. The Reliable Minimum Estimate of standing volume obtained is288.34 m^3/ha for all stratum at confidence level of 95%.

Table 27: Average result of the forest management inventory

Result types	Average measures	Sampling Error %	Reliable Minimum Estimate (m^3/ha)
Tree volume	327.101	11.84	288.34
Tree counts	125.79	6.95	117.04
Tree basal Area	21.50	14.90	18.29

AAC for each Working Circle

The AAC for each working circle is calculated on basis of whole production area and the assumed rotation period of each working circle. The AAC for each working circle is given in the following table (Table 28). The AAC for each stratum has been calculated due to different rotation period for each stratum, However, while implementing practically in the field, it is essential to consider that one cable line may pass through more than one stratum and therefore, total AAC (sum total of AAC for each stratum) should be considered instead of relying on individual stratum.

Table 28: AAC for the Working Circles (Standing volume)

Strata	Net Operable Area (ha)	Rotation	RME ofmature standing volume (m^3/ha)	AAC (m^3/year)	Clear cut Equivalent (ha)
A. Commercial Use					
Mixed conifer	1994.64	165	288.34	3485.66	12.08
Blue pine	1050.12	120	288.34	2523.28	8.75
Fir	294.55	180	288.34	471.83	1.63
Broadleaf	118.54	110	288.34	310.74	1.07
Total	**3457.87**			**6791.54**	**23.55**
B. Local Use					

Mix conifer	536.49	165	288.34	937.54	
Blue pine	373.31	120	288.34	897.00	
Fir	119.70	180	288.34	191.76	
Broadleaf	159.02	110	288.34	416.83	
Total	**1188.54**			**2443.14**	
Grand Total	**4646.41**			**9234.68**	

Therefore, the total workable AAC for Selela FMU is fixed at **9230 m^3** in standing volume. It is permissible to vary the AAC area by + - of 10% in individual years, but the volume cut in each five-year period must be no more than five times the AAC. The AAC prescribed is not solely to be met from the cable lines but also volume obtained from ad-hoc logging, sanitation operations, illegal sized/felled timbers and thinning should be incorporated and accounted to annual AAC.

There has been substantial decrease in AAC allocation for last three consecutive plan periods. During first plan period AAC allocated was 20,000$m^3$and later in year 2000 the AAC was reduce to 12,600m^3 with commercial AAC of 8,568$m^3$and Rural AAC of 4,032m^3. In 2nd plan revision, total AAC was fix at 11,885.63$m^3$with commercial AAC of 8,885.63$m^3$and rural AAC of 3000 $m^{3.}$ The total AAC for this plan period is fixed at ***9230 m^3***which is less by 2655 m^3 than the previous plan. Therefore, the AAC for this plan period is fixed at ***6790 m^3 for Commercial*** and ***2440 m^3 for Rural use.***

14.2 Recording and Accounting for AAC

Annual Allowable Cut will be monitored through records of tree marked (Tree Marking Register) for both commercial and local use in all the Working Circles. AAC has been calculated as gross volume and this is the measure that should be added on annual basis from Tree Marking Register. AAC for FMU has been calculated on the basis of the whole production area and the expected rotation period. Thus, all material removed from of Production Working Circle, including the volumes that is extracted from group and cable corridor, must be accounted in the AAC. This includes timber cut for rural use, timber from normal cable lines, sanitation of pests and disease infested trees, fire burnt areas, ad-hoc removal, wind-thrown& uprooted trees, fire burnt areas, illegally harvested timbers, road construction, etc. It is also crucial that all material felled but not removed is included in the 'actual cut'.

The preference for allocation of Rural timber will be first given to local residents and followed by near-by local villages and then to other Geogs and Dzongkhag. The Unit In-charge must

maintain separate registers for recording rural timber allocation to local residents and for applicants from other Geogs and Dzongkhag. This will help future planner Unit In-Charge in getting accurate picture of demand of the local residents and others separately which ultimately will planners during next plan revision.

14.3 Allocation of AAC

The allocation of AAC has taken into account the needs of both rural people (living within and near Selela FMU) and commercial demands. The AAC for rural use has been allotted based on demand and the Local Use Area.

Table 28: Allocation of AAC

Standing Vol (m^3)	Allotted to
2440 m^3	Local Use: Local villagers and general public for rural house construction
6790 m^3	NRDCL: To meet the commercial timber demand in the market

14.3.1 Allocation of AAC for Rural use

The AAC for Rural use has been calculated for individual blocks to minimize heavy timber marking from particular block. The allocated AAC for rural was 3000 m^3 in previous plan however, with no separated AAC allotted for individual blocks, it was observed that rural timber allotment for last nine years was made from Tegola block. The rural allotment from Chhepji block was carried out only during last one-year period. From Holela block rural timber allotment was nil during last ten years implementation period. With such trend allotment mechanism not only is silviculturally unhealthy but also very goal and objective of sustainable management of FMUs is defected.

Therefore, to avoid such management lapses in future, the UICs must marked trees equally in all four rural blocks considering area and timber quantity. The allotment from four blocks should not excess prescribed annual rural AAC.

In case of Rural block (Tegola 4x) the marking of trees to be strictly made from areas where previous commercial extraction was not carried in previous plan. To avoid overlap with interline areas, the unit In-charge is advised to use rural block maps shapefile while carrying tree marking

in this particular block. The installation of K500/sky cable line is recommended to extract timber from accessible areas.

The rural timber allotment for Bempu village under Naja Geog and Papaling & Chazhe villages under Meta and Dungna Geog will be made from Holela 3a,3b,3c, 2c and Chhepji 1x.

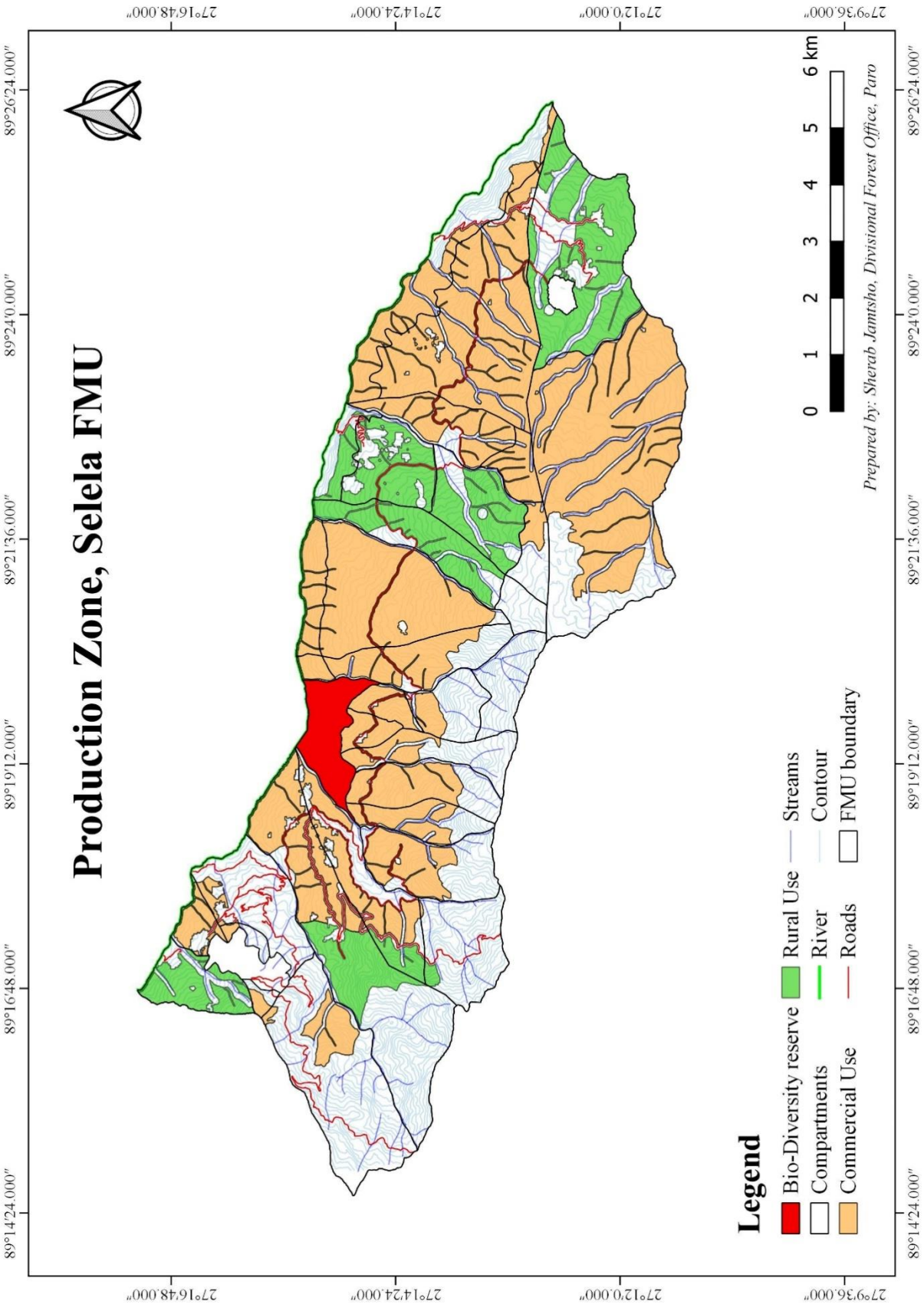
Timber allotment modality

Preference of allotment will be first given to the local community residing within and near FMU and then to the people of near-by gewogs of Haa and Paro. However, if there is balance AAC after meeting all the demand within and near-by FMU community, the Rural allotment to the people of Paro and Haa Dzongkhag will be make available.

14.4 Distribution of the cut

AAC has been calculated by Working Circles. However, during the implementation, it should be noted that the distribution of cut will be considered as the entire FMU and not as individual working circle. If the operation area for a particular area falls completely under one working circle, the sum total of AAC for that yearwill be removed from this working circle. Therefore, the AAC for each stratum is mentioned purely for calculation purposes and not to be read as individual cut foreach working circle. The number of cable lines to be harvested annually should be mentioned in the Annual Operational Plan.

Further, calculation of AAC is based on **AREA** and **VOLUME**. To this, AAC should also be regulated either through volume or through clear-cut area equivalent for each year. In this plan period, the total permissible clear-cut area per year for FMU is ***23.55 ha***, meaning area cut through cable corridors, group openings, road construction, sanitation operation etc. should not surpass more than 23.55 ha per year. If AAC achieved through clear-cut area is equivalent to 23.55 ha and even if there are remaining cable lines, FMU should immediately stop harvesting timber from cable lines. Remaining cable lines should be earmarked for next operational year.


Production Zone, Selela FMU
Legend
Bio-Diversity reserve
Compartments
Commercial Use
Rural Use
River
Roads
Streams
Contour
FMU boundary
0 1 2 3 4 5 6 km
Prepared by: Sherab Jamtsho, Divisional Forest Office, Paro
89°14'24.000"
89°16'48.000"
89°19'12.000"
89°21'36.000"
89°24'0.000"
89°26'24.000"
27°16'48.000"
27°14'24.000"
27°12'0.000"
27°9'36.000"

15. SILVICULTURAL SYSTEM

15.1 Group Selection System

Group selection system is considered to be appropriate silviculture system for managing temperate conifer forest as per a study of silvicultural system conducted in mixed conifer forest (Thimphu and Bumthang). The system promotes natural regeneration and requires no treatment of the forest floor to induce natural regeneration (Moktan, 2003). This system suits a range of species, ranging from light demanders, through moderate shade bearers to shade enduring species (Mathews, 1999). The group size can vary according to the light requirements. The forest in SFMU is dominantly composed of mixed conifer (Blue Pine, Hemlock, Fir and Spruce) and small patches of broad-leaved forest towards the southern boundary. Considering vegetation types and the natural course of growth in natural forest, group selection system is the most appropriate silvicultural system for the area. Diebacks, bark beetle attacks, fire etc. are common occurrences, which create gaps in natural forest. The regeneration therefore, occurs in patches or groups and thus, justifies group selection system as it would imitate the natural pattern.

15.1.1 Working Pattern

Under group selection system small opening will be created in the stand allowing light to reach the forest floor and creating conducive micro climate for seed germination and establishment of seedlings. The opening will be no longer than one and half tree length in Hemlock, Spruce and Fir Stand. The groups will be open along cable lines. The distance between cable lines will be not less than 60 meters, and between groups along cable line not less than 50 meters. The corridors should not exceed four-meter widths. The effective area within the limit of standard cable length is 6 hectares (1000 m x 60 m), less the area of the corridor 0.40 hectares (1000 m x 4 m), thus the one-third removal would be equivalent to (1.87 ha) which is the area available for opening groups. Thus, it would be possible to open up about 9 to 10 groups along the standard cable lines, if the average tree height is taken about 35 m and further the diameter of any opening will not exceed 50 m.

The individual openings need not be uniform in shape or size and systematically located along cable lines. In most cases, the openings will be irregular in shape and systematic location of groups will be almost impossible. Aspect, slope and silvicultural requirement would influence the actual size of the groups. An average of 0.15 ha opening is recommended. However, group

opening in fir working circle will not exceed 0.1 ha if the understory conditions is with bamboo/large rhododendron understory and 0.25 ha is the understory conditions is herbaceous/moss understory, no major competitors.

Group openings should be created in already opened up/barren/blank areas and opening area of 0.15 ha for mixed conifer and 0.1 ha for fir if the understory conditions is with bamboo/large rhododendron understory and 0.25 ha if understory conditions is herbaceous/moss understory, no major competitors should be calculated for clear felled area in the operational plan.

The tree should be felled towards center of group opening whenever possible to avoid damage to the unmarked trees. Terrain with steep slope and exposed South and South-West aspects should be avoided, or the opening should be smaller to match with the terrain and site conditions or the selection system should be applied.

In areas where opening cannot be created under group selection system (in between two cable lines) such areas should be operated under Single Tree Selection System. However, care should be taken that spatial distribution of the trees are strictly followed and should match with openings created under Group Selection System.

The Group Selection System has the following advantages:

- Regeneration in the small groups under even-aged condition gives better stem form;
- Larger openings in comparison to that under single tree selection system permit the establishment of intolerant species;
- Harvesting is more concentrated, so the logging cost is lower;
- Harvesting in group lower damages to residual stands;
- Intermediate cuts may be made less frequently;
- Aesthetically and environmentally more acceptable than clear cutting system.

15.1.2 Calculating Number of Cable Lines Annually

Mixed Conifer: Commercial use

Assuming, the standard cable line length to be 1,000 meters with 10 numbers of group opening of 0.15 ha each in mixed conifer working circle, the approximate number of cable lines that can be installed to achieve the annual allowable cut is worked out below:

Length of the cable line = 1,000 meters

Clear-felled area of cable line corridor = 4 m x 1,000 m = 4,000 m

=4,000/10,000ha = 0.4ha

Clear-felled area of groups = 10 x 0.15ha = 1.5ha

Total clear-felled area per line (in Mixed Conifer WC) = 0.4ha + 1.5ha = 1.9ha

AAC for commercial harvesting of Mixed conifer = 3485.699m^3/year

Volume = 288.34m^3/ha

Clear cut area equivalent = 3485.699/288.34 = 12.08 ha

Therefore, total cable lines that can be installed annually to achieve the AAC is

= (12.08 ha / 1.9 ha)

= 6 cable lines/year

Fir: Commercial use

Length of the cable line = 1,000 meters

Clear-felled area of cable line corridor = 4 m x 1,000 m = 4,000 m

=4,000/10,000ha = 0.4ha

Clear-felled area of groups = 10 x 0.1ha = 1ha

Total clear-felled area per line (in Mixed Conifer WC) = 0.4ha + 1ha = 1.4ha

AAC for commercial harvesting of Fir = 471.83m^3/year

Volume = 288.34m^3/ha

Clear cut area equivalent = 471.83/288.34 = 1.6 ha

Therefore, total cable lines that can be installed annually to achieve the AAC is

= (1.6 ha / 1.4 ha)

= 1cable lines/year

Note: Group opening for Blue pine and broadleaf is 0.15ha

Considering average cable length of 1000 m, about 14 cable lines can be tentatively harvested annually from the production area by NRDCL from FMU.

Table 29: Showing number of cable lines and clear-cut areas

Stratum	AAC	Volume	Clear cut area equivalent	Clear cut equivalent area of one cable line	Numbers of cable lines
Mix conifer	3485.66	*288.34*	12.08	1.9	6
Blue pine	2523.28	288.34	8.75	1.9	4
Fir	471.83	288.34	1.63	1.4	1
Broadleaf	310.74	288.34	1.07	1.9	1
				Total	**12**

Although, the above projection is done considering the length of the cable line to be1,000 meters, the length of the cable line while practically planning in the field may vary based on the topography and site conditions. Therefore, this projection should only be used to initially plan the field work during operational plan preparation. The actual number of cable lines to be installed annually will be guided by the operational inventory and cable line survey carried out during preparation of operational plan.

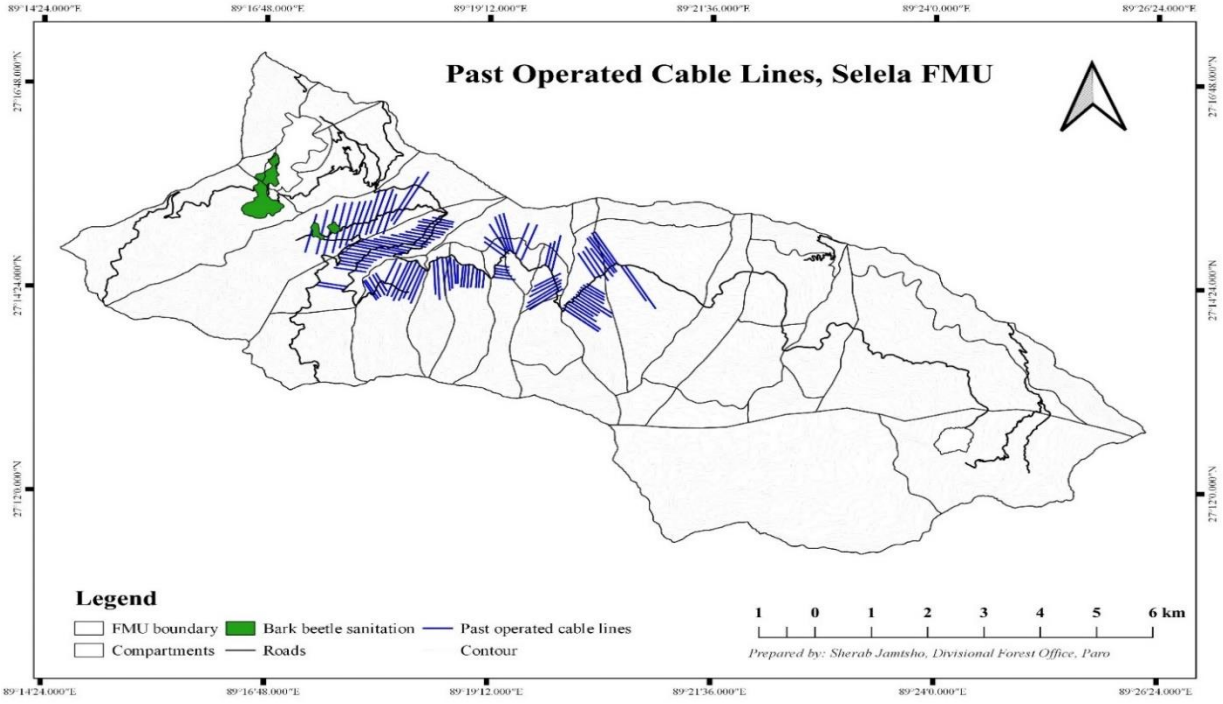


Figure 18: Map showing Past Operated Cable lines

15.1.3 Prescribed Silvicultural System in Broadleaf Forests - Patch Cut with Artificial Regeneration

On 17thof January 2005, Silvicultural Systems Consultative Workshop was held at the DoFPS's Conference Hall. During the workshop, the participants agreed to prescribe Patch Cut System with artificial regeneration as the silvicultural system in broadleaf forests in Bhutan.

The following considerations should be made before the application of the silvicultural system.

1. **Factors of Locality**

Factors of locality include micro-climate, slope aspects, soil, humidity, rainfall, and geology of the locality which affect the growth of plant. The nutrient contain of soil is also very important for regeneration of the area. Biotic factors like grazing should be considered before clear felling.

2. **Potential Productivity of the Site**

Potential Productivity of site should be assessed and silvicultural technique should be suitably modified to ensure rapid growth of new plants in the clear-felled areas. In Bhutan there isa lack of information on potential productivity of sites. It is also imperative that inputs are applied judiciously. In other countries, people have even irrigated as well as applied fertilizers to the site.

3. **Species and composition**

Clear felling system is suited to light demanding species. The composition of the species can be changed to ensure the best financial results. But there are trees that can't withstand wind throws. So, clear cutting is going to expose them, causing uprooting and other damages. Some species can't stand the frosts during winter. Clearcutting exposes them to such adverse condition. Choice for species and composition should be made taking into consideration these characteristics of different species.

4. **Regeneration**

The success of any system depends entirely on the success of the regeneration of the logged areas. Artificial regeneration is the only option if there is no natural regeneration. The practice of keeping the area barren for a year allowing firewood contractors to collect lop and tops from the cable line could mean extended exposure of the area to soil erosion. But in sub-tropical conditions of Bhutan, grasses and shrubs cover the soil soon after the clear cutting. Thus, even

with the canopy gone, the cover provided by grasses and shrubs are enough safeguards against soil erosion or soil deterioration. However, the invasion by grasses and shrubs can mean danger of fire for other inter-cable line stands. Once the area is about to be planted, the weeds and shrubs should be weeded out. Weeding should take place as per Norms and Standard of Plantation 2019 issued by SFED.

To ensure the survival of artificial regeneration created by the NRDCL the UIC should carry out plantation survival survey by doing total count in the planted areas annually. If the survival percentage is less than 70% the NRDCL should be apprised to carry out beating up and other necessary maintenance work to improve the status of regeneration

Group Selection System has been prescribed for broadleaf forests. The group selection system has been prescribed in preference to Strip Clear Cutting system that was in operation in previous plan basically because the latter is seen as environmentally riskier. The large tracts of land being clear felled would open the area to hazards of monsoonal rain and soil erosions. Even aesthetically, the large openings would be an eye sore. In group selection system, trees develop in clearly defined even-aged aggregations; this is of substantial advantage in developing good form especially in hardwoods.

Under the group selection system, small openings will be created in the stand allowing light to reach the forest floor and creating microclimatic conditions conducive for seed germination and establishment of seedlings. There are important unresolved problems with sub-tropical and warm broadleaved silviculture in Bhutan; particularly the poorly understood regeneration dynamics of commercial species. Good regeneration has proved extremely difficult. There are also still considerable doubts regarding the best silvicultural systems for managing broadleaved forest. It is likely to be some time before research results are available and it is quite possible that stand succession towards commercially useful species is naturally a very long process (Whitfield, 2001).

Since one of the main reasons for failing of silvicultural systems is the lack of regeneration, it has been proposed during the Consultative Workshop that the group selection system should be combined with artificial regeneration. The Group Selection System with artificial regeneration is synonymous to the Patch Cutting.

System as recommended by the RNR-RC Yuispang as per the *Forest Research Findings and Recommendations during the 8th FYP, RNR RC Yusipang (2003)*. The "patch" in patch cutting system would mean smaller groups (as compared to groups Group Selection Systemin Conifers) in Group Selection System. As per their research findings, the patch cutting system with fencing is proven to be the best option in terms of fostering biodiversity, mitigating grazing impact and safeguarding financial viability for sustainable management of mixed broadleaf forests in Eastern Bhutan

General guidelines for Patch-cutting system (group selection system) in broadleaf forest. *(vide the Forest Research Findings and Recommendations during the 8th FYP, RNR RC Yusipang, 2003)*

- ✓ Patches of mature and over-mature trees under which there is existing regeneration or which are most likely to regenerate successfully should be given first preference. This would include large trees with spreading crowns, which absorb sunlight if permitted to reach the forest floor would enhance seedling development.
- ✓ In selecting patches, ridge tops are preferred over depressions, up slope positions over downslope in order to minimize damage to regeneration in subsequent felling operations.
- ✓ The size of openings should depend on stand composition and condition. In general, the size of opening should vary from 0.15 to 0.5 ha. It should not be too large, as it will favor growth of other species, which have less timber value.
- ✓ Distance between the patches retained should be such that patches of trees retained will form a wind firm group of trees and appear as a uniform patch.
- ✓ In mature broad-leaved forests with many mature and over-mature trees it is expected that 75% of the standing volume would be harvested by felling 40 to 60 % of the area.
- ✓ The direction of the tree lean, and the topography should be taken into account to prevent large trees being felled on nearby advanced growth.
- ✓ Dead or dying trees or those showing symptoms of decay or damage (snags, scarsconk, mistletoe, etc.) should be retained to safeguard flora and fauna niches or
- ✓ Sufficient seed trees in the interline spaces adjacent to the cable lines opened up should be retained as potential seed sources for seedling regeneration in patch-cuts.

The Group Selection System has following advantages:

- ✓ Regeneration in the small groups under even aged conditions, which gives better stem form
- ✓ Larger openings in comparison to single tree selection system permit the establishment of intolerant species
- ✓ Harvesting is more concentrated, so logging cost is lower
- ✓ Harvesting in groups lower damages to residual stands
- ✓ Immediate cuts may be made less frequently
- ✓ Aesthetically and environmentally more acceptable than clear cutting

15.2 Single Tree Selection System

The Single Tree Selection System will be applied to Local Use areas in case of rural marking for extraction of rural house building timber and firewood. Single tree selection system follows principles of nature that matured trees are selected and removed to enable regeneration to replace them. The felling should be scattered all over the operational area instead of confining to certain parts of forest. Felling should involve removing of trees or small groups of trees. This system helps to maintain uneven-aged character of the forest crop. This system is applicable to stands in need of thinning as well.

In single tree selection system, sustained yield must be maintained by making thinning among the various age classes to ensure that:

- ✓ Stands are maintained in their correct proportions
- ✓ A suitable mixture of species is maintained
- ✓ Young saplings are freed from suppression
- ✓ Defective stands are removed wherever they are hampering better ones

It is observed in most cases that the trees of best economic interest are selected and felled. Instead of following this, Unit In-charge of the particular FMU should judge and familiarize with the forest condition and silvicultural requirement of the species and do the selection with the interest of meeting the objectives of the system. As far as possible, selection of trees to be felled should be done for following categories first especially in young and immature stands.

- ✓ Dead, dying, diseased, misshapen or otherwise defective trees which interferes with the growth of neighboring vegetation.

- ✓ Trees of undesirable species.
- ✓ Immature tree which can be removed by judicious thinning.
- ✓ Mature trees above the exploitable diameter, which will leave gaps for regeneration to come up.

15.3 Seed Tree System

Blue Pine Working Circle will be worked under Seed Tree System, if in case theidentified harvesting area is pure blue pine stratum as Blue Pine regenerates very easily under Seed Tree System. This system involves retaining certain number of trees to supply seed for regeneration after rest of the trees are harvested. These trees must be of good health and vigorous in growth which would truly serve as good seed source. Slope characteristics, wind firmness and aesthetic value have to be taken into consideration while utilizing this system. Blue pine regenerates easily when light is ample and ground vegetation is sparse. In applying this system, site condition like aspect must be considered as Seed Tree System is not suitable on steep and exposed south and southwest sites; rather group selection system should be preferred on such condition

15.3.1 Working Pattern

For cable line harvesting, the felling area of 1000 x 30 m can be logged, if the felling is confined only to Blue pine stand stratum with the retention of about 20-25 trees/ha that are phenotypically superior. Harvesting lines must not run directly downhill. Lines must be 90m apart, allowing 2 interline operations. Dead, dying, malformed and diseased tree will be cut on priority basis. On exposed or sensitive site harvesting must leave 40 to 50 trees / ha. The distance between the seed bearers should not be more than one crown length as it can be easily colonized by weeds and/or regeneration of unwanted species

Seed Tree System has the Following Advantages;

- ✓ Compared to artificial sowing, the seed from seed trees is gradually released over the time and this can increase the probability of seed being on the ground when the desired germination conditions occur.
- ✓ The expense of collecting and sowing of seed is avoided where there is suitable on-site seed
- ✓ The local gene pool is more closely reproduced, leading to better adaptation to the site

- ✓ Harvesting is more concentrated, so logging cost is reduced
- ✓ Aesthetically and environmentally more acceptable than clear cutting

15.4. Thinning

Thinning is an important silviculture activity. It is particularly important where there is dense stocking of young trees of similar age and size. The objective of thinning is primarily for improvement (of stand increment and quality) although poles and fuel wood will also be produced. The young Blue Pine stands (Blue Pine Working Circle) will be worked under thinning. Thinning will be done by positive selection with due consideration to stabilize the structure of the stands. This type of thinning will be to direct the growth potential of the stand and site to the most promising individuals of the tree populations to maximize volume and quality production. The stand to be thinned will be identified from the treatment map and field visit. Pruning in the appropriate stands will also improve the value of the forests. Marking of trees will depend on the number of stems per hectare, age or size class and spatial distribution. Dead, dying, malformed and diseased tree will be thinned on priority basis. Large opening must not be created. Thinning area should be identified as per this plan and should be carried out annually in order to improve the existing stand.

The marking guidelines for thinning are as under;

- ✓ Mark 20% of the standing volume for thinning
- ✓ Marking of trees will depend on number of trees per ha, age or size class and spatial distribution
- ✓ Only low thinning will be done in most stands, where only dead, dying, suppressed, diseased and defective trees will be marked first.
- ✓ In stands less than 20 m average height, the target spacing should be approximately 4.5mx 4.5m or about 500 trees per ha.
- ✓ In stands with pole crop (average height 10-20m), the spacing of trees after the thinning should be no more than 5-6m, or approximately, 300-400 trees per ha
- ✓ In stands which at present have less than desired tree density and spacing, only tree that grows in cluster, very close together and competing for light and nutrients can be removed, diseased trees, especially those infected with mistletoe can be removed
- ✓ Care must be taken not to create large opening in the thinned stands.

15.5 Coupe Clearance

Divisional Forest Office, Paro and Selela FMU should follow the following procedure for issuance of coupe clearance for execution of timber extraction from planned cable lines in this plan period. The following procedure was recommended by FRMD on issuance of coupe clearance certificate in FMUs vide No. FRMD/MPS/2(1)2018-2019/708 dated 17/01/2019.

1. The concern Territorial Division through Unit office must issue coupe clearances to NRDCL prior to execution of timber extraction works from planned cable lines. The operation of cable lines by NRDCL must commence only upon obtaining the coupe clearance issued by the division.
2. Coupe clearance for the 1st cable line to be issued prior to installation of cable cranes. Further the cable crane in the 1stline will be removed only upon complete extraction of lops and tops from the cable corridor and are brought to the landing site.
3. Coupe clearance for the 2nd cable line to be issued while 1st cable line is still under Operation so as to enable marking of trees and installation of cable crane in the end cable line.
4. Coupe clearance for the 3rdline to be issued only after lops and tops extracted from 1st cable line is completely disposed from the landing site. The same procedure must be followed for the operation of following consecutive lines.

16. FOREST PROTECTION

16.1 Forest fire

Selela FMU consist of coniferous forest mostly which is very much prone to forest fires. Although very few incidences of forest fires have been recorded in Selela. It cannot be overlooked because a single incidence of uncontrolled fire can destroy extensive forest areas. It causes damages to trees, regeneration, soil (exposing it to elements of nature that can lead to erosion), and productive power of the forest, protective power of the forest, wild animals and the recreational and scenic value of the forest.

Forest fires in Bhutan are mostly caused by human activities and are due to either carelessness/ accidental or deliberate. Therefore, it is of utmost importance to educate the people and to garner their goodwill and corporation to not just to prevent forest fire but also gain support during such outbreaks. Fire management covers all activities concerned with prevention, control and use of fire in forests.

THE FUTURE MANAGEMENT

Therefore, the Unit In-charge and the Production In-charge of NRDCL will need to review forest fire protection programs at regular interval in close consultation with the local communities and forest workers in the FMU. The danger of forest fire outbreak from the burning of field debris should be well informed to the local people, as it is the common practiced followed by the local people. When the local people are going to burn their property, the information must reach to territorial staff so that monitoring can be taken.

Fire Management Procedures:

- ✓ Obtain the necessary permit or authority to conduct prescribed burn,
- ✓ Observe weather conditions to determine when to carry out the prescribed burn,
- ✓ Always extinguish the fire before leaving,
- ✓ Use ground fires to reduce the amount of inflammable fuel in forests (dead branches and leaf litter),
- ✓ Create fire breaks around forest fringes and in sensitive areas to stop fires spreading. Establish and maintain these in October-November (before the fire season). Fire breaks (Fire line) width may depend on the slope.
- ✓ Reduce fuel loads inside high-risk forest stands. This means removing dry woody material that is likely to burn. This can be done by controlled burning or physical removal.

16.2 Pest and Diseases Management

The Eastern Himalayan spruce bark beetle, *Ips schmutzenhoferi*, is a serious pest of *Picea spinulosa* and *Pinus wallichiana* in Bhutan. In Selela FMU major bark beetle sanitation operation was carried out between 2014 and 2018 (Figure 19). Total of 665 number of trees equivalent to 3762.01 m3 in standing volume from 51.72 ha (Figure 20) of land were operated to avoid further spreading.

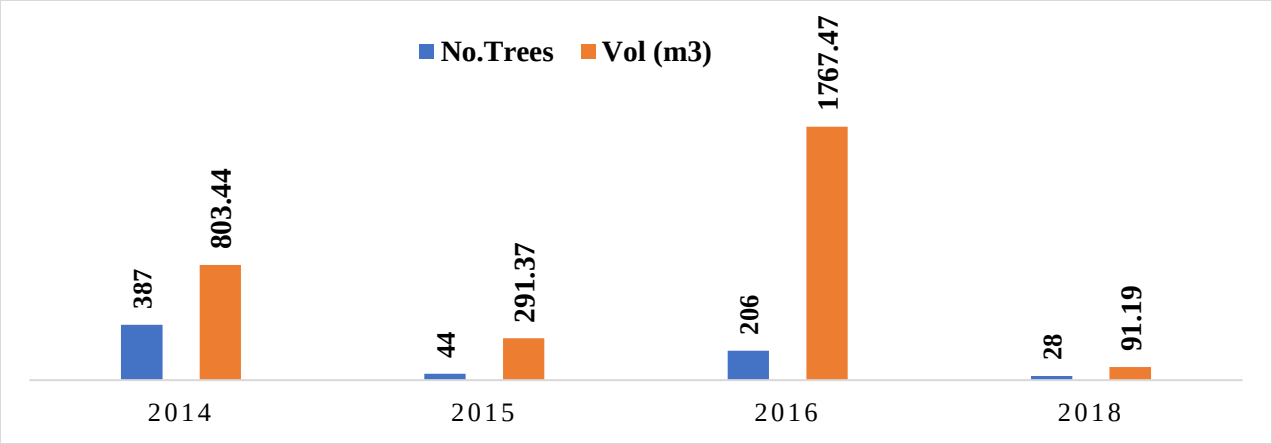


Figure 19: Graph showing Bark beetle sanitation areas under SFMU

In most of the infested stands, mortality of trees was observed in the patch form and this could be because of root-to-root contact of the fungus. To our understanding, stands would have infested by bark beetles after weakening the trees with damage to the root system by root rot. The other probable causes of beetle outbreak could be because of poor management and harvesting practices.

With incidents of outbreak of spruce bark beetle over past years, there are possibility of pest and diseases outbreak any time during this plan period. Therefore, periodic monitoring to detect any outbreak of pest and diseases should be conducted by FMU and NRDCL. Immediate reports should be made to concern CFO and seek approval for immediate sanitation from head of the Department.

The following are the control measures suggested:

- ✓ Regular periodic survey of the forest and removal of deformed trees.
- ✓ Regular survey of regenerated areas and burning of infected plants after slashing and debarking.
- ✓ Education extension program for the people and the workers in the forest to report symptoms of the disease will be part of the pest and disease management program within the FMU.

- ✓ The planting stock at any nursery, which will be supplied to the Unit for further plantation, will need to be monitored for pest and diseases. The infected seedlings should not be supplied, instead destroy by burning at the nursery itself.

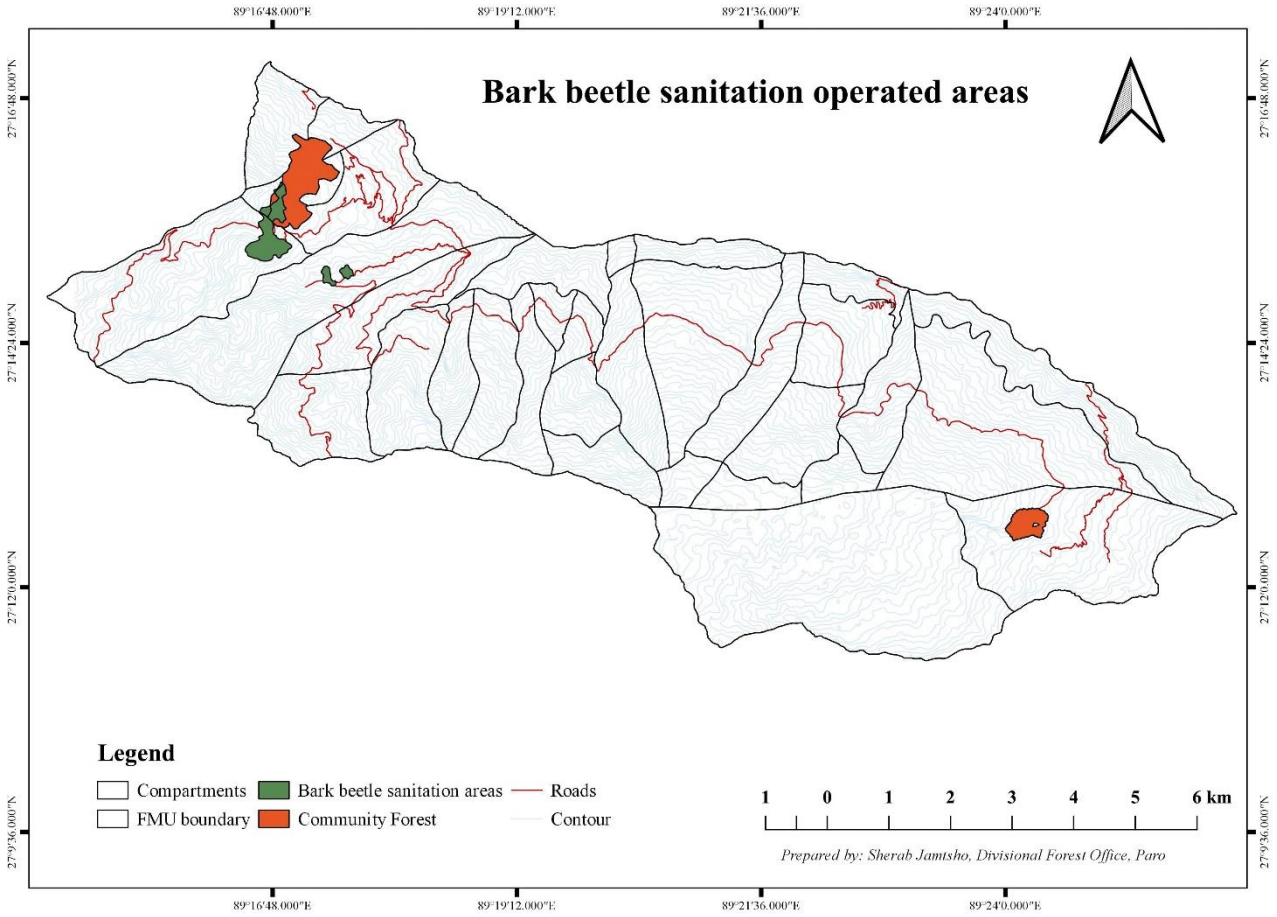


Figure 20: Map showing Bark beetle sanitation areas

16.3 Grazing

In line with the multiple-use of the forest and traditional rights of grazing within the FMU, grazing will be allowed to continue in some part of the Unit.

However, grazing will be excluded from Protection functions and light grazing will be permitted in Conservation functions. Grazing in planted areas along the cable corridors and any other areas where plantation has been taken up by NRDCL should be avoided. In this plan period, FMU should focus more on educating people regarding impact of grazing and their participation in managing FMU and other ecosystem services. FMU should collaborate with livestock sector of Dzongkhag or gewogs to develop appropriate methods and approaches to avoid impact on natural regeneration and plantation within FMU during plan period. More importantly, a participatory approach to secure the cooperation of local villagers in keeping their cattle out of environmentally sensitive areas and away from regeneration coupes will be adopted with high priority.

NRDCL should provide adequate support with available local materials to support and protect planted seedlings until its establishment. Regular maintenance should carry out as per maintenance schedule reflected in the annual operational plan to prevent damage of seedlings from grazing.

17. ENVIRONMENTAL IMPACT ASSESSMENT

All developmental proposals in Bhutan have to fulfill certain environmental criteria as per the provision of the Environmental Assessment Act, 2000. The Chapter III, Section 18 of the Environmental Assessment Act necessitates obtaining environmental clearance prior to the commencement of the proposed developmental activity. To carry out any forestry activities, the National Environment Commission Secretariat has developed Regulation for Environmental Clearance of Projects in2002, the procedures of which the applicant should meet. This section of the plan provides all necessary information required for environmental clearance which includes the perceived threats of the proposed project to the environment and necessary mitigation measures to minimize the impacts resulting from the planned activities. This section, altogether, meets the requirement of the Act to be fulfilled by the applicant concerned.

THE FUTURE MANAGEMENT

This section of Selela Forest Management Unit Plan provides information how the forestry activity will be carried out and controlled so that the proposed activity meets the requirements of the Act.

17.1 Project Description

17.1.1 Introduction

Bhutan Forest Act, 1969 provided the first legal framework for regulating forest resources in the country than National Forest Policy of 1974 provided focused and objective to the directives with regards to forest and its management. The revised policy of 1991 has four main objectives for which the forest is to be managed, one of it being, to meet the long-term needs of all the people for woods and other forest product by placing the country's productive forest areas under sustainable forest management. Numerous forest management units were identified across the country to manage the forest scientifically and sustainably.

Selela FMU is under commercial harvesting for last 22 years since the forest was brought under scientific management in 1998.The harvesting operations were carried out generously during its first plan period with AAC of 20,000m^3huge volume of timber was extracted on a sustainable harvesting principle. However, during second plan period, the harvesting of timber was drastically brought down. This was done in order to protect the sustainability principle of the forest management. Selela FMU will be worked on principle of sustainability to meet timber for commercial as well as bona fide rural requirements. The FMU will be managed on the basis of sustainability principles which will ultimately improve the forest stands.

A total FMU area of 9,155.72 ha will be managed under the principle of sustainable forest management. From the gross production area of 5162.68 ha, the net production area allotted for timber extraction operation is fixed at 4646.41 ha. The broad objective of this project is to harvest the over matured and matured trees to improve the forest stands and also to make timber available in the market along with generation of revenue for the government. To enable transportation of logs from the forest, a total of approximately 10 kms of forest road has been proposed by NRDCL for construction for next ten-year plan period.

17.1.2 Objectives

- ✓ To maintain and improve the present vegetation cover to protect the environment, soil and water conservation and as well as biodiversity;
- ✓ To ensure sustain supply of timber, construction poles and posts, fuel wood and other non-wood forest products for local supply through regulated harvesting and collection;
- ✓ To strengthen the awareness of the communities within the Forest Management Unit to participate in forest protection and conservation;
- ✓ To ensure that multiple use of forest does not result in unacceptable level of ecological and environmental disturbances;
- ✓ To generate local employment opportunities in the forest-based activities;
- ✓ To regulate grazing to maintain the ecology and natural regeneration potential of forest;
- ✓ To promote local research, demonstration, aesthetic and educational values of the natural forest ecosystem.

17.1.3 Project Location and Area

Selela Forest Management Unit is located in three Dzongkhag (Chukha, Haa & Paro) and total of four Geogs Sama Geog under Haa Dzongkhag, Meta and Dungna under Chukha & Naja Geog under Paro falls within the SFMU area. It lies between27°15'25.07"N and 89°16'15.78"E and 27°12'40.41"N and 89°25'49.16"E. The total area of Selela FMU is 9,155.72ha. The entire area will not be subjected to harvesting. From the gross production area of 5162.68 ha, the net production area allotted for scientific and sustained timber extraction operation for this plan period is fixed at 4646.41 ha. Rest of the area is categorized under various protection and non-production zones.

17.1.4. Benefits

The forest management inventory results indicated that timber species trees within some mixed conifer and fir stand of Selela FMU have attained harvestable size and some stands are matured and annual increment growth will be not significant. Removing matured stands would create space for regeneration and help to improve the forest condition. Regeneration is always a problem in the natural forest due to limited space and light, grazing pressure from the domestic animals and competition from unwanted species that dominates over the principle commercial

species. Therefore, timber harvest with application of scientific approach will improve forest structure and condition to suit natural regeneration for restock and other ecosystem services. This not only benefits in terms of generating revenues but also help improve the forest conditions. The FMU activities can also contribute towards providing employment opportunities to local communities. Localpeople can be involved as unskilled labor during maintenance of road, construction of forest road, extraction of timber and transportation. This will help uplift the livelihood of the people residing in and near by the Forest Management Unit.

The existing FMU road and the proposed new roads will benefit the settlements within the FMU. Newly proposed FMU road will help people extract rural timber for their house construction and renovation purposes. The harvesting of matured trees as per the prescription of the plan will allow the extraction on sustainable basis and also contribute towards government revenues. Managed forest will definitely ensure future sustainability of the resources.

17.2 Forest Management Unit: Planning and Zoning

All the Management Plans have to be prepared based on Forest Management Code of Bhutan, 2004. Very comprehensive and consultative land use planning was carried out while preparing this Management Plan. The process is briefly outlined below:

Potential production forest area was identified using QGIS Desktop 3.0.0 with GRASS 7.4.0, Land Use Land Cover, 2016 and existing national data like Digital Elevation Model (DEM), drainage, road networks, protected area system, etc. Application of GIS was then followed by the ground reconnaissance of selected area in conjunction with the local community consultation to ascertain potential conflicts between forestry use and existing local use. These consultations included local communities and local government. Forest resource inventory was carried out to provide the information about tree stocking, regeneration, timber volumes, sites characteristics, wildlife presence and understory species.

Forest zoning is based on above data collected, using the forest function mapping prescribed in the Forest Management Code of Bhutan. The area is divided into different forest type called Working Circle and they are further divided into Blocks, Compartments and Sub-compartments.

The protection areas such as soil protection, wild life protection, rivers and streams buffer protection, etc. are excluded from net operable area.

The silvicultural system to be implemented is Group Selection System for Mixed Conifer and Fir Working Circle and patch cut system for Broadleaf working circle. For Blue Pine Working Circle, Seed Tree System and Thinning operations will be applied. No clear cutting will be permitted and all the trees will be harvested using the skyline cable crane. The opening of the group size can vary between 0.1ha to 0.15ha depending upon the stand composition and condition. The distance between the cable lines will be not less than 60 meters and distance between the groups will be not less than 50 meters.

17.3 Harvesting and Extraction

Fixed volume of timber expressed as *"Annual Allowable Cut or AAC"* is prescribed in this Management Plan. The AAC prescribed is **9234.68 m^3** in Standing Volume per year. This means that the maximum volume that can be harvested from Selela FMU will not exceed 9234.68 m^3 per year. The AAC allotted for Commercial is **6791.54m^3**and **2443.14 m^3** for rural use. Considering the terrain condition and forest composition and structure, timber will be extracted using the skyline cable crane system. Skidding and rolling of timber from commercial production zone is strictly prohibited.

However, mitigating measures will be employed during harvesting and extraction to minimize potential negative environmental impacts. Cable cranes would be used for harvesting operation and no manual logging would be permitted in the laid cable lines. Power chain saws would be used in place of the axe to reduce waste.

The harvesting prescription and silvicultural treatment have been taken care of anddescribed in detail in the Management Plan.

17.4 Road Construction and Maintenance

The forest road construction in Selela FMU is aimed at minimum negative environmental impacts. The physical assessment for the road construction in Selela FMU was carried out by the team comprising of Engineer from NRDCL, Unit staffs both from NRDCL and Paro Territorial Division.

The proposed 10 km road in Holela and Chhepji block has been aligned in such a way that none of the drinking water sources and settlement is affected. For stream crossings, culverts, side drains and hume pipe have been designed to minimize the pollution of the stream. The proposed road and the alignment areas was presented at public consultation meeting and was agreed by general public residing within FMU area and the Local Government leaders of Naja, Meta and Dungna Gewog during the consultation meeting held at Naja Geog hall.

During road construction, the NRDCL engineers will supervise and no deviation from the proposed road alignment should take place. As general rules, excavators will be deployed. Bulldozers shall not be permitted for use. Road Standards recommended by FRMD and the general principles and practices to be followed during forest road construction as identified by NEC Forestry Sectoral Guidelines will be followed. These will ensure that the road construction within the FMU will meet the recommendations and also ensure that any erosion or other negative impacts will be minimized or eliminated. Complete Road Standard is given in Annexure 2.

17.5 Regeneration and Post Harvesting Treatments

It is prescribed in the Management Plan that harvesting will be followed by natural regeneration. If the natural regeneration fails, artificial planting will be carried out with immediate fencing. 1,600 seedlings per hectare should be planted. Thereafter, weeding and tending operations should be carried out every year till the regeneration gets established. Regeneration is considered successful only if>80% of 1600 seedlings planted gets established. Therefore, establishment of a forest nursery of principal species by NRDCL is recommended in this Plan period.

Besides, regular maintenance of the plantation will be done by NRDCL. CFO, Paro TD shall monitor establishment of regeneration in harvested areas at the end of first year. If the survival percentage is lower than the above prescribed number, immediate beating up will be carried out with the same local species. The established regeneration should be evenly distributed in the operated area and not concentrated in one particular place. Fencing could be removed once the regeneration gets established.

17.6 Existing Environment

17.6.1 Topography and Geology

The general terrain of FMU ranges from moderate to steep landscape. At a glance whole of the FMU area bears the steep landscape but in reality, the middle and uppermost portion of FMU has the gentle slope. The terrain in some compartment is gentle but in most of the compartments, steep and rocky outcrops are very prominent. The total area of FMU is 9155.72 ha and the net production area is only 4646.41 ha. About 1948.94 ha of the total area are delineated as soil protection (slope above 100%). The uppermost portion of the FMU is devoid of any tree stand; those areas are either blank or bear alpine grass. Elevation of FMU ranges from 2200 m above sea level at the valley bottom to 4000 m above sea level at the ridge top. The rock of is of Paro formation. This formation is characterized by mica-schist, quartzite-schist, calc-silicate, graphite schist, marble etc.

17.6.2 Hydrology

Within Selela FMU, there are four main rivers and no lakes. These four main rivers are Tergola Chhu, Selela Chhu, Sagolumchu and Kalyana chu.

The residents of the FMU are dependent heavily upon these water sources for drinking and cultivation. These smaller streams are also the source of water for livestock.

17.6.3 Air Quality and Noise

There are neither developmental works nor there is any interference from the tourism. The forest of FMU has only been used by local residents of villages around FMU and only noise is from the cattle grazing in the forest.

17.6.4 Plant, Animal Species and Habitat

Multi-resource inventory was carried out by FRMD inventory crew and Territorial Division Office, Paro. During the inventory, crew noted various signs and sighting of the animals and corresponding data collected via commonly identifiable signs (footprints, scats, actual sighting, browsing and other ground disturbances signs) includes animal like barking deer, Sambar deer, goral, wild boar, Himalayan black bear and occasionally musk deer and Red Panda. Since data did not indicate number of different species in the particular area, the measure of density population of different species at this planning stage may not be possible.

17.6.5 Scenic Qualities

The area has no unique scenario in particular to complements it scenic beauty.

17.6.6 Cultural Significant Sites

There are no historical monuments and monasteries within the FMU.

17.7 Assessment of Impacts and Mitigating Measures

17.7.1 Impact on water

Pollution

The FMU has a number of perennial streams, large and smaller ones. While carrying out the planned activities in the FMU, there are higher chances of polluting the waterbodies within the FMU with garbage by workers engaged in road constructions and harvesting operations. Some harmful pollutants might include oil spills from vehicles and machineries

Drying up of water source

Water source originate from the forested area. Though the proposed construction road doesn't pass through the drinking water source but during the construction phases, damage to the surrounding vegetation is inevitable. Thus, harvesting operation and opening of forest might have small impact on water source.

Mitigations

A buffer of 30 meters on the either of the main river, drinking water source and other perennial streams has to be maintained. The forested area where the drinking water source is located will not be subjected to commercial harvesting. The coupe will be laid in such a way that they are located away from the streams and rivers. Proper pit latrines and garbage disposal should be in place and the camp sites are at least 100m away from the main streams.

During the road construction, NRDCL site engineer will monitor the construction activities. Moreover, the bulldozer will be replaced by excavator in order to avoid the blockage of river and streams from wind throw. At few places, forest road passes through streams and rivers sources but to mitigate the impacts, 100 meters buffer have been kept to prevent damage to the water source. Water pipes will be replaced, if damaged during road construction

17.7.2 Impact on Forest Resources

As the timber harvesting operation is the main activity in the FMU, it is evident that there will be impact on forest resources. Although, prescribed silvicultural systems are encouraged during harvesting operations, it will result in reduction of the forest cover within the FMU. Mixed conifer will be worked under Group Selection System while the Blue Pine Working Circle will be worked under Seed Tree System. The opening of corridors and groups during the harvesting operation might open the area for grazing with less regeneration of principle timber species. This could result in exposing the site to various environmental and climatic conditions and thus affect the ecological processes in place. In certain forest type, openings can lead to increased undergrowth and hence regeneration of commercial native species will be affected.

Employment of untrained personnel during harvesting operations might lead to wastage of resources while felling trees such as increased number of splitting, breaking and other sorts of felling damages. Excessive collection of NWFPs may also lead to unsustainable harvesting of such resources in the future.

Mitigations

The management plan for the FMU is prepared for a period of ten years and before the commencement of harvesting operations. The harvesting will not exceed the prescribed AAC, nor will the size of the opening be larger than that prescribed in the management plan. If the natural regeneration fails to establish then the area will be planted with local timber species. However, natural regeneration is preferred over artificial regeneration considering its ecological as well as economic importance. The introduction of exotic species will be restricted.

For proper planning, implementation and monitoring of activities in the Forest Management Unit, a full-time dedicated staff for the FMU will be required from both DoFPS and NRDCL. CFO, Paro, will be responsible for deputing adequate staff for effective functioning of FMU. Only trained power chain saw operators will be allowed to carry out the felling and harvesting operations to reduce the felling damage within the FMU. The Unit-in-Charge should monitor community activities outside Production Working Circle to ensure that they are not locally concentrated to the extent that they affect biodiversity, water quality and soil stability.

17.7.3 Impacts on the Faunal Diversity

Habitat fragmentation and disturbance to wildlife is one of the major threats as a result of operation in the FMU. Activities such as road construction and timber extraction will cause disturbance in the wildlife habitat and thereby increasing the chances of reduction in wildlife population. Construction of roads will also affect the movement of animals from one niche to another. Harvesting operations will adversely impact the prey base and may create imbalance in the food chain.

Mitigations

Certain areas within the FMU have been designated as wildlife protection areas while the remaining areas are designated as nature conservation areas. No harvesting operations will be allowed in area designated as wildlife protection function. As all forest areas are not subjected to harvesting operations, enough areas have been kept for free movement of wild animals. Sufficient number of snag trees and fruit bearing trees will be retained to provide enough food for survival and reproduction of wild animals.

In the interest of wildlife, clear felling of large stretch of forest will be avoided so that sufficient forest is retained for forage, shelter and cover. In operated areas, if natural regeneration fails to establish, artificial regeneration by native trees will be undertaken and subsequently fenced to avoid grazing by domestic as well as wild animals. Regular monitoring and patrolling of the forest area will be carried out in order to minimize poaching and other illegal activities within the FMU.

17.7.4 Impacts on Ecology (Flora)

One of the possible impacts of harvesting operations within the FMU is the change in present forest composition. There are higher possibilities of the harvested areas being invaded by non-native species of plants if proper monitoring of the area from time to time is not undertaken. Moreover, colonization of mixed conifer areas and natural grassland by Blue Pine is one of the perceived threats.

Mitigations

In order to retain the original forest composition in the harvested areas, the operation should follow the prescriptions strictly. Opening along the cable lines should be maintained as per the prescribed silvicultural systems so that it creates conducive environment for desired species to regenerate. Larger openings will be avoided in the mixed conifer stand in order to avoid its colonization by blue pine species. To ensure adequate regeneration of desired species, mother trees will be retained insufficient numbers as a source of seed. Forest roads have been aligned in such a way that it does not pass through sensitive and critical areas. Proper monitoring should be ensured while constructing new forest roads to ascertain minimal damage to nearby vegetation.

17.8 Monitoring and Evaluation

The Management plan, which is for the period of ten years, will be prepared by Divisional Forest Office, Paro and facilitated by FRMD, DoFPS. It will be approved by the Minister, Ministry of Agriculture and Forests. The plan will be implemented by NRDCL under supervision of Chief Forestry Officer, Paro. Annual Operational Plans (OP) will be prepared by Divisional Forest Office, Paro, in consultation with the stakeholders, based on the management plan. The OP will be approved by the Head of the Department. Annual monitoring will be carried out by Division (CFO and Unit In-charge). A report will be submitted to FRMD, Department of Forest and Park Services, based on the annual monitoring forms. FRMD will also monitor the implementation of the activities.

There will be two evaluations of FMU: mid-term evaluation at last quarter of the fifth year and final evaluation at the last quarter of the ninth year by the independent of staff implementation. An evaluation team will be constituted by the head of the Department. CFO will apprise the Department for evaluation and evaluate the FMU as per terms of reference.

Table 30: Check list of Environmental parameters for forestry projects

		Preliminary Evaluation			
	Adverse Environmental Impacts	No Significant Effect	Small Effect	Moderate Effect	Major Effect
I. COMMERCIAL LOGGING					
A. Environmental Considerations Regarding Project Siting					

	Adverse Environmental Impacts	Preliminary Evaluation			
		No Significant Effect	Small Effect	Moderate Effect	Major Effect
1. Watershed Areas					
a) erosion	*a) downstream economic losses*	✓			
b) siltation	*b) downstream economic losses*	✓			
c) hydrology	*c) increased peak and flood flows*	✓			
d) water quality	*d) loss of downstream beneficial uses*	✓			
2. Relation to other dedicated land uses					
a) conservation areas	*a) impaired ecological and recreational opportunities*	✓			
b) economic ventures	*b) possible economic loss*	✓			
3. Traditional forest uses	3. Impaired beneficial uses		✓		
4. Re-habitation	4. Social problems	✓			
5. Relation to regional/ national forestry plans	5. Possible conflicts with established management policies	✓			
6. Critical environmental areas	6. Downstream economic losses	NA			
a) erosion	*a) downstream economic losses*	✓			
b) siltation	*b) downstream economic losses*	✓			
c) hydrology	*c) increased peak and flood flows*	✓			
d) water quality	*d) loss of downstream beneficial uses*	✓			
7. Precious ecology	7. Loss of ecological values	NA			
B. Considerations Regarding Planning and Design					
1. Cost/benefit analysis		✓			
2. Operations and maintenance	2. Diminished project efficiency and objectives if lack of funds	✓			
3. Data base for decision making			✓		
4. Road network design					
a) erosion	*a) downstream economic losses*		✓		
b) siltation	*b) downstream economic*		✓		

	Adverse Environmental Impacts	Preliminary Evaluation			
		No Significant Effect	Small Effect	Moderate Effect	Major Effect
	losses				
c) hydrology	*c) increased peak and flood flows*		✓		
d) water quality	*d) loss of downstream beneficial uses*		✓		
5. Design of logging activities	5. Unnecessary damage to residual stand		✓		
6. Critical environmental areas		NA			
a) erosion	*a) downstream economic losses*				
b) siltation	*b) downstream economic losses*				
c) hydrology	*c) increased peak and flood flows*				
d) water quality	*d) loss of downstream beneficial uses*				
7. Precious ecology	7. Loss of ecological values	NA			
8. Appropriate technology	8. Diminished project objectives if inappropriate				
C. Considerations Regarding Project Operations					
1. Road construction					
a) erosion	*a) downstream economic losses*				
b) siltation	*b) downstream economic losses*				
c) hydrology	*c) increased peak and flood flows*				
d) water quality	*d) loss of downstream beneficial uses*				
2. Felling					
a) erosion	*a) downstream economic losses*	✓			
b) siltation	*b) downstream economic losses*	✓			
c) hydrology	*c) increased peak and flood flows*	✓			
d) water quality	*d) loss of downstream beneficial uses*	✓			
3. Log conveyance and allocation					
a) erosion	*a) downstream economic losses*				
b) soil compaction	*b) increased runoff*				
c) log floatation	*c) impede navigation*	N.A.			

	Adverse Environmental Impacts	Preliminary Evaluation			
		No Significant Effect	Small Effect	Moderate Effect	Major Effect
d) allocation	*d) less than optimum economic benefits*	✓			
4. Logging in riparian zones	4. Degradation of waterways/fisheries		✓		
5. Socio-economics					
a) employment opportunities			✓		
b) loss of traditional forest use	*b) economic and cultural losses*		✓		
D. Considerations Regarding Post-Project Activities					
1. Rehabilitation and conservation					
2. Road shutdown			✓		
II. REFORESTATION/AFFORESTATION					
A. Considerations Regarding Project Siting					
1. History of forest abuse	1. Negation of project goals if not effectively controlled		✓		
2. Relation to other dedicated land uses					
a) conservation areas					
b) economic ventures	*b) Interference with more profitable ventures*				
c) regional/national forestry plans		✓			
3. Rehabitation	3. Social Problems	✓			
4. Siting in degraded forest	4. Possible unnecessary loss of ecological values	✓			
B. Considerations Regarding Planning and Design					
1. Cost/benefit analysis		✓			
2. Selection of tree species	2. Diminished project objectives				
3. Precious ecology		NA			
a) wildlife					
b) fisheries					
c) plants					
d) soil and water					
4. Allocation of benefits to locals			✓		
a) employment opportunities	*a) social conflict if local people not significantly involved*		✓		
b) training			✓		
c) non-wood products		✓			

	Adverse Environmental Impacts	Preliminary Evaluation			
		No Significant Effect	Small Effect	Moderate Effect	Major Effect
5. Operations and maintenance	5. Diminished project efficiency and objectives if lack of funds		✓		
6. Data base for decision making			✓		
7. Project financing and reservoirs		NA			
8. Appropriate technology	8. Diminished project objectives if inappropriate	✓			
9. Relation to other dedicated land uses	9. Potential social and economic conflicts	✓			
a) extensive land use modification		✓			
10. Road network design	10. Increased erosion	✓			
11. Use of grasslands		✓			
C. Consideration Regarding Project Operations					
1. Commercial logging	1. Same as in Commercial Logging A and B				
2. Reduced water supplies	2. Socioeconomic losses	✓			
3. Chemicals and fertilizers	3. Impaired fisheries and aquatic systems	NA			
4. First-year operations	4. Increased erosion due to soil disturbance	NA			
5. Soil conservation benefits					
a) erosion				✓	
b) sedimentation		✓			
c) soil capacity		✓			
d) soil surface moisture		✓			
e) soil nutrients		✓			
6. Socioeconomic benefits					
a) employment opportunities			✓		
b) fuel-wood			✓		
c) enhanced fisheries		✓			
d) enhanced recreation/ tourism		✓			
7. Water resources benefits					
a) minimized overland flows		✓			
b) reduced flood peaks		✓			
c) water quality		✓			

18. FINANCIAL AND ECONOMIC APPRAISAL

Ten-year financial forecast and economical appraisal has been drawn for Selela FMU. This is intended to identify the revenue to NRDCL and Treasury (via royalty) and the cost and royalty paid by NRDCL. Overhead costs to NRDCL are not included. Some of the figures are estimates based on the assumptions listed and the information made available to the planner. The assumptions for the forecast are listed in Table 31.

Table 31: Assumption used for financial forecast

Assumptions	Figures
M^3 to cft	35.31
Recovery volume (%)	60
Road construction (Nu/km)	1200000
Length of proposed new road (km)	10
Road maintenance (Nu/km/yr)	12000
Distance to depot (km)	5
Cable crane (Nu/cft)/(Nu/m^3)	10.01/cft or 353.45/m^3
Regeneration maintenance (for cable line) (Nu/ha)	3500
Plantation cost (as per plantation norms and standard, SFD)	19000

Table 32: Financial Forecast Summary (For this plan period)

Category	Amount (Nu)
Total Revenue for NRDCL	113662890
Total Costs for NRDCL	51347300
Total Royalty for NRDCL	10381140
Total Revenue-Total Costs-Total Royalty	51934450

THE FUTURE MANAGEMENT

					2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	10 year
	AAC (m3)	Rec. Vol (m3)	Nu/cft	Nu/m3	Nu	Nu	Nu	NU	Nu	Nu	Nu	Nu	Nu	Nu	Total (Nu)
Revenue:NRDCL															
Timber-Commercial	8048	4828	107.3	3788.763	11366289	11366289	11366289	11366289	11366289	11366289	11366289	11366289	11366289	11366289	113662890
Timber-Rural	2771														
Total Revenue: NRDCL					11366289	11366289	11366289	11366289	11366289	11366289	11366289	11366289	11366289	11366289	113662890
Costs: NRDCL															
Bridge construction							1500000								1500000
Road construction						2400000	2400000	2400000	2400000	2400000	2400000	2400000	2400000	2400000	21600000
Road maintenance					238000	238000	238000	238000	238000	238000	238000	238000	238000	238000	2380000
Marking cost			0.08	2.83	14150	14150	14150	14150	14150	14150	14150	14150	14150	14150	141500
Inventory cost			0.08	2.83	14150	14150	14150	14150	14150	14150	14150	14150	14150	14150	141500
Felling and crosscutting cost			5	176.06	852624.8	852624.8	852624.8	852624.8	852624.8	852624.8	852624.8	852624.8	852624.8	852625	8526248
Debarking			3	176.6	852625	852625	852625	852625	852625	852625	852625	852625	852625	852625	8526250
Cable craning			20	706.4	3410499	3410499	3410499	3410499	3410499	3410499	3410499	3410499	3410499	3410499	34104992
Transportation to depot			17	600.44	2898924	2898924	2898924	2898924	2898924	2898924	2898924	2898924	2898924	2898924	28989243.2
Stand tending (spacing etc.)															
Regeneration maintenance(Nu	Nu 3000/ha				56100	56100	56100	56100	56100	56100	56100	56100	56100	56100	561000
Creation of plantation	Nu 19000/ha				95000	95000	95000	95000	95000	95000	95000	95000	95000	95000	950000
Plantation maintenance	Nu 3500/ha				17500	17500	17500	17500	17500	17500	17500	17500	17500	17500	175000
Total Cost: NRDCL					8449573	10849573	12349573	10849573	10849573	10849573	10849573	10849573	10849573	1.1E+07	107595733
Total revenue less Total cost: NRDCL					2916716	516715.7	-983284	516715.7	516715.7	516715.7	516715.7	516715.7	516715.7	516716	6067156.8
Royalty-commercial			9.8	346.038	1038114	1038114	1038114	1038114	1038114	1038114	1038114	1038114	1038114	1038114	10381140
Total Revenue: (Revenue less Cost less Royalty): NR					1878602	-521398.3	-2021398	-521398.3	-521398	-521398	-521398	-521398	-521398.3	-521398	-4313983.2
Note: it is recommended that a contingency fund be established for these activities due to the uncertainity of the occurance of bark beetle during the plan															
period: the amount of plantation is for cable lines and does not include potential plantation areas															

19. RESEARCH

Research programs will be in collaboration with UWICER. The Division and Unit staffs can also collaborate as appropriate. The prioritized areas for research are mentioned below:

- Determination of Annual Allowable harvest of NWFPs in the FMU.
- Invasion of operated areas by bamboos and its impacts to natural regeneration
- Habitat assessment of Red Panda and Musk Deer.
- Timber recovery rate for particular FMU.
- Forest composition change overtime due to commercial harvesting.
- Human wildlife conflict.
- Development of new Local volume table for SFMU.

PART 3

IMPLEMENTATION OF THE PLAN

20. IMPLEMENTING AGENCY

The Department of Forests and Park Services is vested with the responsibility of protection and management of forest resources in Bhutan. In the field, the territorial division is mandated by the Department to discharge the responsibility of implementing and monitoring all the activities mentioned in the plan. The Chief Forestry Officer of Divisional Forest Office, Paro will be responsible for implementation of this Management Plan assisted by Unit In-charge and other staffs of Forest Management Unit.

20.1 Cutting Cycle

For sustainability of forest resources in FMU, the cable line spacing must be properly laid to enable subsequent passes in the future. A minimum of60 meters needs to be kept in between cable lines so that two passes can be enabled in future. Mixed Conifer Working Circle has a rotation period of 165years, which means that the two cable lines that will be implemented in future are occurring at year 55 and year 110. This is diagrammatically represented in Figure21. The original line will therefore be harvested in year 165. This gives the adjacent area time to regenerate and also prevents the area from being open largely. The same could be applied to the Fir Working Circle except that the return to the interlines would occur at after 58

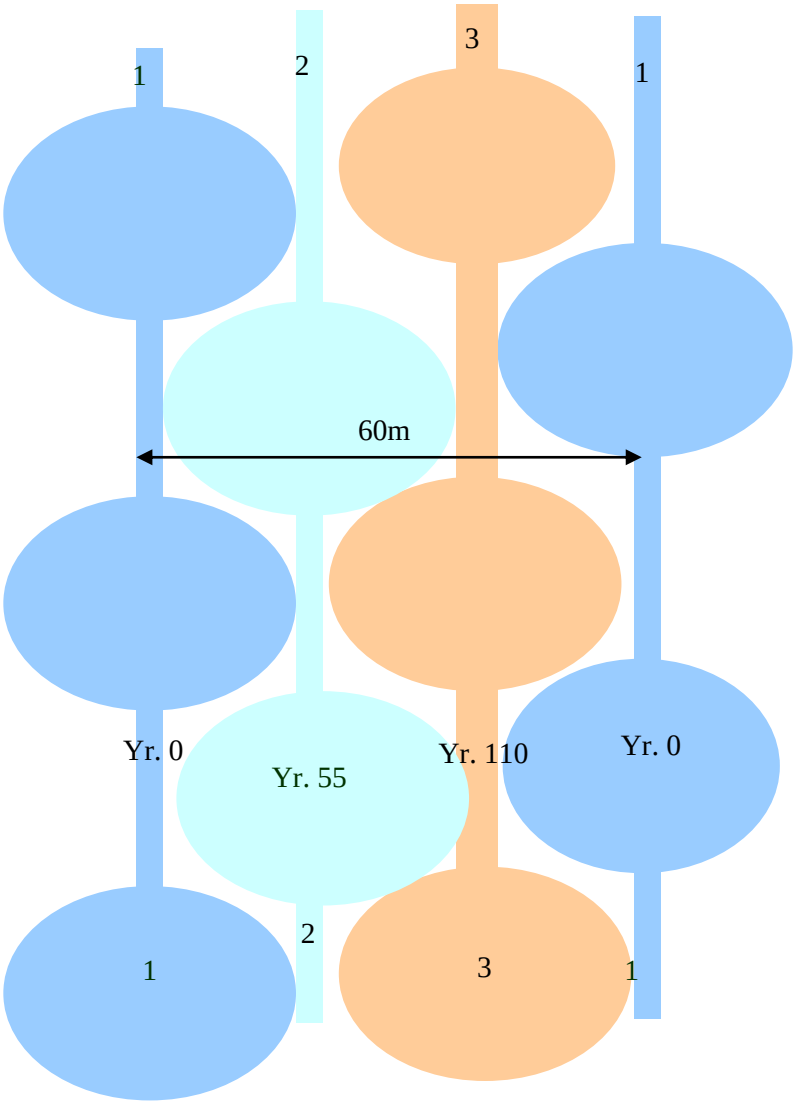


Figure 21: Map showing Cutting cycle diagram

years and size of group opening will be no more than 0.1ha.

The terrain in Bhutan poses a problem for layout. The layout in the field must be tailored to suit the terrain and to the best possible guidelines must be followed.

The Blue pine Working Circle, which will be worked under Seed Tree System, requires 90m spacing between initial cable lines. Thus, the two interlines in the future will be harvested at year 40 and 80, with original line being harvested at year 120.

The young Blue Pine stand will be worked under thinning. The thinning will be done by positive selection with due consideration to stabilize the structure of the stand. The thinning will ensure the growth potential of the stand and site to the most promising individual of the tree population to maximize the volume and quality production.

The Mixed Broadleaved working circle will be worked under Patch-cut System. The patch will not exceed more than 0.25 ha and will be spaced in the interval of 50 m. and 4 m cable corridor will be maintained. Artificial regeneration will be taken up immediately after coupe clearance is issued. NRDCL should maintain nursery at the site for artificial regeneration. Nursery should be well stocked with local and commercial species for replantation.

20.2 Annual Coupe

The Unit In-charge will determine the location and extend of cable lines in the compartment to be harvested annually, in consultation with NRDCL staff. All prescription and restriction laid down in the plan must be considered and adhered completely. NRDCL will obtain Coupe Clearance Certificate in writing from FMU to start marking felling. The Unit In-charge will arrange to mark along the cable corridor and openings and allot to NRDCL for felling. The annual coupe will follow the required spacing designed as per the prescribed silvicultural system of each working circle. The cable lines may traverse slopes greater than 100%, but extraction is not allowed. This means there should not be any group openings in those areas having slope greater than 100 %.

Coupes must comply with the following conditions:

- ✓ The Unit In-charge, in consultation with the NRDCL counterpart, will determine the location and extend of the cable lines in the compartment to be harvested annually. All

prescription and restriction laid down in the plan must be considered and adhered to completely.

- ✓ The cable lines must be laid to the full length if the area is operable in order to avoid unnecessary loss of production area. This practice will also help cutdown the expenditure for road construction.
- ✓ The Unit In-charge will arrange to mark the trees as per the approved annual Operational Plan.
- ✓ Cable line layout will be based on safety, stand composition, environment and cost consideration. This will be done in consultation with the Unit In-charge.
- ✓ The cable lines may traverse slopes greater than 100% but extraction is not allowed.
- ✓ Cable line layout will be based on safety, stand composition, environment and cost considerations. Alignment of cable line must be done in consultation with the unit in-charge. NRDCL, in consultation with the UIC may align the cable lines diagonally across contour lines in order to avoid environmentally sensitive sites to secure a more stable landing point or to achieve a more cost-effective harvesting.

20.3 Tree Marking Rules

- ✓ Groups of matured and over-matured trees are selected systematically according to the group size given in the plan.
- ✓ Trees within stream buffer stripes and on slopes greater than 100% must not be marked.
- ✓ The direction of the tree lean and topography has to be taken into account to prevent large tree being felled on nearby advanced growth.
- ✓ Some dead, dying, malformed or damaged (snags, scars. conk, etc.) and fruiting trees will be retained in between groups, and in the interline spaces, to safeguard the niches or habitats for the flora and fauna, but not in the harvested group themselves, where there is risk of wind throw and danger to personnel working underneath.
- ✓ Diseased trees (bark beetle, mistletoe) will be removed to protect the quality of the remaining stand.
- ✓ All species listed for protection under the Forest and Nature Conservation Act (1995) must be protected if encountered.

- ✓ The trees selected will be marked with the authorized marking hammer close to ground level by Unit Staff, and diameter measurements, along with estimated total tree height and tree species, will be entered in the Marking register.
- ✓ The volume of each tree will be estimated using an appropriate Volume Table. The standing volume marked will be recorded in the Marking Register. Log volume at the NRDCL Depot will be recorded.
- ✓ During the tree marking, the mitigating measure against the impacts recognized during the Environment Impact Assessment must be referred

20.4 Harvesting

To reduce the negative impact to the forest and environment due to extraction, the hauling method for transporting logs from the coupe to road will be done by skyline crane system. This system will allow logs to be kept above the forest floor during extraction and will enable logs to be taken across sensitive ecological sites, gullies and riparian filter buffer zones. Cutting trees 10 cm above the ground level will be strictly followed to avoid the wastage. To maintain the sanitation and hygienic condition of the forest, the cut over debris must be disposed off and if possible, burn in a proper place avoiding forest fire. The skyline cable system has the following advantages:

- ✓ Minimizes soil disturbance and initiation of soil erosion.
- ✓ Maximizes work safety (if used correctly according to the manufacturer's directions and according to the safety practices in the Code of Logging Practice).
- ✓ Avoid damage to residual reserve stands.
- ✓ Avoid disruption to wildlife corridors in the valley bottoms.
- ✓ Minimizes noise and dust pollution on any adjacent farmland and villages.
- ✓ Eliminates the need for log extraction tracks and feeder road construction

Harvesting in the Working Circle is to be carried out in accordance with following prescriptions:

- ✓ The layout of the cable lines should be planned and undertaken well in advance of the harvesting operations after the logging coupe has been demarcated. Suitable log landing site should be identified and incorporated into the forest road design.

- ✓ Care should be taken to avoid lines in and along gullies and other protected areas, but lines may cross these at an angle. Trees to be felled will be enumerated and marked in time so as not to delay harvesting operations.
- ✓ The cable corridor shall not exceed the prescribed width stated in the Silvicultural System for each working circle.
- ✓ Trees will be felled, de-limbed, crosscut, extracted on the cable, loaded and hauled to the log depot. Only chain saws and hand saws will be permitted in felling operations. Trees will be felled, where possible, into natural openings, into harvested openings or in a direction that will not damage residual stands. Damage to soil should be minimized at all times.
- ✓ The use of axes is discouraged except in fuel wood splitting.
- ✓ All infected Blue pine and Spruce, if any, will be debarked as soon as they are felled to avoid the spread of bark beetles.
- ✓ All logs will be measured and recorded in the Log Yard Register. This should be kept up-to-date and made available to inspecting officers as required. A copy of the list of log/timber entered in the Log yard Register will be submitted to concern CFO every month. This information will be used for royalty calculation and issuance of removal permits. Logs will be transported by private haulage contractors and all deliveries will be made to designated depots and/or sawmills.
- ✓ Records of all trees marked and issued for local use or for conversion within the forest, by blocks and compartments will be maintained by the Unit staff and furnished monthly to the concern CFO.
- ✓ The CFO and the Regional Manager, NRDCL will co-operate and coordinate to ensure that the logging operation and log outturn are conducted smoothly and in accordance with local and other demands.
- ✓ Fuel wood will be collected from harvesting residues. It is important that all lops and tops for fuel wood are collected along entire cable lines, not just the easily accessible areas. It is desirable that the trees to be used as fuel wood are extracted with the cable line and fuel wood conversion occurs at the designated log landing areas.

Skyline cable systems are the only form of cable harvesting systems used in Bhutan. Although no other harvesting systems are being introduced, it would be beneficial to investigate other

possibilities that would increase the production. This would allow more 'less desirable' timber to make it to the landing, promoting utilization of poorer quality timber and fuel wood residues.

20.5 Reforestation of Harvested Sites

Natural regeneration is preferred method of reforestation in the harvested areas of FMU. Natural regeneration is ecologically and economically viable method to ensure sustainable development of forest resources. Therefore, it is crucial that natural regeneration is given preference over artificial regeneration.

It is essential that harvested areas are effectively regenerated as soon as harvesting operations are complete. However, if natural regeneration fails to get established in the harvested sites, restocking by means of artificial regeneration through plantation shall be carried out by NRDCL. It might be evident in some FMUs that the natural regeneration is either very poor or prove to be a complete failure because of site conditions, over grazing, prolonged disturbance due to protracted harvesting operations and overgrowth of weeds and other invasive plant species. These problems must be considered, analyzed and eliminated to successfully regenerate the operated areas.

It is prescribed that periodic tending activities such as weeding, brushing and fencing are carried out to increase the chances of natural regeneration establishment in FMU. Such interventions will help cut down the plantation cost and ensure higher survival percentage of forest crops. In case of natural regeneration failure, NRDCL should have a reserve of seedlings of locally viable species which can be done through establishment of forest nurseries. Care should be taken to plant commercially viable local species in the FMU to ensure sustainable harvest in the future. In areas where plantations are carried out, regular maintenance should be done for higher survival percentage. The maintenance of plantation should be carried out as per the Norms for Plantation and Nursery, 2019 and the concern CFO must monitor and evaluate the plantations on annual basis.

The past harvested cable lines should be monitored periodically and regeneration surveys should be conducted every three years until the regeneration has reached height that will ensure its survival. If the second survey (6th year) indicates poor stocking, remedial actions must be taken in the following plantation season. The Unit In-charge must ensure that stocking of natural

regeneration is first monitored within three years following completion of the harvested operation. Enrichment plantation, if necessary, should be carried out by NRDCL. The NRDCL in consultation with the Unit In-charge should keep adequate budget provisions in Operational Plan to carry out plantation creation and maintenance works.

FRMD recommends that the target stocking density in plantations to be up to 1600stems per hectare. Any plantation with survival rate below 80% will require beating up.

20.6 Sequence of Operations related to the Annual Coupe

The operations relating to operating to annual coupe should follow the sequence given in following table

Table 33: Sequence of Operations Relating to the Annual Coupe

Operation Description	Timing (months) (-before felling; + after felling)
Unit In-charge decides regarding the location and size of annual coupe in accordance with the Biennial Operation Plan	-12
NRDCL and FMU In-charge prepares an estimate of human, material, equipment's and financial resources required.	-10
Unit In-charge finalizes the annual coupe size, demarcates the coupe and instructs NRDCL to carry out pre-logging planning	-6
NRDCL prepares cable line layout and alignment plan, proposed log depot and log landing points and submits these to Unit In-charge for approval	-3
Unit In-charge marks the carriage corridor trees and the tress to be felled in the first sub-coupe	-2
NRDCL manually fells trees that are in the way of the skyline installation and installs the skyline and cable crane	-1
NRDCL comments systematic harvesting and extraction operation according to the approved sequence in the Biennial Operation Plan	0
NRDCL/Contractor completes harvesting and extraction	When completed
The Unit In-charge will inspect the coups when harvesting is completed and will issue a Coupe Clearance Certificate only if all aspects of the operation are satisfactory.	When works completed
DoFPS asses success of natural regeneration	As per Guidelines
NRDCL completes post harvesting operation	As per Unit In-charge instruction

20.7 Road Construction

Forest roads are essential component for efficient management of forest. It allows transportation of timber from the landing sites to the depot at the right time. It also provides access to the forest areas for management and monitoring.

Road construction in the FMU requires extra precaution to achieve the environmental best practice. The basic necessity in the forest road construction is to avoid steep and fragile areas, to provide proper drainage system, especially for safe discharge of run-off water during monsoon, with enough culverts and cross drains, to have an efficiently drained compacted road surface. In this plan period, NRDCL will construct forest road of 10 km at Holela and Chhepji block.

Road Standards

A set of road standards have been developed by the forest engineers of TFDP. These road standards although developed in the east, address policies that are required throughout Bhutan. These standards will be adopted for Selela FMU and NRDCL engineers must follow these standards, given in the annexure during designing and estimation and provide supervision during construction to ensure that the standards are met. The impact management recommendations from National Environment Commission (1999) and sectoral guidelines for Road must also be referred, where in general principle and practices to minimize negative economic and environmental impacts of road are cited. Road design in the Selela FMU should follow the recommended road profile in Figure 22to avoid excessive water pooling leading to rutted road surfaces that inhibit access during monsoon season. Improper drainage may also lead to landslides. Following recommended road design would also decrease maintenance cost for future

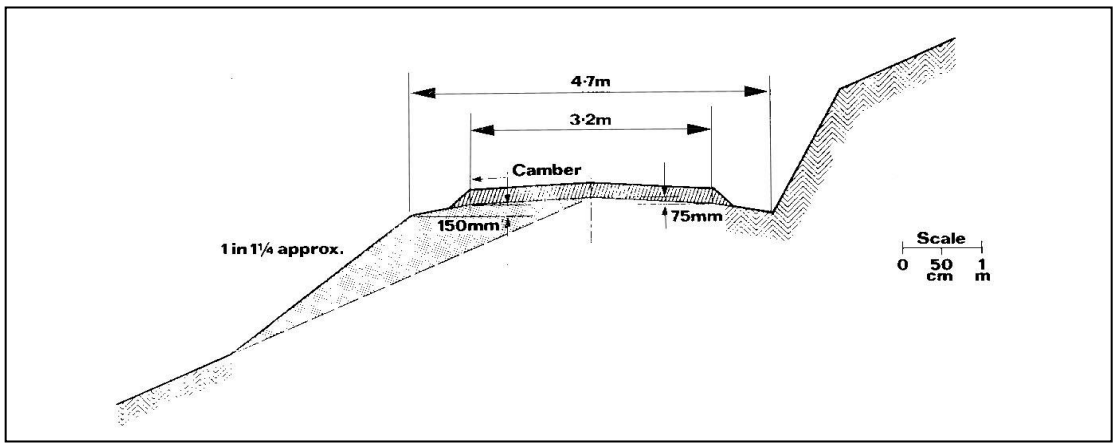
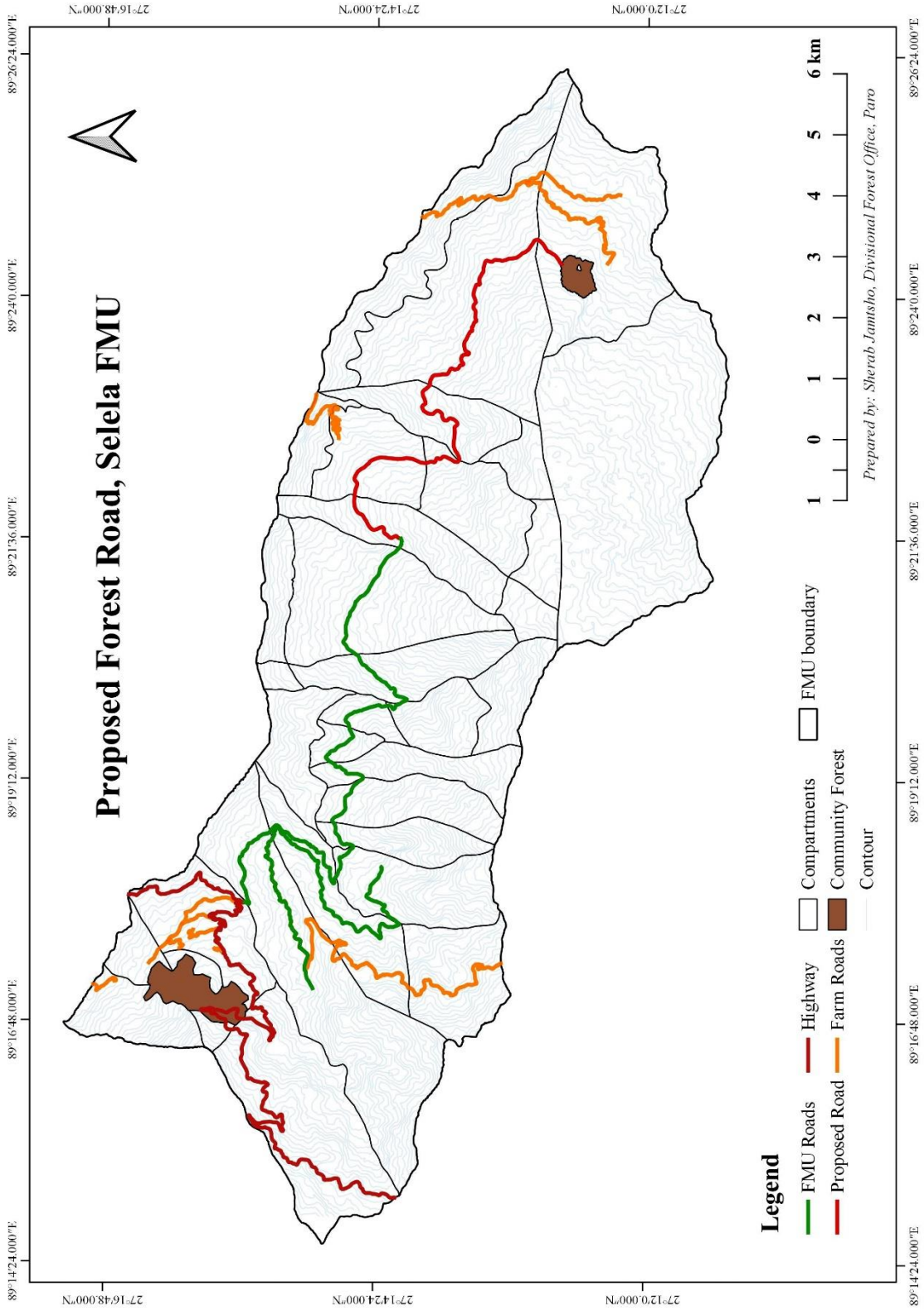


Figure 22: Figure showing Recommended Road Profile

IMPLEMENTATION OF THE PLAN



IMPLEMENTATION OF THE PLAN

21. PLANNING

21.1 Operational Plan

For facilitating the timely implementation of the Management Plan, a Biennial Operational Plan will be prepared by the CFO, Paro and the Unit In-charge. Guidelines for preparation of Operational Plan are given in the FMCB (2004) and a copy of each is available at Division office. TheOperational Plan is also tool used to provide for changes that cannot be foreseen or allowed for in the FMU Plan, such as insect and disease outbreaks, severe fire, etc. If and when these occur, the current Operational Plan should be immediately reviewed and the areas and or methods of operation modified to deal most effectively with possible changes in the sustainable level of harvest

The Operational Plan will be prepared in consultation with all the agencies and parties who will be using the forest. Inclusion of a consultation process with local communities in the preparation of the plan is particularly important so that potential issues concerning communities in the forthcoming operational areas are worked through before the plan is implemented.

The Operational Plan is meant to be a rolling one, i.e., Operational Plan is prepared annually but the plan period is for two years. Therefore, activities for the second year of the plan are carried forward into the first year of the next plan (Table 24). This has important implication on budgeting (since will then be possible to estimate well in advance of the start of the financial planning year) and for participatory process since these can be carried out a year before the start of activity. The primary aim in preparing the Operational Plan is to determine and co-ordinate timely input of resources.

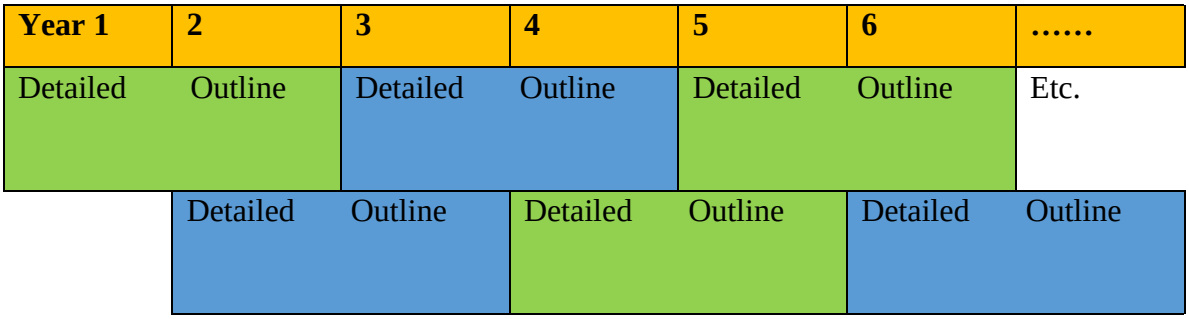


Figure 24: Figure showing Concept of Rolling Plan

IMPLEMENTATION OF THE PLAN

Activity (Planning Step)	Objective	Output	Responsibility (lead)	Comments
1. Approved FMP				
2. PRAs with local Stakeholders	To prepare participatory plan for fire management, grazing control and rural timber To involve relevant stakeholders in planning for activities which have a direct impact in their "interest"	Participatory plan for fire management, grazing management and rural timber harvesting (to be incorporated within the OP)	CFO & FMU In-charge	First step is to enter into discuss with stakeholders and their representatives Use PRA technique to prepare the plan Plan cost are included in the OP
3.Operational inventory	To assess the resource availability for the planned harvesting area Calculation of the harvestable volume	Site-level inventory data for the operational area to be harvested Precise estimate of volume to be removed during the coming year	FMU In-charge NRDCL	For the areas proposed for harvesting during the next two years May be combine with harvesting plan and cable line survey
4. Harvesting plan and cable line survey	To plan for harvesting and extraction activities	Agreed extraction and roading plan	NRDCL	Within the selected identified harvestable area for the year
5. Preparation of Operational plan	To prepare a plan for implementation during the next two years	Approved operational plan with budget	FMU In-charge with stakeholders as required	Activities linked with objectives identified in the FMP and following options

	(involving stakeholders for some activities) To formalize local institutional responsibility for planed activities (e.g. grazing, fire management, rural timber distribution	Identified responsibilities for each planned activity Calculate cost for each planned activity		and guidelines in the FMP Each activity with identified responsibility for implementation, estimated cost, and site-specific location
6. FMU annual report presented to the FMU management committee	To review progress and identify and address any implementation problems To identify any future actions necessary based on issues arising	FMU Annual report endorsed by FMU management committee	FMU Manager presents to the management committee	During FMU management committee annual meeting Implementation problems need to be addressed before endorsing the new OP
7. OP review by FMU committee and endorsed	For the FMU management committee to endorse the OP (prior to approval by CFO) To endorse expenditure estimates for the coming financial year	OP endorsed by FMU management committee	FMU Manager presents to the management committee	During FMU management committee annual meeting
8.NRDCL financial commitment within OP	To ensure that NRDCL is committed to funding the agreed	Budget estimates for the OP endorsed by	FMU management committee	Meeting needs to take by November to ensure that budget

agreed	activities in the OP	NRDCL and FMU management committee		requirements can be included in the NRDCL APO for the next financial year
9. OP approved by Director, DoFPS	To approve OP for implementation	Approved plan and budget	Approved by FRMD and Director, DoFPS	OP approved linked with sanctioned budget for all planned activities
10. OP implementation by NRDCL	To carry out planed activities	Harvested timber; protected area; roads; fuel wood etc	According to responsibilities identified in the OP e.g., FMU In-charge, NRDCL, CFO	Each activity with specific responsibility and budget
11. Monitoring of activities	To assess the level of achievement of planned activities	Information for FMU annual report	FMU In-charge	CFO responsibility is to monitor the implementation of the activities carried by NRDCL Monitoring cost need to appear in the OP
12. CFO, Unit In-charge prepares FMU annual report	To report progress against planned activities To highlight any problems being encountered in implementation	FMU Annual report	FMU In-charge	Prepared annually Progress is reported against each FMP objective and the associated activities
13. Prepare the next year's OP (step 2-5)	To prepare the next OP taking into account progress over the past year	Operational Plan	FMU In-charge	OP may alter in response to FMU management committee suggestions and recommendations

21.2 FMU Level Management Committee

For the smooth implementation of the plan, the FMU-Level Management Committee has been established. The Committee will consist the following members:

- CFO, Paro Territorial Division, Chairman
- FRMD Representative
- FMU In-charge, Selela FMU
- Regional Manager, Rinpung Region, NRDCL
- Gup of Naja, Meta, Dungna & Sama Gewog, Paro & Chukha
- Production in-charge NRDCL, Haa
- Key Village Elders

21.3 Terms of Reference for the FMU Level Management Committee:

During FMP preparation;

- To represent the interests of identified stakeholder groups during the planning process for FMP preparation;
- To discuss and agree on FMU forest management objectives for different parts of the forest (zones and working circles), based on national priorities and combined with specific local conditions and local needs;
- To consult (along with FRMD) with specific groups of stakeholders likely to be significantly affected by proposed activities such as road construction and timber harvesting and ensure that their interests are effectively accommodated in the final version of the management plan;
- To review and endorse the draft forest management plan before it is presented to the DoFPS, submitted to NEC and Ministry of Agriculture and Forests for final approval.

During operational planning, implementation and monitoring

- To represent the interests of all the identified stakeholder groups during annual planning and review of activities under Operational plans;
- To review achievements during the previous year (based on an FMU annual report submitted by the FMU In-charge) and advice and act on any issues identified in this report;

- To make recommendations for changes to the proposed OP for the coming year based on the previous years' experience and on the need to achieve the agreed objectives in the Forest Management Plan (FMP);
- To endorse activities, priorities and funding arrangements within the draft OP before submission to the DoFPS;
- To hold any additional meetings as required in response to specific issues arising from FMP and OP implementation;
- To participate in the mid-term (5-year) and final (10-year) evaluation of the FMP.

This will require minimum one annual meeting of the FMU-Level Management Committee during each year of FMP implementation with the possibility of further meetings to address any urgent matters arising. Meetings need to be timed to ensure consistency with the annual planning cycle and financial year.

21.4 Staff

The Chief Forestry Officer, Paro is the overall controlling Officer of the area. The controlling and management of Selela FMU will be looked after by the FMU In-charge. They will be under the administrative control of the Chief Forestry Officer, Paro Division. The Chief Forestry Officer is the direct representative of DoFPS in the field and as such he is solely responsible for all forestry activities, both technical and administrative within his jurisdiction.

Sl No	Designation	Numbers
1	Unit In-charge (Sr. Range Officer/ Forestry Officer)	1
2	Forest Ranger II/ I/ Sr. Forester/ Forester	4

Table 34: Staff allocation in FMU office

21.4.1 Responsibility

For the smooth monitoring and implementation of the plan in the FMU, following staff will be required (Table 34). It is also being recommended by the Organizational Development Exercise by Royal Civil Service Commission.

IMPLEMENTATION OF THE PLAN

The UIC under the guidance of CFO will be directly responsible for the day-to-day implementation of the plan. The Unit In-charge will keep records of all the works, supervise and initiate other silvicultural activities as envisaged in this plan. Unit In-charge will be responsible to CFO, Divisional Forest Office, Paro.

Forest Ranger will be responsible for carrying out operational inventory, help to prepare the operational plan, supervise road construction and maintenance and keep the track of regeneration of the harvested areas. Ranger will also be responsible for supervising the tree marking and felling, timber extraction, transport of logs to depot and reporting the coupe clearance. He will also be responsible for marking of thinning, fire and pest activities. The forest guards will be assigned to help the Forest Ranger.

21.5 Buildings

A unit office for the UIC and his/her subordinate staff will have to be constructed by the Divisional office, Paro. NRDCL will also have to build an office for the Range manager and his/her subordinate staff to stationed unit staff in the field.

21.6 Vehicles and Equipment

The FMU is currently equipped with the following equipment and instruments:

• Computer (Desktop) set- 1, Printer- 1, Laptop- 1, Clinometer- 1, Diameter tape- 1, Measuring tape- 1, Compass- 1, GPS Garmin- 2, Walkie Talkie Sets- 2,

In order to ensure proper implementation of this plan, the Unit must be equipped with additional equipment as mentioned below:

Photocopy machine 1, Altimeter- 1, Binocular- 1, Digital Camera- 1, Tents- 2 Additional Garmin GPS- 2 numbers, Laptop- 1, Hypsometer- 2, Crown densitometer- 2, Bark gauge- 2 numbers

22. MONITORING AND EVALUATION

The primary focus of the Royal Government of Bhutan's forest policy is to ensure conservation of the environment and, only thereafter, to allow the derivation of economic benefits (such as commercial timber production) from the forest. To ensure that this policy is being carried out in the management of FMUs, a two-stage verification process is necessary. The first stage checks that on-ground activities are being carried out as planned in the short term, the second checks that the objectives of the plan are being achieved over the longer term. Monitoring (checking on

inputs on year-to-year basis) is the term used for first stage and evaluation (checking achievements against objectives over five-year periods) is the second stage. Standard forms for monitoring and evaluation were prepared and are available from the Forest Management Code of Bhutan, 2004. The forms for monitoring were subdivided into Physical, Financial and Environmental sections that contained an exhaustive set of questions and the forms for evaluation were also sub-divided into Evaluation form A and Evaluation form B.

The Third Forestry Development Project (TFDP), working closely with the FRMD developed a new monitoring and evaluation process in 1999, for use on FMUs in Bhutan. Different forms were developed on different time scales; **Monitoring Form A** for annual monitoring process, **Evaluation Form A** for the five-year evaluation, and **Evaluation Form B** for one-time Evaluation. The field data collection forms used, consists of **Physical and Financial Forms 1-3, Environmental Forms 4-11** and the **Physical, Financial and Environmental Summary Form.**

22.1 Monitoring

Monitoring is the continuous/periodic review undertaken by management at every level of implementation of an activity to ensure that input deliveries, work schedules, targeted output and other required actions are proceeding according to the plan. The CFO, Paro will ensure that monitoring is carried out on an annual basis according to the guidelines issued by FRMD.

22.2 Evaluation

Evaluation is the examination of whether objectives are being achieved. In the context to FMU evaluation, sufficient time has to elapse before a realistic assessment can be made of progress towards fulfilling objectives (Incoll 1999). Evaluation should be carried out at the intervals of five year, based on the information collected by annual monitoring.

The Head, FRMD will ensure that evaluation is carried out at five-year intervals, based on the information collected by annual monitoring and other necessary information. Copies of necessary forms can be collected from FRMD. Corrective actions, if necessary, may require changes to a range of inputs or to implementation methodology. The evaluation will be carried out by staffs that are independent of the field implementation activities. The evaluation team will be appointed by the Director, DoFPS.

22.3 Record Keeping

Record keeping and reporting is one of the important tools in this management plan of FMU for sustainability and it has to be maintained throughout the plan period. It is essential that all records of activities and operations within the FMU be maintained so that analysis and investigation of past management can be carried out. Record keeping is the backbone of future management decisions and the importance must be stressed by CFO and FMU in-charge.

FMU should keep detail records of the FMU activities by blocks and compartments, commercial and rural, planned and ad hoc separately in the data base of FMU by not only following all the recording forms recommended in the FMCB, but also by maintaining additional data and information. Records related to forestry activities should be updated until end of the plan period and produce a copy for office record. Data collection must also focus on people-not on trees alone since we need to improve our understanding of the people who live in and around forests to measure the importance of forests on social aspects. This would ensure recording and maintaining correct and consistent annual records of FMUs and facilitate mid-term and final evaluation of FMU. The guidelines to complete and fill in the forms; one for Rural Allotment, one for Commercial Allotment and one for Stand Tending and Regeneration activities are available in FMCB, 2004 or in Territorial Divisions, Paro, and FMU office.

22.4 Reporting

FMU In-Charge should keep FMU records in the standard format recommended in the FMCB and any format circulated by the Divisional office and the DoFPS and follow the timeframe for the submission of required information. Any amendments of record through validation should be apprised to CFO, Paro for similar correction and update.

FMU should be able to furnish any kind of data or record to CFO and to the DoFPS at any time and data maintained in any form should be consistent to each other. Required records for mid-term and final evaluation should be made readily available to the evaluation team.

22.5 Evaluation & Compliance

Evaluation is the examination of whether objectives are being achieved. In the context of FMU evaluation, sufficient time has to elapse before a realistic assessment can be made of progress towards fulfilling objectives (Incoll 1999). Evaluation must be carried out at five-year intervals, based on the information collected by annual monitoring.

IMPLEMENTATION OF THE PLAN

The Head, FRMD and CFO, Paro, will ensure that evaluation is carried out at five-year intervals, based on the information collected by annual monitoring and other necessary.

information. Copies of necessary Forms can be obtained from the Territorial Division, Paro, or from FRMD. However, the detailed forms are there in the FMCB for evaluation.

Staff that are independent of field activities will carry out the evaluation. The evaluation team will be constituted by the Head, DoFPS (minimum five members). The team composition for evaluation of BFMU would comprise of the following members from:

FRMD (leading agency)
Policy and Planning Division, MoAF
CFO, Territorial Division (not from same Division)
NRDCL Regional Manager (not from same Division)
RNR-RDC Forestry
Local Government

22.6 Mid-Term Evaluation

The Mid-Term Evaluation of FMU will take place during the last quarter (April-June) of the fifth year (2025) of the FMP period. Team will evaluate implementation of FMU activities based on the required forms and field observation. Observations with suggested recommendations will be provided to FMU and Divisional Forest Office, Paro, for implementation.

CFO and UIC will implement the recommendations and advices of the evaluation team and submit compliance report. Recommendations would be in achievable in short term and long term. However, the Department will provide sufficient time to implementers to implement the recommendations based on their nature of issues and time required.

The findings of mid-term evaluation should be communicated to the FMU Level Management Committee during their annual meeting by the CFO, Paro. Develop action plan based on the recommendations and address by proposing in the cycle of fiscal year of the Government and then into the operational plan. CFO should submit compliance report to the Department for perusal and record.

22.7 Final Evaluation

Final evaluation is to take place during the last quarter (April-June) of the ninth year (2029) of the FMP period. The evaluation team will evaluate FMU activities and specify corrective actions, if necessary, and who should carry out.

FMU and NRDCL will implement recommendations and submit compliance report to the Department through Division. The Divisional Office, Paro and NRDCL will be given sufficient time for implementation based on the nature of issues and recommendations. The final evaluation should directly inform the preparation of the FMP for the subsequent 10-year period.

CFO should communicate findings and recommendations of the evaluation to the FMU Level Management Committee during their annual meeting. Develop action plan and address by proposing in the operational plan. The CFO should submit compliance report to the Department of Forests and Park Services for perusal and record. The recommendations of the evaluation should be incorporated in the next planning period.

23. CONSTRAINTS AND RISKS

The possible risk and constraints in smooth implementation of the management plan are:

- Inadequate funds for forest management
- Uncertainty of natural regeneration, due to excessive grazing and undergrowth competition
- Lack of research information
- Lack of locomotives for field staffs, leading to an inability of the staff to supervise any management activities in the FMU.
- No regular training for field staffs on preparation of operational plans and other related surveys.
- Lack of skilled and trained forest workers
- Lack of sufficient support to UIC
- Poor coordination between field and office staff and between involved parties

Forest Management Plan relates to multiple uses of forest resources. Increasing benefits of one type may impair or damage others. For instance, timber management may lead to underproduction of non-wood forest products and degradation of bio-diversity. For effective assessment, not only the production function, demand and price structure of each product need to

be understood, but also the relationship and conflicts of resource use should be fully comprehended.

24. DEVIATIONS FROM PLAN PRESCRIPTION

The annual harvested AAC should be made to allow for unforeseen situations. For these and other bono fide reasons, the annual AAC may vary +/- 10%. However, the total volume harvested over successive five-year period must be no more than five times the ACC volume.

Unforeseen other circumstances may warrant deviation from the Plan prescription. In such an event, the CFO, Divisional Forest Office, Paro must obtain prior written approval from the Director, DoFPS. Any such request for plan deviation(s) must fully justified and such approved deviation(s) entered into the Management Plan during its next scheduled revision. The NEC Secretariat must be informed of any Plan Deviations approved by the Head of Department

ANNEXURES

25. References

NEC (1999). Bhutan Environment Assessment Sectoral Guidelines

DoFPS, MoAF (2004). Forest Management Code of Bhutan.

RGoB, MoAF (1995). Forest and Nature Conservation Act of Bhutan, 1995. Thimphu

RGoB, MoAF (2011). National Forest Policy of Bhutan.

NEC (2000). Environmental Assessment Act.

RGoB (2011). The Water Act of Bhutan

ANNEXURES

Annexure 1: Compartment Review and Prescriptions

1. **Block: Tegola COMPARTMENT: I SUBCOMP: a**

Altitude: 2600-3687
Topography: Upper- and Lower-part Steep to very steep, Middle part steep
Total area: 171.155ha
Community Forest: 8.03 ha
Protection:43.7ha
Production: 119.82ha
Non-Production: 7.61
Note: Function like soil conservation, wildlife protection and non-forest overlaps

Past Management

The block has been allotted for local use timber production. The timber allotment during last management plan was carried out from the lower side of the block. For this plan period the same block was kept as rural block so that local community would have easy access to timber facilities.

Forest Description

The main species that are found in this compartment are Blue pine, Spruce, Fir, Oak and other miscellaneous species. Except for that Fir stand, all other timber species are of middle aged. Most of the Blue pine and Spruce at the lower altitude are of young age. The uppermost part of this compartment is quite steep and there is also presence of water source points which need to be kept protected from tree marking. Lowermost part should be kept as buffer and upper most part as protection.

Prescription

A small ridge forms the common boundary between Lonchu and Selela FMU. This compartment being very close to the settlement, people might place demand from this compartment. Thus, this compartment will be used for meeting the rural timber demand in this plan period under Single Tree Selection System. However, in upper part of area installation of cable line is recommended to avoid environmental damage during dragging and rolling of timber logs. Although, the upper region block has good timber stock for allotment, considering the small block area and limited timber stock, it might be able to meet demand for local community residing near block only. The allotment to nearby Geog applicants might have to restrict and try outsourcing from other three blocks.

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Block: Tegola COMPARTMENT: I SUBCOMP: b

Altitude: 2560-3140m
Topography: Moderate to steep
Total area: 68.56 ha
Community Forest: 16.50 ha
Protection: 9.99 ha
Production: 47.73ha
Non-Production: 10.82 ha

Note: Function like soil conservation, wildlife protection and non-forest overlaps

Past management

The block was under rural use in last management plan. Further, the timber supply to VVIP, special size timber for Chukha Dzong had been extracted from this sub compartment.

Forest Description

Mixed blue pine and Spruce with Oak around the cultivated areas. Immature blue pine stands in patches.

Prescription

Single tree selection and thinning of immature stands if required

3. **Block: Tegola COMPARTMENT: 2 SUBCOMP: a**

Altitude: 2600-3100m
Topography: Gentle slope to steep
Total area: 276.16 ha
Community Forest: 11.49 ha
Protection:236.66 ha
Production: 17.70 ha
Non-Production: 21.78 ha

Note: Function like soil conservation, wildlife protection and non-forest overlaps

Past management:

Extracted for rural, VVIP and special size timber for Chukha Dzong and Tsirang Dzong construction. Portion above the road had been over harvested. However, during the last management circle no timber extraction was carried out from this block.

Forest Description

Mixture of Blue pine and spruce with dominant pine stands on private registered land. The upper portion of the block is partially covered by Fir and hemlock species.

Prescription

The Major chunk of areas falls under protection zone and however if national timber emergency requirement arises in future, tree may be mark on single tree system from below the national way area. In next working circle the block may be allot for rural use.

4. **Block: Tegola COMPARTMENT: 2 SUBCOMP: b**

Altitude: 2600-3100m
Topography: Steep to very steep
Total area:25.68 ha
Protection:29.25 ha
Community Forest: 60.12 ha
Production: 18.79 ha
Non-Production: 0.35 ha

Note: Function like soil conservation, wildlife protection and non-forest overlaps

Past management

Sanitation felling done with seed broadcast management was carried out extensively after bark beetle sanitation operation. Later sometimes in 2012 major chunk of area was designated as community forest for Dorikha local people. The bark beetle sanitation inside CF is still undergoing and areas which are outside CF were proposed for Plantation in 2019.

Forest Description

Spruce mixed with Pine and Oak in the lower part. Hemlock and Hardwood (Betula) in the upper part. Blank area with bamboo scrub at the top.

Prescription for Future Management

After establishment of Community Forest, very negligible area has been left aside. Therefore, this sub-compartment can neither be used for commercial harvesting nor be allotted for rural timber harvesting. The areas left after designation of Community Forest should be monitored properly so that the timber demand pressure is not felt in the surrounding GRF land.

5. **Block: Tegola COMPARTMENT: 3 SUBCOMP: x**

Altitude: 3300m-3900m
Topography: Steep to very steep
Total area: 588.51
Protection: 503.78 ha

Production: 76.17 ha
Non-Production: 8.55 ha

Note: Function like soil conservation, wildlife protection and non-forest overlaps

Past management

This block was used for local timber supply as well as for commercial timber extraction in the last management circle. Owing to steep terrain condition no major commercial timber extraction works were carried out. The rural timber allotment was carried out almost for last nine years from this same block.

Forest Description

Lower part Spruce mixed with Blue pine and upper areas are dominated by Fir mixed with hard wood trees.There are two blank areas in the northern part of the compartment and Haa- Samtse national high way fall withing this block.

Prescription for Future Management

The block is under protection zone and harvesting is restricted for this plan period. However, since there is local community residing nearby two small blocks has been identified for national emergency timber supply. The marking to be allow on single tree selection system. The grazing should be minimized in the sub-compartment so that regenerations are established within short period of time. Sanitation operations may be carried out if required

6. Block: Tegola COMPARTMENT: 4 SUBCOMP: x

Altitude: 2520m - 4100m
Topography: Steep and moderate steep
Total area: 788.13 ha
Protection: 385.16 ha
Production: 384.76 ha
Non-Production: 18.20 ha

Note: Function like soil conservation, wildlife protection and non-forest overlaps

Past management:

Protection along the Haa Chu, upper part of the compartment is also protected and steep part in the middle are protected too. Group selection system with sanitation felling had been done. Limited thinning for local use and it had been prescribed to be not more than 10% of the volume. Commercial as well as major timber for local use, VVIP timber and Timber for Chukha and Tsirang Dzong construction had been extracted from this compartment.

ANNEXURES

In the second management plan period total of 14 cable lines were installed for commercial timber extraction by NRDCL. Two patches of areas were also clear felled for bark beetle sanitation operation. Just below the road near Lamjogang village the VVIP timber has been extracted

Forest Description

Spruce with Hemlock just above Haa Chu, Blue pine with Spruce at the lower portion around settlements. Blue pine commonly appears on drier sides and Hemlock on cooler side along gullies. In the upper part, fir mixed with Hardwood is seen and are matured. Alpine scrub on the ridge top (Tegola).

Prescription for Future Management

For this plan period upper portion of compartment is allocated for meeting local timber demand. The silviculture system for tree marking will be under single tree selection. However, in geographically inaccessible areas, installation of cable lines will be allowed after conducting detail feasibility study. The approval for cable line installation to be seek from department after consultation with relevant parties.

As commercial harvesting was carried out in below current identified rural use compartment, if required thinning operations should be carried out in areas where blue pine regeneration is dense. The UICs is recommended to use local use shapefiles with available technical resources to validate rural boundary with protection and commercial extraction area. The marking of tree should be on single tree selection system and wherever gradient are steep UICs and marking officer must retain area and avoid any marking. Moreover, the past operated lines should be monitored periodically to ensure that adequate regeneration occurs in the harvested lines. Grazing should be minimized in this compartment to ensure proper establishment of regenerations in the operated sites

7. **Block: Selela COMPARTMENT: 1 SUBCOMP: a**

Altitude: 2740m-3680m
Topography: Gentle steep to steep
Total area: 302.55ha

Protection: 111.19 ha
Production: 173.51 ha
Non-Production: 17.84 ha

Note: Function like soil conservation, wildlife protection and non-forest overlaps

Past management

The commercial harvesting operations using cable crane was carried out during the second plan period. Total of approximately 26 number of cable lines were installed for timber extraction. Regeneration survey and Plantation had been done along the corridors and group openings.

Forest Description

Mixed conifers mainly spruce mixed with blue pine. Uppermost portion is protected owing to steep slope and low regeneration rate. Group selection system for commercial harvesting and enrichment planting or gap fills should be done if the survival rate of the plantation is low.

Prescription for Future Management

As commercial harvesting operation in this sub-compartment was completed during the second plan period, the cable corridors and groups should be monitored regularly for regenerations. The upper portion of (above Sektena road) block is kept for Local use. The installation of cable line and k500 is recommended to extract timber logs so that damage to environment minimized. The cable line approval to be seek from Department. The UICs is recommended to use local use shapefiles with available technical resources to validate rural boundary with protection and commercial extraction area. The marking of tree should be on single tree selection system and wherever gradient are steep UICs and marking officer must retain area and avoid any marking. The grazing should be minimized in the sub-compartment so that regenerations are established within short period of time. Sanitary operations may be carried out if required.

8. Block: Selela COMPARTMENT: I SUBCOMP: b

Altitude: 3200-3900m
Topography: Steep to very steep
Total area:267.44 ha
Protection: 255.34 ha
Production:11.70 ha
Non-Production: 0.39 ha

Note: Function like soil conservation, wildlife protection and non-forest overlaps

Past management

The compartment was under soil protection zone and no logging activities observed however, farm road to Sektena village has been constructed inside this compartment during 2nd plan period.

Forest Description

Alpine scrub at the top, Fir mixed with Hemlock at the lower part.

Prescription for Future Management

As the over matured fir trees occupies the steep upper ridges of the compartment, no commercial harvesting could be prescribed. Most of the area under this compartment is designated as protection and non-production working circle. Small portion of block area is kept for local use timber extraction. The marking of tree should be on single tree selection system and wherever gradient are steep UICs and marking officer must retain area and avoid any marking. The cable line approval to be seek from Department. The Plantations could be carried out in the blank areas so that the sustainability of timber could be assured in the future.

9. Block: Selela COMPARTMENT: 2 SUBCOMP: a

Altitude: 2800m-3900m
Topography: gentle at the lower portion to steep at upper part.
Total area: 270.72ha
Protection:138.79
Production:131.01 ha
Non-Production: 0.91 ha

Note: Function like soil conservation, wildlife protection and non-forest overlaps

Past management

The commercial harvesting operations using cable crane was carried out during the second plan period with upper part under protection zone. Total of 13 numbers of cable line were installed by NRDCL for commercial timber extraction.

ANNEXURES

Forest Description

The upper most portions consist of Alpine scrub on the ridge top and scattered distribution of matured Fir. The middle portion consists of mature Hemlock. The lower portion consists of immature stand of Blue Pine mixed with few matured Hemlock. There is also presence of hard wood understory in the lower part.

Prescription for Future Management

As commercial harvesting operation in this sub-compartment was completed during the second plan period, the cable corridors and groups should be monitored regularly for regenerations. The grazing should be minimized in the sub-compartment so that regenerations are established within short period of time. Sanitary operations may be carried out if required.

10. Block: Selela COMPARTMENT: 2 SUBCOMP: b

Altitude: 2800m-3900m
Topography: Steep to very steep
Total area: 137.68ha
Protection:53.46 ha
Production:84.21 ha

Note: Function like soil conservation, wildlife protection and non-forest overlaps

Past management

The commercial harvesting operations using cable crane was carried out during second plan period with upper part under protection zone. Total 2 numbers of cable line were installed by NRDCL for commercial timber extraction

Forest Description

Spruce mixed with Hemlock in the upper part and Fir in the higher elevation. Also, Alpine scrub in the higher elevation.

Prescription for Future Management

As commercial harvesting operation in this sub-compartment was completed during the second plan period, the cable corridors and groups should be monitored regularly for regenerations. The grazing should be minimized in the sub-compartment so that regenerations are established within short period of time. Sanitary operations may be carried out if required.

11. **Block: Selela** **COMPARTMENT: 3** **SUBCOMP: a**

Altitude: 2720m-3900m
Topography: Gentle to steep
Total area:212.16 ha
Protection:73.60 ha
Production:138.32 ha
Non-Production: 0.23 ha

Note: Function like soil conservation, wildlife protection and non-forest overlaps

Past management

The commercial harvesting operations using cable crane was carried out during second plan period with upper part under protection zone. Total of 12 numbers of cable line were installed by NRDCL for commercial timber extraction

Forest Description

Alpine scrub at the top of the compartment with Spruce and Hemlock at the lower portion.

Prescription for Future Management

As commercial harvesting operation in this sub-compartment was completed during the second plan period, the cable corridors and groups should be monitored regularly for regenerations. The grazing should be minimized in the sub-compartment so that regenerations are established within short period of time. Sanitary operations may be carried out if required.

12. Block: Selela **COMPARTMENT: 3** **SUBCOMP: b**

Altitude: 2800m-3900m
Topography: Steep to very steep
Total area: 170.73 ha
Protection: 112.66 ha
Production: 57.77 ha
Non-Production: 0.28 ha

Note: Function like soil conservation, wildlife protection and non-forest overlaps

ANNEXURES

Past management

The commercial harvesting operations using cable crane was carried out during second plan period with upper part under protection zone. Total of 8 numbers of cable line were installed by NRDCL for commercial timber extraction

Forest Description

Spruce with Hemlock and Blue pine regeneration in the blank area. Middle portion consists of Hemlock with Blue pine with hardwood under story. In the upper most part there is presence of Alpine scrub

Prescription for Future Management

As commercial harvesting operation in this sub-compartment was completed during the second plan period, the cable corridors and groups should be monitored regularly for regenerations. The grazing should be minimized in the sub-compartment so that regenerations are established within short period of time. Sanitary operations may be carried out if required.

13. **Block: Selela** **COMPARTMENT: 4** **SUBCOMP: a**

Altitude: 2800m-3200m
Topography: Steep slope towards the stream
Total area: 54.75 ha
Protection: 3.55 ha
Production:49.64 ha
Non-Production: 1.56 ha

Note: Function like soil conservation, wildlife protection and non-forest overlaps

Past management

Bark beetle sanitation was carried in this compartment. With large area being expose after group opening the vegetation is covered with under growth bamboo species. Apart from sanitation two number of cable line were also installed below road for commercial timber extraction.

Forest Description: Mainly Hemlock mixed with Spruce and Hardwood under story.

Future management: Single tree selection system if demand comes from national construction otherwise, Group selection system for commercial harvesting and Regeneration survey should

ANNEXURES

Prescription for Future Management

As partial commercial harvesting operation in this sub-compartment was completed during second plan period, the cable corridors and groups should be monitored regularly for regenerations. The grazing should be minimized in the sub-compartment so that regenerations are established within short period of time. Sanitary operations may be carried out if required. Further, additional plantation may be required to fill up the open areas.

14. Block: Selela COMPARTMENT: 4 SUBCOMP: b

Altitude: 2800m-3600m
Topography: Steep slope along the both side of the stream.
Total area: 63.95ha
Protection: 7.45 ha
Production:55.81 ha
Non-Production: 0.68 ha

Note: Function like soil conservation, wildlife protection and non-forest overlaps

Past Management

The commercial harvesting operations using cable crane was carried out during second plan period with upper part under protection zone. Total of 8 numbers of cable line were installed by NRDCL for commercial timber extraction

Forest Description

Hemlock in scattered form dominates the area, with immature Blue Pine in the lower region. Quercus sp. does exist there although not significantly in good quantities as that of Hemlock.

Prescription for Future Management

As partial commercial harvesting operation in this sub-compartment was completed during second plan period, the cable corridors and groups should be monitored regularly for regenerations. The grazing should be minimized in the sub-compartment so that regenerations are established within short period of time. Sanitary operations may be carried out if required. Further, additional plantation may be required to fill up the open areas.

15. Block: Selela COMPARTMENT: 4 SUBCOMP: c

Altitude: 3200m-3600m
Topography: Very steep throughout the compartment.
Total area: 140.78 ha
Protection: 104.73 ha
Production: 35.79 ha
Non-Production: 0.25 ha

Note: Function like soil conservation, wildlife protection and non-forest overlaps

Past management

Commercial harvesting activities were not carried out during the previousplan.

Forest Description

Fir with Hemlock in the upper part and Hemlock with Spruce in the lower portion.

Prescription for Future Management

The compartment can be taken up for commercial harvesting given that it is feasible for NRDCL to extract timber. The commercial harvesting can be carried out only on the lower portion where Fir, Spruce and Hemlock species of commercial girth are available.

16. Block: Selela COMPARTMENT: 4 SUBCOMP: d

Altitude: 3600m-3900m
Topography: Upper steep to very steep at the lower portion.
Total area:145.95 ha
Protection: 145.95 ha
Production: Nil

Note: Function like soil conservation, wildlife protection and non-forest overlaps

Forest Description

Fir mixed with Hard wood under story. Alpine scrub along the top of the ridge

Past management: Untouched

Future Management: Protected

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17. Block: Selela **COMPARTMENT :5** **SUBCOMP: x**

Altitude: 2400m-2800m
Topography: Steep to Gentle
Total area: 176.81 ha
Protection: 176.81 ha
Production: Nil

Past management

The entire compartment was identified for Protected as Biodiversity Reserve in the 1st management plan, however in 2nd management plan implementation period, approximately 7 to 10 number of cable lines were found installed inside the area. Since only small portion of areas were disturbed by cable line, FRMD plan reviewing committee during the plan presentation agreed to maintain areas as Bio-Diversity Conservation area. The area got reduced because of the boundary realignment.

Forest Description: Mixed conifer (Hemlock, Spruce and Blue pine) with thick understory of Hardwood.

Prescription for Future Management

The area should strictly maintain under protection zone and any kind of tree marking and collection of NWFP inside the area to be prohibited. Any individuals/Government institutes who desire to study or conduct research should seek research clearance from department.

18. **Block: Holela** **COMPARTMENT: 1** **SUBCOMP: a**

Altitude: 2800m-3800m
Topography: Steep slope from the stream till the top of the ridge
Total area:234.29 ha
Protection: 82.41 ha
Production: 151.88 ha

Note: Function like soil conservation, wildlife protection and non-forest overlaps

Past management

The commercial harvesting operations using cable crane was carried out during second plan period with upper part under protection zone. Total of 18 numbers of cable line were installed by NRDCL for commercial timber extraction

ANNEXURES

Forest Description

Mixed coniferous mainly Hemlock mixed with Spruce in the middle and lower part and Fir in the upper reaches. Pockets of Pine in the lower parts on the warmer sites.

Prescription for Future Management

As commercial harvesting operation in this sub-compartment was completed during second plan period, the cable corridors and groups should be monitored regularly for regenerations. The grazing should be minimized in the sub-compartment so that regenerations are established within short period of time. Sanitary operations may be carried out if required.

19. Block: Holela COMPARTMENT: 1 SUBCOMP: b

Altitude: 2600m-2700m
Topography: Very steep above Haa chu
Total area: 26.05 ha
Protection: 2.64 ha
Production: 23.41 ha

Note: Function like soil conservation, wildlife protection and non-forest overlaps

Past management

Commercial harvesting activities were not carried out during the previous plan.

Forest Description

Hemlock and Spruce with thick undergrowth of Hardwood

Future Management

The compartment can be taken up for commercial harvesting given that it is feasible for NRDCL to extract timber. The commercial harvesting can be carried out with maintaining of buffer to nearby stream and Haa chu river

20. Block: Holela COMPARTMENT: 2 SUBCOMP: a

Altitude: 2400m-3880m
Topography: Fairly Gentle throughout the compartment
Total area: 519.31 ha
Protection: 33.49 ha
Production:482.92 ha

Non-Production: 2.89 ha

Note: Function like soil conservation, wildlife protection and non-forest overlaps

Past management

The commercial harvesting operations using cable crane was carried out within small portion of compartment during second plan period. The cable line installed was only 2 number in the previous plan. The whole compartment is suitable for commercial timber harvesting. The first commercial harvesting for this plan period (Third management plan period) will begin from this compartment. Total of seven cable line has been proposed for extraction from this compartment.

Forest Description

Mixed Conifer (Hemlock and Fir in the upper part and Spruce and Blue pine in the middle and lower part.)

Prescription for Future Management

As partial commercial harvesting operation in this sub-compartment was completed during second plan period, the cable corridors and groups should be monitored regularly for regenerations. The grazing should be minimized in the sub-compartment so that regenerations are established within short period of time. Sanitary operations may be carried out if required.

Further, this compartment will be used for commercial harvesting under Group Selection System in this plan period.

21. Block: Holela COMPARTMENT: 2 SUBCOMP: b

Altitude: 2800m-3160m
Topography: Steep slopes along each side of the stream.
Total area:103.09 ha
Protection:12.67 ha
Production: 90.43

Note: Function like soil conservation, wildlife protection and non-forest overlaps

Past management

The compartment was in protection zone in pervious zone, however in this plan period based on the ground truthing, the area is allotted for commercial timber production area.

ANNEXURES

Forest Description

Mixed Conifer (Hemlock mixed with Spruce and Hard wood in the western part) Considerable area of pine in the eastern aspect.

Future Management

The compartment can be taken up for commercial harvesting given that it is feasible for NRDCL to extract timber. The commercial harvesting can be carried out with maintaining of buffer to nearby stream and Haa chu river

22. Block: Holela COMPARTMENT: 2 SUBCOMP: c

Altitude: 2600m-3800m
Topography: Gentle to steep slope in the middle portion and steep in the upper part.
Total area: 244.74 ha
Protection: 57.18 ha
Production: 187.56 ha

Note: Function like soil conservation, wildlife protection and non-forest overlaps

Past management

The compartment was allotted for local and commercial timber production in previous plan. However, both rural and commercial timber were not harvest during previous plan

Forest Description

Mixed Conifer (Hemlock mixed with Fir and Hardwood in the upper part and with Spruce in lower part. Blue pine on the drier and warmer side and small pockets of Larch in the lower part.

Prescription for Future Management

As the compartment has lot of middle-aged blue pine trees, it has been designated as local use area. The compartment will be used for allotment of rural timber and firewood for the local communities. The markings will be done as per the prescriptions of single tree selection system. Since some part of block is located below forest road, the installation of K500 or sky cable line is recommended to extract timber to road point. The cable line approval to be seek from Department. The marking of tree should be on single tree selection system and wherever gradient

is steep, the UIC and marking officer must retain area and avoid any marking from that particular area. Strict buffer to be maintained from streams, forest road and other water sources.

Block: Holela COMPARTMENT: 2 SUBCOMP: d

Altitude: 3800m-4800m
Topography: Steep area below the upper ridges.
Total area: 65.17 ha
Protection: 65.17 ha
Production: nil

Note: Function like soil conservation, wildlife protection and non-forest overlaps

Past Management: Protected zone

Forest Description

Alpine scrub in the upper ridge and Fir with Hemlock at the lower part.

Prescription for Future Management: Protected zone

23. Block: Holela COMPARTMENT: 3 SUBCOMP: a

Altitude: 2600m-2740m
Topography: Very steep slope, gorge above Haa chu
Total area: 112.5 ha
Protection: 65.17 ha
Production: 47.33
Non-Production: 1.19 ha

Note: Function like soil conservation, wildlife protection and non-forest overlaps

Past management

The compartment was in protection zone in pervious zone, however in this plan period based on the ground truthing it was observed that timber can be harvested from most of the block areas. therefore, the compartment is allotted for local use.

Forest Description

Mixed conifer (Mixture of Spruce and Pine on drier areas) Hemlock with Hardwood in some part.

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Prescription for Future Management

It has been designated as local use area. The compartment will be used for allotment of rural timber and firewood for the local communities. The marking of tree should be on single tree selection system and wherever gradient is steep, the UIC and marking officer must retain area and avoid any marking from that particular area. Strict buffer to be maintained from streams, forest road and other water sources. The installation of K500 or sky cable is recommended in manually dragging inaccessible areas. The cable line approval to be seek from Department.

24. **Block: Holela** **COMPARTMENT: 3** **SUBCOMP: b**

Altitude: 2600m-3280m
Topography: Fairly gentle around the settlement, steep towards the stream separating compartment 3 to comp 4.
Total area: 231.69
Protection: 27.83 ha
Production:157.70 ha
Non-Production: 46.15 ha

Note: Function like soil conservation, wildlife protection and non-forest overlaps

Past management

The compartment was allotted for local timber production in previous plan. However, rural timber was not harvest during previous plan

Forest Description

Patches of Blue pine surrounding cultivated land, Spruce and Hemlock mixed with Blue pine and Hard wood in the eastern part of the compartment along the stream. Patches of young Pines indicating abundant regeneration around cultivated land.

Prescription for Future Management

For this management plan the compartment is designated as local use area. The allotment of rural timber and firewood for local use will be met from this compartment on single tree selection system.

25. Block: Holela **COMPARTMENT: 3** **SUBCOMP: c**

Altitude: 2750m-3800m
Topography: Gentle slope at the lower portion to steep slope near the ridges.
Total area: 242.54 ha
Local area: 7.68ha
Protection: 71.88 ha
Production:170.66 ha

Note: Function like soil conservation, wildlife protection and non-forest overlaps

Past management: Untouched

Forest Description

Fir and Hemlock upper part and Spruce and Hemlock mixed with patches of Blue pine and Hardwood.

Prescription for Future Management

For this management plan the compartment is designated as local use area. The allotment of rural timber and firewood for local use will be met from this compartment. The marking of tree should be on single tree selection system and wherever gradient are steep, the UIC and marking officer must retain area and avoid any marking from that particular area. Strict buffer to be maintained from streams, forest road and other water sources. The installation of K500 or sky cable is recommended in manually dragging inaccessible areas. The cable line approval to be seek from Department.

Block: Holela **COMPARTMENT: 3** **SUBCOMP: d**

Altitude: 3800m-4080m
Topography: Steep at the upper part and fairly gentle at the lower part of the sub-compartment.
Total area: 91.74 ha
Protection: 62.02 ha
Production: 29.29
Non-Production: 0.44 ha

Note: Function like soil conservation, wildlife protection and non-forest overlaps

Past management: Untouched and protected

Forest Description

Fir mixed with Hemlock and Hardwood in the part and Alpine scrub at the uppermost portion of the Sub-compartment.

Prescription for Future Management: Protected zone

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26. Block: Holela **COMPARTMENT: 4** **SUBCOMP: a**

Altitude: 2400m-3600m
Topography: Very steep near the stream and gentler in the rest of the sub-compartment
Total area: 201.99 ha
Protection: 47.40 ha
Production:154.59 ha

Past management: Untouched

Forest Description

Mixed Conifer (Mainly Hemlock mixed with Spruce and Pine in the drier sites.) Hardwood is common.

Prescription for Future Management

The compartment can be taken up for commercial harvesting given that it is feasible for NRDCL to extract timber. Group selection system, with groups not exceeding 0.15 ha for commercial timber extraction to be followed.

27. Block: Holela **COMPARTMENT: 4** **SUBCOMP: b**

Altitude: 3000m-3800m
Topography: Very steep in lower part of sub-compartment and steep towards the ridges.
Total area: 80.73 ha
Protection: 10.70 ha
Production: 70.02 ha
Use: Protected
Past management: Untouched and protected

Forest Description

Alpine scrub at the upper part or top of the ridge and fir mixed with Hemlock and Spruce in the lower part of Sub-compartment.

Prescription for Future Management

Upper portion is Protected zone under soil protection and lower part are proposed for commercial timber extraction in this plan period.

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28. **Block: Holela** **COMPARTMENT: 5** **SUBCOMP: a**

Altitude: 2600m-2740m
Topography: Very steep-gorge towards Haa chu
Total area: 356.56
Protection: 167.66 ha
Production: 188.74 ha
Non-Production: 0.15 ha

Note: Function like soil conservation, wildlife protection and non-forest overlaps

Past management: Untouched and protected

Forest Description: Mixture of Hemlock with Hardwood and Spruce and pine in drier and warmer places.

Prescription for Future Management

Upper portion is proposed for commercial timber extraction in this plan period. However, the lower part of the compartment is designated as Protected zone

29. Block: Holela **COMPARTMENT: 5** **SUBCOMP: b**

Altitude: 2400m-3600m
Topography: Steep slope in most part of the sub-compartment
Total area: 753.71 ha
Protection: 104.13 ha
Production: 638.25 ha
Non-Production: 11.33 ha

Note: Function like soil conservation, wildlife protection and non-forest overlaps

Past management: Untouched

Forest Description

Fir mixed with Hemlock in the middle of the sub-compartment. Considerable area of Spruce mixed with Hemlock and Blue pine in the western part of the sub-compartment. Patches of young Blue pines in the east part of the middle section.

Future Management

ANNEXURES

The compartment can be taken up for commercial harvesting in this plan period. The Group selection system, with groups not exceeding 0.15 ha for commercial timber extraction to be followed. Light thinning in the Blue pines stands for chams and poles.

30. **Block: Chhepji** **COMPARTMENT: 1** **SUBCOMP: x**

Altitude: 2100m-3500m
Topography: Steep near the river otherwise gentle
Total area: 648.33 ha
Protection: 153.85 ha
Production:434.43 ha
Non-Production: 31.34 ha

Note: Function like soil conservation, wildlife protection and non-forest overlaps

Past management: local use

Forest Description

Quercus in the lower part, Blue pine mixed with Spruce and Hard wood. Good Blue pine regeneration around the cultivated land.

Prescription for Future Management

For this management plan the compartment is designated as local use area. The allotment of rural timber and firewood for local use will be met from this compartment. The marking of tree should be on single tree selection system and wherever gradient are steep, the UIC and marking officer must retain area and avoid any marking from that particular area. Strict buffer to be maintained from streams, forest road and other water sources. The installation of K500 or sky cable is recommended in manually dragging inaccessible areas. The cable line approval to be seek from Department.

Block: Chhepji **COMPARTMENT: 2** **SUBCOMP: x**

Altitude: 2900m-4800m
Topography: Gentle steep down the river
Total area: 1283.32 ha
Protection: 341.41 ha
Production:938.84 ha
Non-Production: 3.06 ha

Note: Function like soil conservation, wildlife protection and non-forest overlaps

ANNEXURES

Past management: Untouched with most upper portion under protection zone

Forest Description

Spruce mixed with pine and Oak in the lower part. Hemlock mixed with Hard wood in the upper part. Blank area with Bamboo scrub at the Top.

Prescription for Future Management

The compartment can be taken up for commercial harvesting given that it is feasible for NRDCL to extract timber. Group selection system, with groups not exceeding 0.15 ha for commercial timber extraction to be followed.

ANNEXURES

Annexure 2: Road and Standards

The road standards developed in the east by TFDP will be implemented for design, drainage and construction of all forest roads in the Selela FMU.

Road Design

- Road lengths and density should be minimized, consistent with access requirements to reduce environmental impacts and enhance access economics.
- Where possible locate roads in areas with low side slopes, the maximum side slopes allowed in all areas except rock is 100%.
- Roads must be constructed in such a way that no earth works or soil spill into water courses or watercourse buffer areas. Care should also be taken to ensure that no earth works or soil is allowed to spill onto agricultural land, near houses or main roads.
- Roads should be planned in such a way as to balance cut and fill to minimize transport of construction materials.
- Roads should not be constructed in steep and unstable areas where there is the possibility of landslide. A thorough survey of any area suspected of being unstable should be undertaken prior to work commencing.
- Roads should be kept as narrow as possible to reduce damage to the environment and to reduce costs.
- Where possible, box cuts should be avoided, however they are acceptable for short distances (up to 300 m), if they reduce the length of the road, reduce environmental damage and are properly drained.
- Minimum radius formed by curves or corners should be 15m and should where possible fit the topography of the land.
- Roads should be located on elevated areas where possible to minimize side cutting, width of clearing and drainage problems.
- Side cutting should be carried out leaving a stepped batter, each step no more than 3m in vertical height and no more than 100% gradient with a 1.5m horizontal step.
- Convex road surface should be maintained at all times with the center line 30cm higher than the edges.

- Stabilize and revegetate cut and fill slopes with shrubs, grasses and legumes as soon as possible after construction.
- Ensure proper maintenance of roads and enforce road use restrictions during critical weather conditions such as monsoon seasons.

Drainage

- Road planning should ensure that roads are located in such a way as to minimize stream river crossings and avoid areas which are prone to floods during monsoon
- In areas where side slopes of 70% or greater extend for a distance of 100 m or more above the proposed road catch drains should be constructed to divert surface water into culverts. Side drains or table drains should be at least 40 cm deep and 65 cm wide and should drain into culverts of sufficient size and frequency
- All culverts must have stone or concrete aprons at their exit points to prevent erosion by water. These aprons should be of suitable width and design to prevent any erosion, taking place and should extend down the slope for at least the length of the spill. They should divert the water back into the stream if the water came from a stream.
- Culverts of appropriate diameter (not less than 30 cm) should be placed at regular intervals along the road. The following table gives the minimum spacing required according to road gradient. Should the roadside drain be composed of erodible material then the distance between the culverts must be reduced by 50%.

Road Gradient (%)	Distance Between Culverts (m)
4	110
5-8	90
9-10	80
11-15	60

Culverts should be laid at 2 to 5 % gradient across the road to enable water to flow but should not exceed 6% as damage from erosion will result. Culverts pipes (Hume pipe) should be buried a minimum of 700 mm below the surface of the road.

- In areas of high seasonal rainfall, catch drains should be constructed above the road to collect surface runoff and prevent it from reaching the road.

- Drains should not be allowed to directly enter a watercourse but should be diverted into surrounding vegetation at least 50 m before a watercourse
- Sumps or silt traps should be places in drains every 50 m in erodable soils and must be cleaned regularly.

Road Construction

- All timbers above 30 cm diameter must be felled and removed from the road alignment, the remaining timber should be cut and burnt (no organic material should be used as fill).
- Primary excavation should be done in such a manner as to remove the topsoil and place it on the downward slope of the road. This will allow vegetation to regenerate and stabilize the slopes
- Where side slopes of 70% or more extend more than 100 m downhill no side casting of spoil should be allowed. In this situation end haul methods must be used
- Forest roads should only be constructed on stable soil types where there is no possibility of slippage
- All road construction on side slopes of over 50% or difficult terrain, such as boulder fields, must be carried out using excavators
- Batter and fill slopes should not exceed 100%.
- Where road construction is carried out on side slopes of over 90% rock or concrete wall should be built to support both batter and fill (this is not required in solid rocks).
- On side slopes of over 70% all of the load carrying surface of the road must be built on stable ground. The road should not be supported by fill.
- The adverse gradient should not exceed 10%. However, grades of up to 12%will be allowed for distances of up to 300 m if this substantially reduces road length. Following this incline, a minimum distance of 100 m of grades of10% or less must be maintained
- The favorable gradient should not exceed 12%. However, grades of up to15% for distances of up to 300 m will be allowed if this substantially reduces road length. These grades should be followed by grades of less than 10% for distances of 100 m or more.

ANNEXURES

Annexure 3: Environmental Impact Assessment of Forest Road

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Natural Resources Development Corporation Ltd.

ROYAL GOVERNMENT OF BHUTAN

THIMPHU: BHUTAN

NRDCL
dhi Company

NRDCL/HQ/Engg-Sec/13/2020/ 988 June 19, 2020

The Chief Forestry Officer
Territorial Forest Division
Paro

Sub: **Environment Impact Assessment (EIA) Report of Selela FMU**

Ref: PFD/RAMS/FRMS-13/1393 dated 02/03/2020

Sir,

With reference to above cited letter, please kindly find herewith the enclosed Environmental Impact Assessment Report of Selela FMU forest road for revision of FMU plan. The entire report consists of Environmental Management Plan, Google earth images showing the tentative road alignment, dump sites & Labor camp locations for the execution of timber operational works in the next ten years.

For any queries please contact Mr. Nidup Dorji Jr. Engineer, Forest Resource Division at 02-323868/323834 or email: nidupdorji@nrdcl.bt.

This is submitted for your kind information and further necessary action please.

Yours sincerely,

(Sonam Wangchuk)
Chief Executive Officer

Copy to:

1. Chief Forestry Officer, FRMD, DoFPS, for kind information.
2. General Manager, Forest Resource Division, NRDCL HO for necessary action.
3. Regional Manager, Rinpung Regional Office, Paro, for necessary actions.

To be the premier institution in providing reliable and quality natural resource products and services to support nation building.

Post Box No. 192. | Telephone No. CEO: +975-2-322615 | EPABX: +975-2-323834/323868/ 328959 | Fax No.: 00975-2-325585 | E-mail: **info@nrdcl.bt** | website: www.nrdcl.bt

ANNEXURES

ENVIRONMENTAL IMPACT ASSESSMENT REPORT FOR CONSTRUCTION OF FOREST ROAD AT SELELA FMU, HAA DZONGKHAG UNDER NRDCL RINPUNG REGION

1 Name of the applicant : Natural Resources Development Corporation Limited

2 Name of project : Construction of Forest Road

3 Present mailing address : Chief Executive Officer, NRDCL Thimphu, P.O. Box no. 192, Tel. no. 326749, EPABX no. 00975-02-323834/323868. Fax no. 00975-02-325585. Email: info@nrdcl.bt

4 Name of environmental focal person : Mr. Nidup Dorji, Jr. Engineer, Forest Resource Division, NRDCL HQ, Thimphu. Tel. no. 02-323834/323868. Email: nidup.dorji@nrdcl.bt

5 Project objectives : Timber harvesting & afforestation of harvested areas

6 Relevence to overall planning : Revision of Forest Management Plan

7 Funding and costs : Funded by NRDCL, Thimphu

: Nu. 31,100,000.00

8 Project description

8.1 Project location : Continuation from existing forest road.

Table 1: Road location details by Dzongkhag and Geog

Road chainage		Dzongkhag	Gewog	Town	Village
From	To				
0+0000	10000+0000	Haa	Naja		Bempo

8.2 Category of road : Access road

8.3 Road specification

Table 2. Road Specification/Quantities

Item	Unit	Specification/Quantities
Right of way clearing	m	10.00
Formation Width	m	5.00
Pavement Width including edging	m	3.50
Pavement material (Edging & soling)	cum	13,140.87
Volume of excavated material		
a) Excavation in soil all type	cum	67,128.66
b) Excavation in rock all type	cum	15,301.38
Average road gradient	%	±9
Maximum road gradient	%	±12
Cross drain	no	NIL
Box/Hume pipe culvert	no	29
V-shaped side drain diamensions		
In soil (horizontal x vertical)	cm	40CM X 30 Cm
In rock (horizontal x vertical)	cm	30 CM X 20 CM
Total length of v-shaped drain	m	9,898.50
Box shaped side drain diamensions (lengthxbreadthxheight)	cm	NIL
Total length of box drain	m	NIL

8.4 Excavated Materials : The excavated material will be managed and disposed off safely at designated locations through the use of excavator and tipper trucks or hydraulic tractors.

8.5 Explosives : Approximate quantity of explosive to be used is as under:

Sl. No	Particulars	Quantity		
1	Safety fuse	1320 coils	(Approx)	
2	detonator	2310 Nos.	(Approx)	
3	D-chord	1870 m	(Approx)	
4	Jelatine	2970 kgs	(Approx)	

10

Control single shot blasting technique will be adopted with the engagement of a trained & certified blaster.

9 Alternatives : NIL

10 Public Consultation : Public consultation meeting conducted

11 Project site Physical Environmental details

11.1 Topography and Geology

Table 3: Topography and observations along the road

Chainage(Km 0+000)		distance (m)	Side slope (%)	Observation on geology & possible problem	Method of slope & terrain stabilization Above & Below road
From	To				
0 + 000	0 + 10000	10,000.00	10 -120	Thimphu Gneiss complex formation & no problem foreseen	Normal Bio-engineering + Retaining & Breast wall structure works wherever required.
Total		**10,000.00**			

11.2 Water Course Crossings

Table 4: Details of water courses that will require crossing along the proposed road

Chainage at which road crosses water course	Name of water course	Type of crossing	If bridge, Length of bridge (m)	Down stream water users- details		
				Name of community or individual	House hold (no)	Type of use
0+000 + 0+102	N A	Hume pipe culvert	NIL	None	None	None
0+102 + 0+123	N A	Hume pipe culvert	NIL	None		
0+123 + 0+298	NA	Hume pipe culvert	NIL	None		
0+298 + 0+317	NA	Hume pipe culvert	NIL	None		
0+317 + 0+346	NA	Hume pipe culvert	NIL	None		
0+346 + 0+422	NA	Hume pipe culvert	NIL	None		
0+422 + 0+687	NA	Hume pipe culvert	NIL	None		
0+687 + 0+895	NA	Hume pipe culvert	NIL	None		
0+895 + 1+258	NA	Hume pipe culvert	NIL	None		
1+258 + 1+859	NA	Hume pipe culvert	NIL	None		
1+859 + 1+907	NA	Hume pipe culvert	NIL	None		
1+907 + 1+969	NA	Hume pipe culvert	NIL	None		
1+969 + 2+083	NA	Hume pipe culvert	NIL	None		
2+083 + 2+200	NA	Hume pipe culvert	NIL	None		
2+200 + 2+503	NA	Hume pipe culvert	NIL	None		
2+503 + 3+519	NA	Hume pipe culvert	NIL	None		
3+519 + 3+751	NA	Hume pipe culvert	NIL	None		

3+751 + 3+812	NA	Hume pipe culvert	NIL	None	None	None
3+812 + 4+312	NA	Hume pipe culvert	NIL	None		
4+312 + 5+916	NA	Hume pipe culvert	NIL	None		
5+916 + 6+356	NA	Hume pipe culvert	NIL	None		
6+356 + 6+812	NA	Hume pipe culvert	NIL	None		
6+812 + 6+7642	NA	Hume pipe culvert	NIL	None		
7+642 + 8+148	NA	Hume pipe culvert	NIL	None		
8+148 + 8+423	NA	Hume pipe culvert	NIL	None		
8+423 + 8+951	NA	Hume pipe culvert	NIL	None		
8+951+ 9+444	NA	Hume pipe culvert	NIL	None		
9+444 + 9+758	NA	Hume pipe culvert	NIL	None		
9+758 + 10+000	NA	Hume pipe culvert	NIL	None		

12 Project Site Ecological Description

12.1 Land Use/Vegetation

Table 5: Land use and forest clearance required for road construction

Chainage from take off		Land use	Area (M^2)	Tenure	Affected House hold no
From	To				
0 + 000	10 + 000	Mixed conifer forest	100,000.00	10 years	NIL

Table 6: Areas Required for Project Facilities

Facility	Land use	Area (m^2)	Tenure/ownership	Remarks
Labour camp	Mixed conifer forest	2000 per annum	Govt. reserve forest	Till project completes
Others				

12.2. Protected area : The protected areas such as Soil protection, local water supply protection, Reparian protection, Wild life protection etc. shall be indentified where no commercial activities shall be allowed.

13 Project social environment

13.1. Population

Table 7: Project Beneficiaries. Households with possible access <2km either side of the road

Dzongkhag	Gewog	Households (No)
Haa	Naja	9

Source of information: As per the villager of Bempo

Loss of Houses, Services, Infrastructure and Cultural Heritage Sites

Type of loss	NOS	Description of disturbance
Service	NIL	NIL
House	NIL	NIL
Infrastructure	NIL	NIL
Cultural sites	NIL	NIL

Heritage	NIL	NIL

13.3 Aesthetics

No aesthetic distrubance is foreseen however, grass seeding & other bio-engineering technique measures shall be applied on the slopes for reclaiming immediately after road construction.

14 Project Impacts and Mitigation Measures

Type of negative impact	Mitigation measures	Estimated metigation costs
Blockage of water canal	Cleaning & maintenance	Nu. 10,000.00 (Lumpsum)
House	NIL	NIL
Infrastructure	NIL	NIL

14.1. Monitoring Program

Monitoring of the construction works will be done by Site supervisor, Selela Unit, NRDCL, including time to time monitoring by the Unit Manager, Selela Unit under Rinpung Regional Office, Paro. The Regional Manager, Rinpung Regional Office, NRDCL Paro, shall also carry out the frequent monitoring. Also the Engineer from Forest Resource Division, NRDCL HO, shall carry out the monitoring of the construction works as & when required.

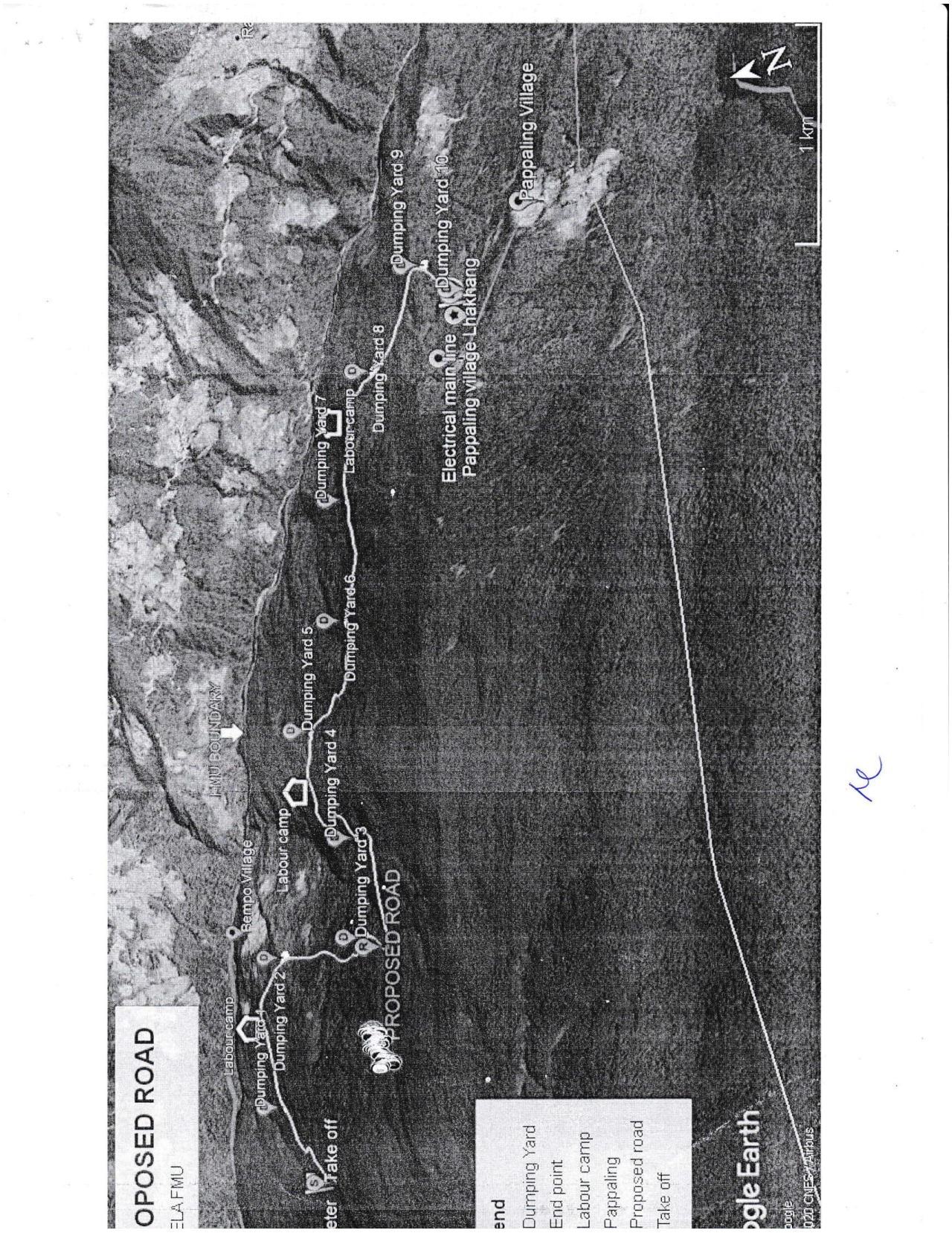
(Nidup Dorji)
Junior Civil Engineer
Forest Resource Division, NRDCL,HO

ENVIRONMENTAL MANAGEMENT PLAN FOR THE CONSTRUCTION OF ROAD

Sl. No.	Activity	Potential Negative Environment Impact	Mitigation Measures	Public Participation and Coordination	Socio-Economic and cultural considerations	Budgeting	Supervision	Monitoring
1	Work camp location, operation & closure, restriction on workers (sanitation, fuel wood collection, poaching etc.)	• Garbage, oil & grease pollution Damage to vegetation & wildlife	• Provide sanitary facilities and restore • Provide fuel to workers	• DoF&PS • Awareness of labours	• Consider local culture and compensate, if required	• Incorporated	• Unit Manager • Site supervisor	• Regional Manager • Engineer, NRDCL HQ • External team
2	Explosive & toxic waste management	• Fire & explosion hazard • Ground & surface water pollution	• Do not store near surface water • Use plastic sheeting under hazardous material • Collect waste properly & dispose off safely	• Contact Ministry of Home & Cultural Affairs in case of hazard or needing material innihilation	• Consider local drinking water sources	• Incorporated	• Unit Manager • Site supervisor	• Regional Manager • Engineer NRDCL HQ • External team
3	Water Management	• Sedimentation of surface water • Slope failure • Creation of new gullies • Water seepage	• Build check dams • Tap excess water by catch drains and dispose off to natural gullies	• Involve locals when deciding about discharge location • Dzongkhag administration	• Irrigation channel and drinking water supplies need consideration	• Will be incorporated if required.	• Unit Manager • Site supervisor	• Regional Manager • Engineer NRDCL HQ • External team

(Nidup Dorji)
Jr. Civil Engineer
Forest Resource Division, NRDCL HO

ANNEXURES


OPOSED ROAD
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Take off
Dumping Yard 1
Labour camp
Dumping Yard 2
Rempo Village
Labour camp
Dumping Yard 3
PROPOSED ROAD
Dumping Yard 4
Dumping Yard 5
Dumping Yard 6
Dumping Yard 7
Labour camp
Dumping Yard 8
Dumping Yard 9
Dumping Yard 10
Electrical main line
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Labour camp
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ANNEXURES

Annexure 4 : Tree Marking Guidelines

Marking Guidelines for Group Selection System

The Group Selection System aims to secure natural regeneration by imitating nature in the creation of small opening in the forest stand; thus, allowing light to reach the forest floor and creating favorable microclimatic condition for seed germination and seedling establishment. It is important to avoid damage to the remaining standby selecting only trees that will fall into the opening and ensuring that accurate felling is carried out.

- ✓ Small groups spaced at specified interval will be harvested removing all tress over 10 cm DBH.
- ✓ The group will be located along extraction lines.
- ✓ The distance between the extraction lines will be no less than 60 m.
- ✓ The distance between the groups, along the extraction lines, will be less than50 m.
- ✓ The shape of the harvested groups can be irregular, according to the site and terrain conditions.
- ✓ Existing opening in the stand having already established regeneration should be used as a nucleus for marking the groups.
- ✓ Signs of existing wind fall in the stand should form the basis of the opening. In such a case, opening boundaries should correspond to changes in soil moisture that is often the cause of the windfall.
- ✓ Wind firm trees must surround the selection groups. This could be achieved by leaving intermediate height trees along the edge of the opening.
- ✓ The trees will be marked for harvesting along the extraction corridors.
- ✓ The extraction corridors must be as narrow as possible; 2-4 m in the Fir stands and no wider than 4 m in the Spruce and Hemlock stands.
- ✓ The maximum size of the groups will be on an average less than 0.15 hectares depending on the sites characteristics and stand condition.
- ✓ Diseased, dead and malformed tress will be marked on the priority basis and should be used as a nucleus for creating as opening.

- ✓ Boundaries of opening should, where possible corresponds to change in slope. An opening should not end in the middle of a steep slope since tree will slide into the remaining stand during logging.
- ✓ Care must be taken in choosing the boundary of the opening. Trees, which can be expected to fall into the opening, should be marked while trees leaning out of the proposed opening must be left standing so as to minimize damage to the remaining stand.
- ✓ Trees damaged during harvesting will be cut and removed in the subsequent cleaning operations.
- ✓ Fruiting trees and some hollow trees which will have less economic value will not be harvested; it will be left for preserving biodiversity.

Marking guidelines for Single Tree Selection System

Felling under the Single Tree Selection System should be done in accordance with the following guidelines:

- ✓ Trees marked for harvesting will be evenly distributed throughout the stand.
- ✓ Diseased, malformed, dead and decaying trees will be marked on a priority basis; especially these are hampering the better ones (unless objectives of biodiversity conservation dictate otherwise). These trees can be marked even if below the set diameter limit of 50 cm. However, care should be taken that no large openings are created in the stand by marking these trees.
- ✓ Trees of exploitable size should be marked, particularly if defective or lacking in vigor; mature and over-mature trees over 50 cm DBH outside bark to be marked.
- ✓ No more than one third of the stand volume should be marked for harvesting.
- ✓ In mixed stands, an even and suitable distribution of species should be left standing.
- ✓ Fruiting trees and some hollow trees which will have less economic value will not be harvested; it will be left for preserving biodiversity.

Marking Guidelines for Blue Pine under Seed Tree System

- ✓ The seed tree system is used in pure pine stands or mixed stands consisting of mixture of pine and spruce with pine predominating.
- ✓ The Seed Tree System will be used in the above stands only on suitable sites.
- ✓ The system will not be used on steep and exposed, South or South-West sites.
- ✓ In mixed stands, an equal distribution of pine and spruce will be left standing.

- ✓ Slope characteristics, wind firmness and aesthetic value will be considered.
- ✓ About 20 to 25 trees per hectare (i.e. approximately 22 to 26 meters apart) will be left standing.
- ✓ Diseased, malformed and dying trees will be cut on priority basis.
- ✓ Trees left standing will be of good health and form to ensure good seed source.
- ✓ The shape of the area chosen for the seed tree can be irregular.
- ✓ Maximum size of a contiguous area harvested using this system should not exceed one hectare.
- ✓ Fruiting trees and some hollow trees which will have less economic value will not be harvested; it will be left for preserving biodiversity.

Marking Guidelines for Thinning in Blue Pine Stands

Thinning will be carried out in immature stands. The objective of thinning is to increase growth and quality of stands and at the same time provide small dimension. Healthy, vigorous trees will be released by cutting.

Spacing and stand Density Regulation

The spacing of trees should be roughly 2 m and the resulting stand density, approximately 2,500 trees/ha. Preferentially maintain admixed species, unless damaged or malformed. Mean maximum diameters of solitary blue pines provide guidance for optimal size dependent stand density considering a 25% deduction of mean maximum crown dimensions for optimal spacing in closed stands. Trees in closed stands will not develop the crown dimensions of free growing (solitary) trees and at the same time individual tree growth and stand growth have to be optimized.

A too severe reduction of stem density (increase of spacing for optimized growth of individual trees) would result in lower standing volume per hectare.

Selection of Plus Trees

Once the stand reaches crown closure at the beginning of pole stage (at top heights of 12-15 m), differentiation between trees in terms of performance and quality will start to become clearly visible in case initial spacing has been carried out. Trees forming part of the stand at time of the

final cut (plus trees) have to be selected and marked during this time. A change or supplementary marking of plus trees at a later stage are not possible.

The number of plus trees depends on the target diameter during the final harvest. Considering crown dimensions with a target DBH of 50 cm at rotation period of100-130 years, selection of 200 plus trees per hectare resulting in a spacing of 7 m between plus trees is recommended. In case the target production for the stand is40 cm DBH at final harvest, optimal spacing is 6-6.5 m resulting in 260 stems per hectare (Darabant, Rai, Eckmullner, Gratzer, &Gyeltshen, 2012).

In case of doubt, stability should have priority before quality. In locations where suitable trees are lacking, no plus tree should be selected. While carrying out thinning operations, special care should be given to plus trees in order to protect them from damage. In case initial spacing has not been carried out, stands reaching pole stage are densely stocked and differentiation between trees in terms of vitality and quality is not clearly visible. Marking of plus trees at this stage is not meaningful.

Therefore, a series of low-intensity thinning entries should be completed before trees are differentiated enough in terms of stability and quality criteria so that selection of plus trees can be carried out (Darabant, Rai, Eckmullner, Gratzer, &Gyeltshen, 2012).

- ✓ For each plus tree, mark the one or two (maximum three) strongest competitors for removal in order to provide it enough growing space. Ideally, the total volume removed should be around 25% corresponding to moderate thinning intensity
- ✓ Paint plus trees with yellow band to signalize their importance and for ease of marking in subsequent entries. Trees with such a yellow band should be protected throughout the stand development as they represent the final crop
- ✓ The remaining stand may optionally be thinned, but this is not an essential requirement. In case of thinning the remaining stand, concentrate on removal of malformed and diseased trees.
- ✓ In case the favored tree (plus tree or other) has a crown ratio below half or an asymmetric crown, remove maximum one competitor in order not to jeopardize stability
- ✓ Remove trees affected by dwarf mistletoe on a top priority basis.
- ✓ The stems of forked trees belong to the same vegetative individual and have to be treated together- if you remove one, you have to remove both.
- ✓ Remove malformed trees and trees with other diseases than dwarf mistletoe

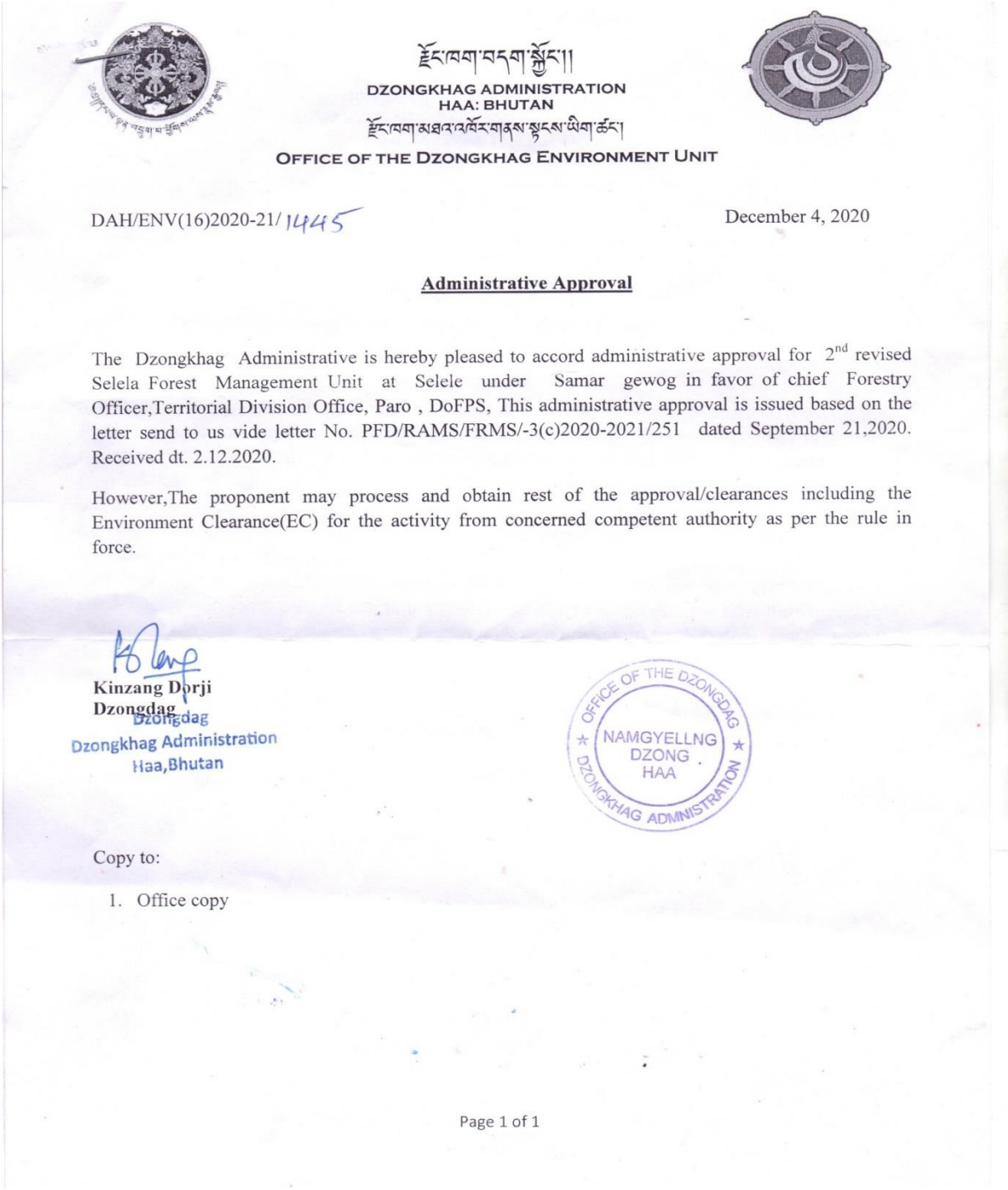
- ✓ Marking should not result in creation of gaps in the canopy
- ✓ Focus on maintaining a well-structured stand
- ✓ Focus on promoting a mixed-species stand
- ✓ Do not blaze trees in the remaining stand. Blazing wounds weaken the trees and provide entry point for pathogens, devaluating the most valuable first log of the tree
- ✓ Remove wolf trees (large emergent trees remaining from an earlier cohort) in a priority basis and do not consider their volume within the target of 25%volume removal
- ✓ Do not worry about having to induce regeneration in the course of thinning
- ✓ Thinning is primarily about stand improvement and is not a regeneration cut (Darabant, Rai, Eckmullner, Gratzer, &Gyeltshen, 2012).

Marking for Rural Uses

- ✓ It is necessary that the marking for rural use, whether for timber or fuelwood, should be done under standard Silvicultural system.
- ✓ Firewood marking when necessary should be done under Single Tree Selection System from local use area only
- ✓ Flag posts, fence posts and poles demand should be met by marking for thinning in the pole crop high density stands thereby subjecting the stands to Silvicultural thinning

ANNEXURES

Annexure 5: Haa Dzongkhag Administrative Approval



རྫོང་ཁག་བདག་སྐྱོང་།།
DZONGKHAG ADMINISTRATION
HAA: BHUTAN
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OFFICE OF THE DZONGKHAG ENVIRONMENT UNIT

DAH/ENV(16)2020-21/ 1445 December 4, 2020

Administrative Approval

The Dzongkhag Administrative is hereby pleased to accord administrative approval for 2nd revised Selela Forest Management Unit at Selele under Samar gewog in favor of chief Forestry Officer,Territorial Division Office, Paro , DoFPS, This administrative approval is issued based on the letter send to us vide letter No. PFD/RAMS/FRMS/-3(c)2020-2021/251 dated September 21,2020. Received dt. 2.12.2020.

However,The proponent may process and obtain rest of the approval/clearances including the Environment Clearance(EC) for the activity from concerned competent authority as per the rule in force.

Kinzang Dorji
Dzongdag
Dzongdag
Dzongkhag Administration
Haa,Bhutan

OFFICE OF THE DZONGDAG
NAMGYELLNG DZONG HAA
DZONGKHAG ADMINISTRATION

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Page 1 of 1

ANNEXURES

Annexure 6: Paro Dzongkhag Administrative Approval

རྒྱལ་ལྷན་འབྲུག་གཞུང་།
THE ROYAL GOVERNMENT OF BHUTAN
རྫོང་ཁག་བདག་སྐྱོང་སྡེ།
DZONGKHAG ADMINISTRATION, PARO

རིན་སྤུངས་རྫོང་།
RINPUNG DZONG

DAP/DEC/04/2020/ 1410

November 18, 2020

Mr. Lhendup Tharchen
Chief Forest Officer
Department of Forest
Paro

Subject: Dzongkhag Administrative Approval

Sir,

This has a reference to your application received vide letter no. PFD/RAMS/FRMS-3-2020-2021/576 dated October 23, 2020 with regard to issuance of administrative approval for 3rd selela Forest Management Unit Plan under Naja geog, Paro Dzongkhag..

In this regard the Dzongkhag administration is pleased to issue the Dzongkhag administrative approval for the said activity however the activity should be carried out with strict adherence to NEPA 2007, EA Act 2000 and its regulation 2016 and any other rules and regulation in force.

The administrative approval will stand valid only upon obtaining the required environmental clearance from the concerned competent authority.

Yours sincerely,

(Kinley Gyeltshen)
DZONGRAB

Cc:

1. Gup, Naja geog for kind information please

ANNEXURES

Annexure 7: Chukha Dzongkhag Administrative Approval

ཨོཾ་དཔལ་ལྡན་འབྲུག་གཞུང་།
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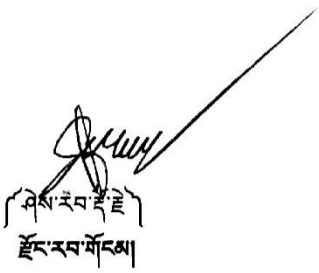
ROYAL GOVERNMENT OF BHUTAN
Chukha Dzongkhag Administration
Ngoedrup-Tse Dzong Chukha

ཆུ་རྫོང་/བདག་སྐྱོང་-০২/২০২০/ ২৭৭৫ ཟླ་ཚེས ০৭/০৯/২০২০ལ།

ཁོང་གསེལ་ཤིང་ཚས་ཚོང་བསྒྲུར་འཐབ་ཆོག་པའི་གནང་བ།

༡ དེ་རེས་སྤོ་རོ་མངའ་སྡེ་ནགས་ཀྱི་གཙོ་འཛིན་འགོ་དཔོན་ཀྱི་ཡིག་ཤང་པི་ཚེཥའི/ཤར་ཞེ་ཚེཥཚེས/ཚེཥ་ཤར་ཚེཥཚེས-ཟླ་སི།২০২০-২০২১ཟླ་ཚེས་ ২১/০৮/২০২০ ཅན་མ་ལྷོད་པ་བཞིན་དུ་ རང་བཞིན་འཐོན་སྐྱེད་གོང་འཕེལ་ལས་འཛིན་ཚད་ནས་ ཁོང་གསེལ་ཤིང་ཚས་ ཚོང་བསྒྲུར་འཛིན་སྐྱོང་འཆར་གཞི་འདི་ སྤྲོན་མ་ཡོད་ལས་གནང་བ་ཡོད་དེ་འབད་རྒྱང་ ལོ་ངོ་১০ ཟླ་ཚེས་ ২১/১২/২০২০ ཉིན་ལས་རྫོགས་སོངམ་ལས་བརྟེན་ ཟླ་ཚེས་ ১/১/২০২১ ལས་འགོ་བཟུང་ ལོ་ངོ་১০དོན་ལུ་ གཤམ་འཁོད་ཞེད་འོག་གི་ ས་གནས་ཁག་ལས་གྲོགས་ཤིང་ཚས་ ཚོང་བསྒྲུར་འཐབ་ཆོག་པའི་གནང་བ་སྦྱོད་ཡོད་པའི་ཀུ་ལྱ།

གདུང་ན་དང་སྨད་ལྷག་ཁ་ ས་གནས་སྐུ་གཞི་དང་སྣ་སྒྲིང་།



ཁེས་རྟེབ་རྡོ་རྗེ།
རྫོང་རབ་གོངམ།

འབྲ/১-སྤུ་རོ་ནགས་ཚལ་གཙོ་འཛིན་འགོ་དཔོན་ལ།
১-དཀེ་འབྲུ་ནགས་ཚལ་གཙོ་འཛིན་འགོ་དཔོན་ལ།
২-གདུང་དང་སྨད་ལྷག་ཆུར་১ལ།

ANNEXURES

Annexure 8: Sama Geog Administrative Approval

ROYAL GOVERNMENT OF BHUTAN
GEWOG ADMINISTRATION
SAMAR GEWOG
HAA DZONGKHAG.

Ref:SG(01)/2020-2021/575 01/10/2020

Chief Forestry Officer

Department of Forest and Park Services

MOAF

Paro

Subject: Administrative Approval Letter

As per the letter received dated 21-09-2020 for the administrative approval, the 2nd management plan was finalized in consultation with local people residing within FMU areas and the Gewog Administration is pleased to inform your kind office that the revised management plan (2021-2031) for Selela Forest Management unit has been approved for implementation.

Submitted for your kind information and needful action.

Thanking you

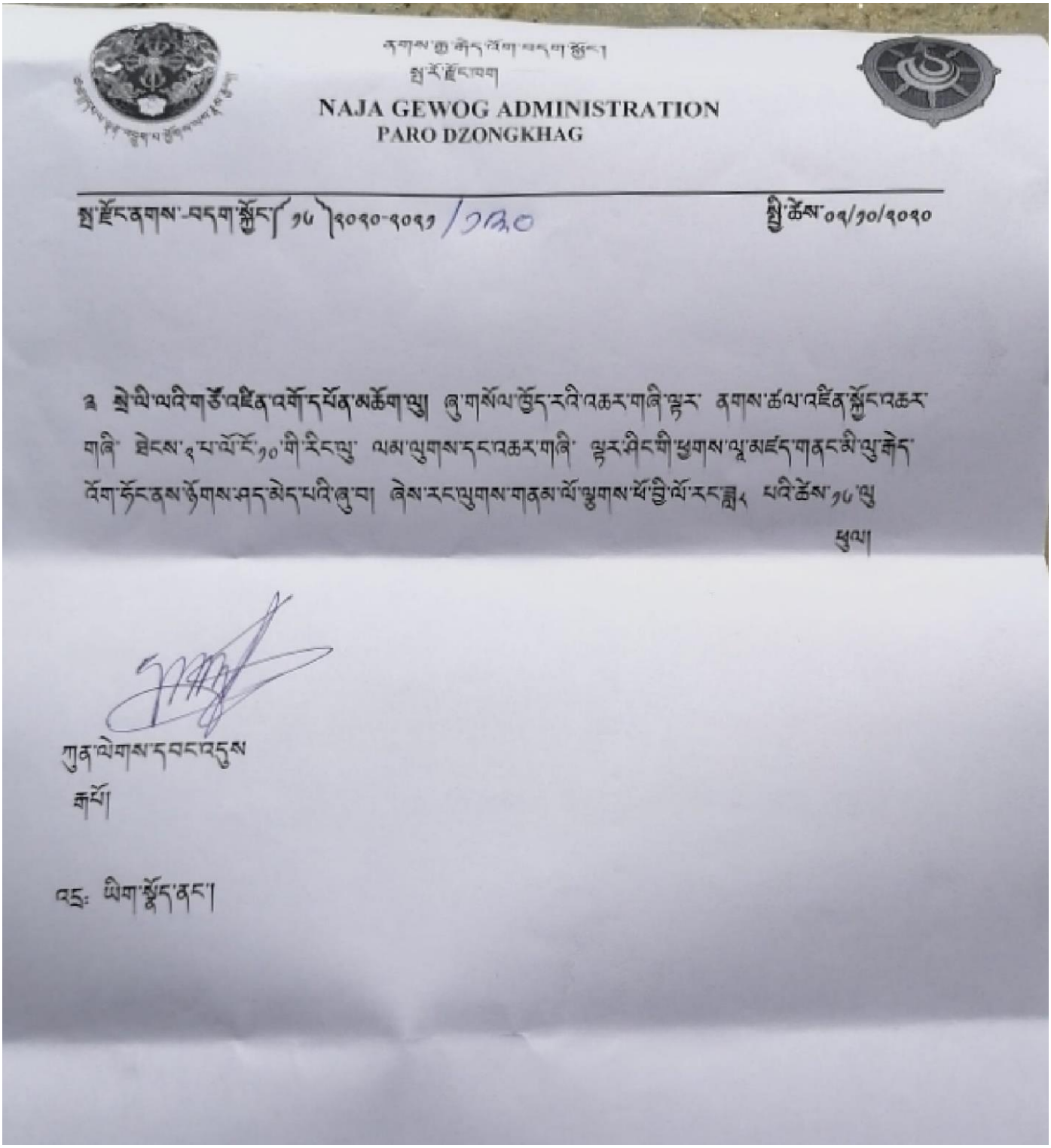
Yours sincerely

(Tshewang Tobgay)
Gup

Gewog Administration, Samar, Haa Dzongkhag.

ANNEXURES

Annexure 9: Naja Geog Administrative Approval



ནག་སྡ་ཀེད་ཁོག་གདུག་སྡོང་།
སྤྱི་རྫོང་ཁག

NAJA GEWOG ADMINISTRATION
PARO DZONGKHAG

སྤྱི་རྫོང་ནག་གཞུང་/ ྨ ༦ ༢༠༢༠-༢༠༢༡ /ྨ୨୦ སྤྱི་ཚེས་ ༠༡/ ྨ ༠/ ༢༠༢༠

མཐེ་ཡི་ལའི་གཅོ་འཛིན་འགོ་དཔོན་མཆོག་ལྟ། ཞུ་གསོལ་ཁྱོད་རའི་འཆར་གཞི་ལྟར་ ནགས་ཚལ་འཛིན་སྐྱོང་འཆར་གཞི་ ཐེངས་ ༢ པ་ལོ་ངོ་ ྨ ༠ གི་རིང་ལུ་ ལམ་ལུགས་དང་འཆར་གཞི་ ལྟར་ཤིང་གི་སྤུགས་ལུ་མཛོད་གནང་ཡི་ཨེད་ བོག་རྟོང་ཆས་ཀྱི་གས་ཤད་མེད་པའི་ཞུ་བ། ཞེས་རང་ལུགས་གནས་ལོ་སྤུགས་ཐོ་བྱི་ལོ་རང་རྒྱ། པའི་ཚེས་ ྨ ༦ ལུ

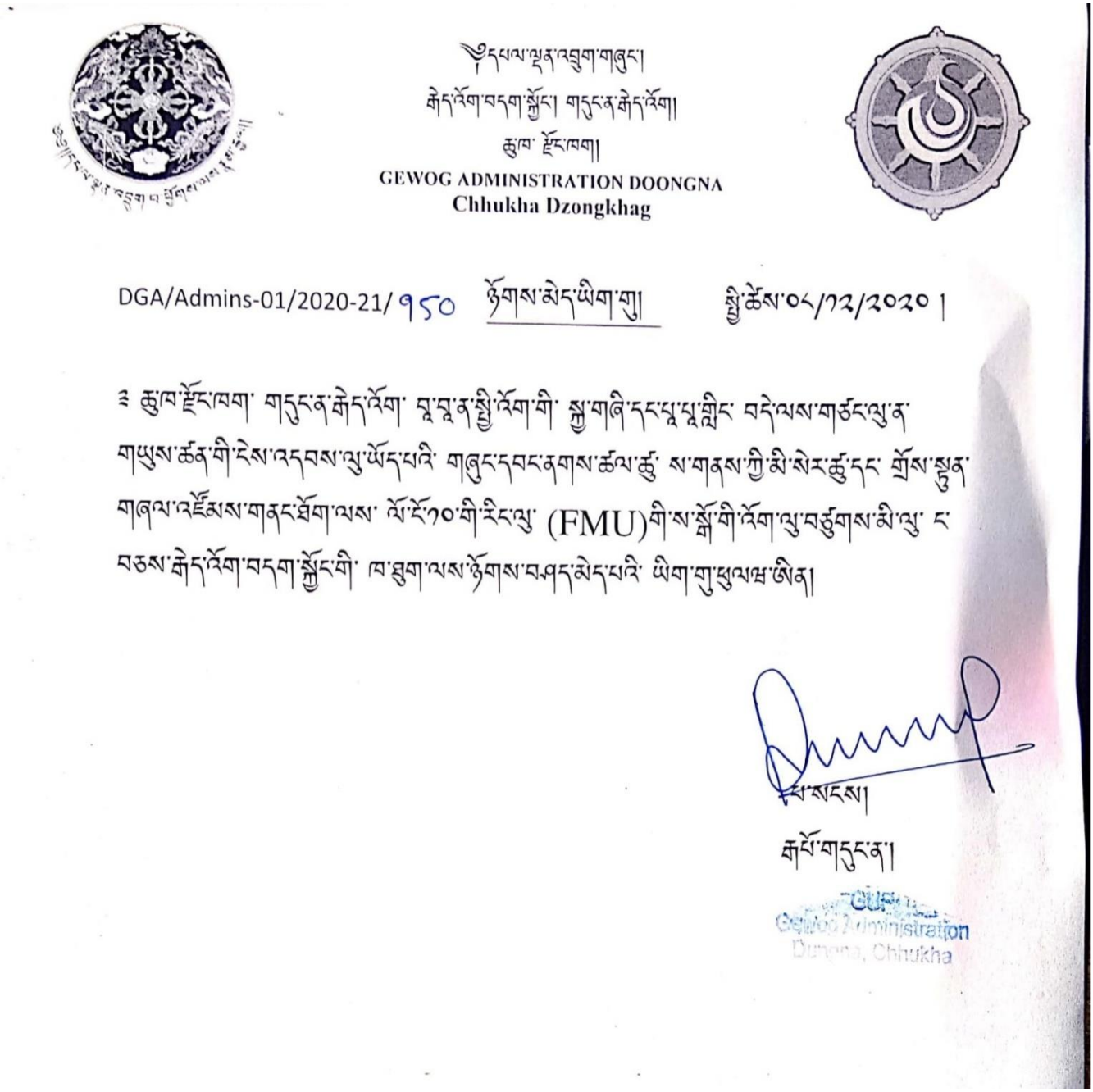
ཕུལ།

ཀུན་ལེགས་དབང་འདུས
རྣལ་

འདྲ། ཡིག་སྟོད་ནང།

ANNEXURES

Annexure 10 : Doongna Geog Administrative Approval



ཀྲི་དཔལ་ལྡན་འབྲུག་གཞུང་།
རྡེད་འོག་བདག་སྐྱོང་། གདུང་ན་རྡེད་འོག།
ཆུ་ཁ་ རྫོང་ཁག།
GEWOG ADMINISTRATION DOONGNA
Chhukha Dzongkhag

DGA/Admins-01/2020-21/ ९५० ཨོག་ལེད་ཡིག་གྱ། སྤྱི་ཟླ་༠༤/༡༢/༢༠༢༠ །

རེ ཆུ་ཁ་རྫོང་ཁག་ གདུང་ན་རྡེད་འོག་ བྱ་བྱ་ན་སྤྱི་འོག་གི་ སྐུ་གཞི་དང་པྱ་པྱ་གྲིང་ བདེ་ལས་གཅོད་ལྷ་ན་ གཡུས་ཚན་གི་རེས་འདབས་ལྷ་ཡོད་པའི་ གཞུང་དབང་ནགས་ཚལ་ཚུ་ ས་གནས་ཀྱི་མི་སེར་ཚུ་དང་ བྱོས་སྤྱན་ གཞལ་འཛོམས་གནང་ཐོག་ལས་ ལོ་ངོ་༧༠གི་རིང་ལྷ་ (FMU)གི་ས་སྒོ་གི་འོག་ལྷ་བཙུགས་མི་ལྷ་ ང་བཅས་རྡེད་འོག་བདག་སྐྱོང་གི་ ཁ་ཐུག་ལས་ཨོག་བཤད་ཟེད་པའི་ ཡིག་གྱ་ཕྱོགས་ཁེན།

རྟེ་སངས།
རྡོ་གདུང་ན།

Gewog Administration
Dungna, Chhukha

ANNEXURES

Annexure 11: Minutes of Meeting

Minutes of Meeting conducted in different Geogs

Dated: 22nd September, 2020

Objective: Selela FMU New Management Plan Consultation meeting.

Place: Gewog meeting Hall: Naja Gewog.

Chaired By: Naja Gup.

Member presence:

1. Sherab Jamtsho (FO, RAMS)
2. Tsheltrim Dorji (FO)
3. Dorji Wangchuk (Sr.FR II, Selela FMU In-Charge)
4. NRDCL Selela In-Charge
5. Singye Wanagdi (Betikha FMU-Incharge.
6. Namgay Wangchuk (FR I, RAMS)
7. Bempu Tshogpa and two villagers
8. Jaba Lingzhi CFMG committee.

Introduction

Selela Forest Mangement Unit was initially established in 2010 with its 10 years management plan drawn in 2010 and successfully completed in 2020. The second cycle of 10 years management plan writing was initiated since mid of 2019 with inception of vigorous resources inventory for 2 months. The one of the important parts of plan has always been consultation meeting with communities and local government residing within and periphery of the management areas and incorporate their management ideas and concerns. Therefore, giving much importance of the communities' involvement in successful plan implementation in next 10 years, the consultation meeting was organised in Gewog Meeting Hall of Naja Gewog. FO Sherab of Resource Allocation and Management Section open the session with presentation on status of Selela FMU with subsequent presentation on new management plan. The presentation mainly covered on working cycle of the FMU for next ten years. He also presented on rural blocks, buffers and protection areas designated in new management plan and open the session for discussion to the committee present. The issues, discussions and resolutions of the consultation meeting are as following:

Sl.No	Issues	Discussions	Resolutions
1	**FMU Roads**	Bempu Chiwog Tshogpa questioned on sustainability and quality of the FMU road. He said the road doesn't benefit any of the communities beside NRDCL themselves citing the example as Nagu top road. Further he expressed the concern on damage that logging and transportation may bring	The Gewog Thrizin and communities dis-courage NRDCL from using their farm road for transportation of timber or whatsoever reasons if they couldn't carry out timely maintenance.

		to their farm road if NRDCL happens to use their farm road due to unavoidable circumstances. To this Selela NRDCL In-Charge said the conditions of FMU road have to compromised to certain extend and hampered by distance of the road and limited budget allocated for maintenance and new construction. The new plan has 10km FMU road construction.	
2	**Protection Areas**	The culturally significance areas, and other vulnerable areas from degradation have to designate as protection areas beside steep slope, watersheds and shrubs (Forest Management Code of Bhutan, 2003.) Beside areas already designated as protection areas the communities believe another as cultural significance and therefore, needed to be designate as protection.	All religious and cultural sites were included in protected zone. The area has cultural significance as per communities and believe it as sacred.
3	**Rural Block**	The areas inside FMU designated for extraction of timber for Rural House Building is called Rural Block. Rural blocks were designated after close consultation with representative of Bempu village. The communities of Bempu village are skeptic about the fact that rural blocks are designated in and around their village. They are worried that it may cause shortage of timber resources for the community. Community expressed their interest in formation of community forest and request if few areas can spare from Rural Blocks for the same.	Considering the fact that no duplication of management plans is entertained by Hon'ble Director and scientifically proven redundant there is very slim chance where community can establish Community Forest inside FMU. And also due to the fact that Bempu village has direct benefits of forest resources from the rural block therefore the committee unanimously decided to keep rural block as it was planned. The first preference for timber allotment will be given to local community and if there are no applicant from community the allotment will be made to near-by community and then to other Geogs within the FMU. The

ANNEXURES

			timber allotment to outside Geogs and Dzongkhag will be made only after fulfilling demand within the FMU settlements.
4	**Buffer (Stream, road and river)**	Citing example as Nagu Top of Haa-East FMU (clear-felled without considering buffers), the member presence questioned the ground application of what they considered as wonderfully scripted plan. While they are wanderlust by the plan well presented, they are equally skeptic of execution of plan in field reality. To this FO Sherab and Selela In-charge briefed the mass that since operation at Nagu top was carry-out due to bark-beetle infestation and therefore, it's unavoidable circumstance where all infested trees had to felled irrespective of buffer or protection.	Strict protection of buffer as per forest Management Code of Bhutan to be implemented and monitored from time to time. 1. Within 30 meters from both side of critical river and 60m from local water source and must prohibited from all kind of activities. 2. Within 30 meters from streams, farm roads and FMU roads must prohibit from felling.

Consultation meeting for Selela Forest Management Plan Revision

Date:20th September, 2020.

Venue: Samar GT Hall.

Participants:

1. Gewog Thrizin.
2. Chiwog representatives (Dorikha)
3. Dawa NRDCL Selela In-Charge.
4. Sherab Jamtsho FO, Paro
5. Tsheltrim Dorji FO, Paro
6. Kinley Wangchuk FR- I UIC Lonchu
7. Tempa Gyeltshen FR-I RO, Haa
8. Dorji Wangchuk Sr. FR-I UIC Selela FMU

Opening Remarks: Dorji Wangchuk (Sr.FR 2) welcome speech to participants.

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Introduction:

The main objective of consultation meeting is to bring public/communities on board for the sustainable management of forest. As the first phase of 10year management plan was successfully completed in mid of 2019 and since then the office has been working on revision and implementation of next 10-year management plan. It is prerequisite to bring communities and their management ideas and incorporate into management plan; in this way the planner doesn't neglects the communities' concern and also well taken care of mutual benefits between revenue generation for government and resources benefit to communities residing inside FMU. In last 10 years, total area of 1850 Ha was operated and total volume of 81246m3 extracted including both commercial and rural. FO Sherab Jamtsho (RAMS) presented on status of Selela FMU, objectives of next 10year plans to the participants and opened floor for discussions. The issues, discussions and resolution as following:

Sl.No	Issues	Discussions	Resolutions
1	**Rural Timber allocation**	Thrizin questioned the contradictory view on Rural timber extraction achievement and availability of timber in ground. 'As per last 10-year plan status only 56% of rural timber extraction target was achieved however, on other hand we're informed about rural timber constraint during annual FMU presentation' Thrizin said. Selela UIC and FO Sherab explained that due to in-accessibility of road to 2 other rural blocks, therefore, the harvest was concentrated only to Dorokha block and was over harvested as it is the only block with road access.	From next 10 years all 3 rural blocks will be connected with FMU roads and will solve the constraint in availability of RHBT (Rural House Building Timber)
2	**Rural Block designation and timber allotment.**	To meet the needs of timber for rural house building, it is pertinent to designate the area particular as Rural Block. The participants questioned in preference official gives to applicants from vicinity community in allotment of RHBT from designated area.	-The preference will be given to applicants of local community or gewog people. - The allotment to other geogs will be made only after meeting demand of local people -To discontinue Dorokha rural block, however, will continue with Nyachuthang side.
3	**FMU Road Maintenance**	-Need of major maintenance in some important road stretch used by the NRDCL. 2.3 km Dorisho Bridge to Lamjogang Village farm road is in need of timely maintenance as it's being used by the NRDCL for timber transportation. The In-Charge expressed his sympathy in not willing to help	-The In-charge agreed to take issue to NRDCL Regional Manager. -Look into possibility to put inside 10-year master plan.

		directly as budgeting and decision are solely based on their managers.	
4	**Farm Road**	The representative from Lamjogang village raise a concern regarding maintaining quality of farm road for all seasons. To this Gewog Thrizin said it's completely out of their hand as it's for the benefit of all.	-Geog administration and Dzongkhag to assist in timely maintenance if possible.
5	**Passing time and prior information to applicants**		To inform applicants of nearby community one week before passing by respective Tshogpa in consultation with Forest Officer.

Date: 29th September,2020

Venue: Naja GT hall

Participants:

1. Mayteykha Thrizin
2. Communities representative of Papali, Chazhi and Tsonglayna.
3. Sherab Jamtsho, FO Paro
4. Tsheltrim Dorji FO, Paro
5.

Sl.No	Issues	Discussions	Resolution
1	**Rural Block**	To minimize the area and include few ha from outside rural block of previous plan	-To this it was agreed that since there was no major timber allotment made from Cheppji during last ten years, the floor decided to maintain same rural block.
2	**Protection areas**	Nye and water source of Papali communities. To include CF (60 Acres) of Papali under protection.	-Nye and water source to be included in protection area. - CF area to authenticate through consultation with Gedu Division.
3	**Farm Road**	Given the timely maintenance and quality assurance, the public of 3 villages wish to give user right of farm road to NRDCL.	-To take discussion into annual NRDCL work plan meeting by concerned NRDCL UM
4	**CF establishment**	The communities wish to establish new CF within	-Agreed to look into possibility through consultation with the

		FMU for sustainable management and resource preservation for their future use. They express their concern on resource scarcity after the FMU plan expired.	CFO and after getting consent from the Hon'ble director.
5	**Timber allotment preference.**	The participants questioned in preference official gives to applicants from vicinity community in allotment of RHBT from designated area.	-The preference will be given to applicants of local community or gewog people. -If there are no applicant from community the allotment will be made to near-by community and then to other Geogs within the FMU. -The timber allotment to outside Geogs and Dzongkhag will be made only after fulfilling demand within the FMU settlements.

Minutes Keeper

Sherab Jamtsho

FO, Paro

ANNEXURES

Annexure 12: Meeting Participants List

List of meeting participants for Selela FMU plan revision consultation meeting conducted at Naja Geog office

Sl No	Name	Designation	CID No	No.days	Signature
1	Tshewang Tobgay	Gup	10704000479		
2	Phuntsho Choeden	GAO	10708000951		
3	Tobgay	Tshogpa Borilcha	10503000366		
4	Dawa.	MEDCL. UM.	10521000975		
5	Dorji Wangchuk	UIC, Selela	10903001518		
6.	Kinley Wangchuk	Vic Lorch	11105001936		
7.	Tempa Gyeltshen	RO, Hes.	11105001989		
8.	Nado	Lamjogang			
9.	Dorji	-"-	10504002366		
10.	Tanyang Lenjin	Dorilcha	10504000718		
11	Tenzin Gelshen	"	10504000333		
12.	Ugyen Thinley	Nobgang	10501000362		
13.	N.m	"	10504001389		
14.	Kinga Zed	"	10504001243		

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DSA payment list for meeting participants

Sl No	Name	Village	CID No	No.days	Signature
15	Karma		10210000 20		
16	Sicho Doma		10210000 939		
17	Pem		10210000 963		
18	Dan Zam		10210000 968		
19	Karma Yangzom		11812001910		

ANNEXURES

List of meeting participants for Selela FMU plan revision consultation meeting conducted at Naja Geog office

Sl No	Name	Designation	CID No	No.days	Signature
1	[illegible]	[illegible]	[illegible]	1	
2	Dawa.	GM.	10501000975	1	
3	Dorji Wangchuk	UIC Selela	10903001518	1	
4	[illegible]				77303745
5	[illegible]				
6	[illegible]				77447545 ~~77337019~~
7	[illegible]		[illegible]		77337019
8	[illegible]	[illegible]	[illegible]		
9	[illegible]	[illegible]	[illegible]	2	
10	[illegible]	[illegible]	[illegible]	2	
11	Sherab Jamtsho	FO	11105001851	1	
12	Namgay Wangchuk	Sr. FR II	11108001878		
13	Chundu Tshering	Mangmi	10807001720	1	
14	Kinga	Gewog Driver	11515002709	1	
15	Karma	Sr. FR	11211000260	1	
16	Tshe Thrim Dorji	FO	10608001180		

ANNEXURES

List of meeting participants for Selela FMU plan revision consultation meeting conducted at Naja Geog office

Sl No	Name	Designation	CID No	No.days	Signature
1	Passang Tshering	metakha Gup	10210000162		
2	Yanten	Tshogpa	10206000082		
3	Najay		10807000003		
4	Tshogay		10210000902		
5	Tshering Dorji		10206000085		
6	passang/chencho Dem		10210000957		
7	Tshongay		10210000900		
8	chencho Rinzin		10206000078		
9	Nangay Om		10206000157		
10	Thinley Dorji		10206000050		
11	Dago Om		10206000057		
12	Najay		10210000969		
13	pem		10206000062		
14	pelden		10210000992		

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Annexure 13: Record keeping formats

MC	WC	Date	Name and Address	Permit #	TMB #	Particulars			Volume (m3)			Comments
						Species	Product Type	Amount	Marked	Recovered	Firewood	

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Annexure 14: Commercial Allotment Form

Block: **Compartment:** **Sub-compartment:**

MC	WC	Year of Activity	Commercial Activities					Volume (m3)				Other Activities	TMB #	Comments (Include detailed description of cable line location in relation to mappable features)
			Cable Lines			Groups/Patches/ Other		Marked		Extracted (FDC)	Firewood (lops/tops)			
			Line #	Length (m)	Azimuth	Total #	Total Area (ha)	# of trees	Vol.					

Annexure 15: Stand Tending and Regeneration Form

Block: **Compartment:** **Sub-compartment:**

MC	WC	Cable line #	Year	Stand Tending		Regeneration						Comments or Other Activities
				Activity	Area (ha)	Natural/ Plantation	Species	Year Surveyed	Area (ha)	Survey Results (stems/ha or survival percent)	Resurvey?	

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Annexure 16: Data Recording Forms

1. **Timber Extraction Records for Cable lines and Adhoc areas**

FORM 1.1: Timber Extraction Records from Cable Line

Form 1.1: Timber Extraction records from Cable Lines					
Name of FMU		Compartment			
Block		Year of Operation (m/y)			
Cable line No		No. of Group (s)			
Cable Line Length(m)		Clear-felled area (Ha)			
Azimuth (degree)					
GPS coordinates	Top Endmass (dd/mm/ss):				
	Bottom Endmass (dd/mm/ss):				
Start Date		End Date			
Detailed of standing and Log volume marked from cable lines (m3)					
Species	**Standing volume (m3)**	**Log volume (m3)**	**Poles (m3)**	**Firewood (m3)**	**Woodchips (m3)**
Hemlock					
Spruce					
Fir					
Broadleaf					
Total					

Details of Royalty Realized	
On Logs	
On firewood/Lops & Tops (Nu.):	
Total Royalty (Nu.):	

Description

FORM 1.1 is to be maintained one for every cable line operated in a year. The standing volume must be transferred from the Marking List maintained by the marking officer prior to operation of the cable line. The Log volume and the volume for Firewood/Woodchips must be entered post operation

of Cable line. The data for Log volume, volume for Firewood and Woodchips can be transferred from **FORM 2.1**

FORM 1.2: Timber Allotment Records from Ad-hoc area

Form 1.2: Timber Extraction records Ad-hoc areas				
Name of the FMU				
Block		Compartment		
Purpose				
Forestry Clearance no				
Length of Road/Transmission Line (m)				
Clear-felled area (ha)		Area (Substitude/alnd lease):		
Year of Operation (m/y)				
Start Date		End Date		

Details of Satnding volume Marked from Ad-hoc Activities(m3)					
Species	Standing volume Marked (m3)	Log volume (m3)	Poles (m3)	Firewood (m3)	Woodchips (m3)
Hemlock					
Spruce					
Fir					
Broadleaf					
Total					

Details of Royalty Realized (On Production Basis)	
On sawn timber (Nu)	
On Logs (Nu)	
On Poles (Nu)	
On Firewood/Lops & Tops (Nu)	
Total Royalty (Nu)	

Description

FORM 1.2 is to be maintained one for every ad-hoc activity in a year. The standing volume must be transferred from Marking List maintained by the Marking Officer prior to operation of the ad-hoc area. The Log volume and the volume for Firewood/Woodchips must be entered post operation of ad-hoc area. The data for Log volume, volume for Firewood and Woodchips can be transferred from **FORM 2.2**

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Monthly Timber allotment records

FORM 2.1: Monthly Commercial Timber Production Details from Cable lines

Form 2.1 Monthly Commercial Timber Production Details from Cable Lines													
Name of FMU													
Month/Year													
Date	COSDTMO No	Cable lines no	Logs (A)			Poles (B)			Total Volume (A+B)	Firewood		Woodchips	
			Vol (Cfts)	No.of pieces	Species	Vol (Cfts)	No.of pieces	Species		Species	Vol (Cfts)	Species	Vol (Cfts)

Description

FORM 2.1 is to be used for maintaining data of Commercial Timber Production from cable lines on actual production basis every month

FORM 2.2: Monthly Commercial Timber Production Details from Ad-hoc areas

Form 2.1 Monthly Commercial Timber Production Details from Ad-hoc areas													
Name of FMU													
Month/Year													
Date	COSDTMO No	Ad-hoc areas	Logs (A)			Poles (B)			Total Volume (A+B)	Firewood		Woodchips	
			Vol (Cfts)	No.of pieces	Species	Vol (Cfts)	No.of pieces	Species		Species	Vol (Cfts)	Species	Vol (Cfts)

Description:

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FORM 2.2 is to be used for maintaining data of Commercial Timber Production from Ad-hoc areas on actual production basis every month.

FORM 2.3: Monthly Rural Timber Allotment (New Construction/ Renovation/ Extension)

Form 2.3: Monthly Rural Timber Allotment Details (New Construction/ Renovation/ Extension)										
Name of FMU										
Month/Year										
Sl No	Date of Issue	Name of Applicant	Address	Tharm No	House No	Permit No	New/Renovation	Sanction letter no	Vol marked/ No.Trees	
									Standing vol (m3)	Log vol (M3)

Description

FORM 2.3 is to be used for maintaining data of Rural Timber allotments made for New Constructions, Renovation, Extension, Cow shed construction…etc from the FMU on monthly basis.

FORM 2.4: Monthly Rural Timber Allotment (Firewood, Flag Poles, Fencing Poles, Others)

Form 2.4: Monthly Rural Timber Allotment Details (Firewood, Flag Poles, Fencing Poles, Others																				
Name of FMU																				
Month/Year																				
Sl No	Date of Issue	CID No	Name of Applicant	Address	Tharm No	House No	Permit No	Purpose	Sanction letter no	Type and Quantity of Forest Produce Supplied										
										Firewood (m3)		Fencing Post		Flag Post		Others		Total Qty (m3)		
										Standing Vol (M3)	Actual production (m3)	Standing Vol (M3)	Nos	Standing Vol (M3)	Nos	Standing Vol (M3)	Nos			

Description

FORM 2.4 is to be used for maintaining data of Rural Timber Allotment made for Firewood, Flagpoles, Fencing Poles, Others. etc from the FMU on monthly basis.

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Form 2.5: Monthly NWFP Supply Record

Name of the FMU:	
Month/Year:	

Sl. No.	Name of the Applicant	CID No.	Thram No.	House No.	Address	Permit No.	Date of Issue	Purpose	Sanction No. and Date	Description and Quantity of NWFP Supplied					
										Stone (m3)	Sand (m3)	Soil (m3)	Bamboo (nos.)	Gravel (m3)	Others

Description

FORM 2.5 is the cumulative data recording form for NWFP extracted from the FMU on a monthly basis.

3. Annual Timber Allotment Records

FORM 3.1: Annual Commercial Timber Extraction from Cable Lines FORM

Form 3.1 : Annual Cable Line Operation Data

Name of the FMU:	
Reporting Year:	

Block/ Compartment No.	Cable Line					Total clear felled area (ha)	Standing volume for each species							Total standing volume (m3)
	No./ Year	Length (m)	GPS Coordinate (Top and Bottom Endmass)	No of Groups/ Area (ha)	Corridor Area (ha)		Blue pine (m^3)	Hemlock (m3)	Spruce (m3)	Fir (m3)	Mixed Conifer others (m^3)	Chirpine (m^3)	Broadleaf (m3)	

Description

FORM 3.1 is the cumulative data recording form for ***STANDING VOLUME*** extracted from all the cable lines operated in a year. The data can be transferred from **FORM 1.1**

FORM 2.5: Monthly NWFP Supply Record FORM

Form 3.2: Annual Ad-hoc Timber Extraction Data										
Name of the FMU:										
Reporting Year:										
Block/ Compartment	Activities	Clear Felled Area (Ha)	Standing Volume for Each Species							Total Standing Volume (m^3)
			Blue Pine (m^3)	Hemlock (m3)	Spruce (m3)	Fir (m3)	Mixed Conifer (m3)	Chirpine (m^3)	Broadleaf (m3)	
	Road (FMU/ Forest Road)									
	Road (Others)									
	Transmission line									
	Sanitation									
	Others									

Description

FORM 3.2 is the cumulative data recording form for ***STANDING VOLUME*** extracted from all the Adhoc Working areas operated in a year. The data can be transferred from **FORM 1.2**

FORM 3.3: Annual Commercial Timber/Firewood supply from cablelines and adhoc areas

Form 3.3: Annual Commercial Timber/ Firewood Supply												
Name of the FMU:												
Reporting Year:												
Quantity Harvested from PLANNED OP Activities (m^3)					Quantity Supplied from UNPLANNED Activities (m^3)					Total Standing Vol. (m^3) (a)+(b)	Remarks
Standing Vol. (m3) (a)	*Log Vol.(m3)*	*Firewood (m3)*	*Woodchips (m^3)*	*Others (m^3)*	Standing Vol./m3 (b)	*Log Vol.(m3)*	*Firewood (m3)*	*Woodchips (m^3)*	*Others (m3)*		

Description

FORM 3.3 is the cumulative data recording form for Commercial Timber extracted from both cablelines and adhoc working areas in a year. The data for this form can be transferred from **FORM 1.1, 1.2, 3.1** and **3.2.**

FORM 3.4: Annual Rural Timber Supply

Form 3.4 : Annual Rural Timber Supply												
Name of the FMU:												
Reporting Year:												
Quantity Supplied in Standing Form											Total Standing Volume Supplied (m^3)	Remarks
Rural House Building Timber			Poles (m^3)		Fencing Post (m^3)		Firewood		Others			
No.	Standing Vol. (m3)	Log Vol. (m3)	No.	Standing Vol. (m3)	No.	Standing Vol. (m3)	No.	Standing Vol. (m3)	No.	Standing Vol. (m3)		

Description

FORM 3.4 is the cumulative data recording form for Rural Timber extracted from the FMU in a year. The data for this form can be transferred from **FORM 2.3** and **2.4.**

FORM 3.2: Annual Commercial Timber Extraction from Ad-Hoc areas

ANNEXURES

FORM 3.5: Annual NWFP supply

Form 3.5: Annual NWFP Supply								
Name of the FMU:								
Reporting Year:								
Year	Product Types							
	Bamboo (Nos.)	Sand (m3)	Top Soil (Tm3)	Stone/ Boulders (m3)	Gravel (m3)	Leaf Mould/ Litters (m3)	Mushroom (Kgs.)	Others (Unit)

Description

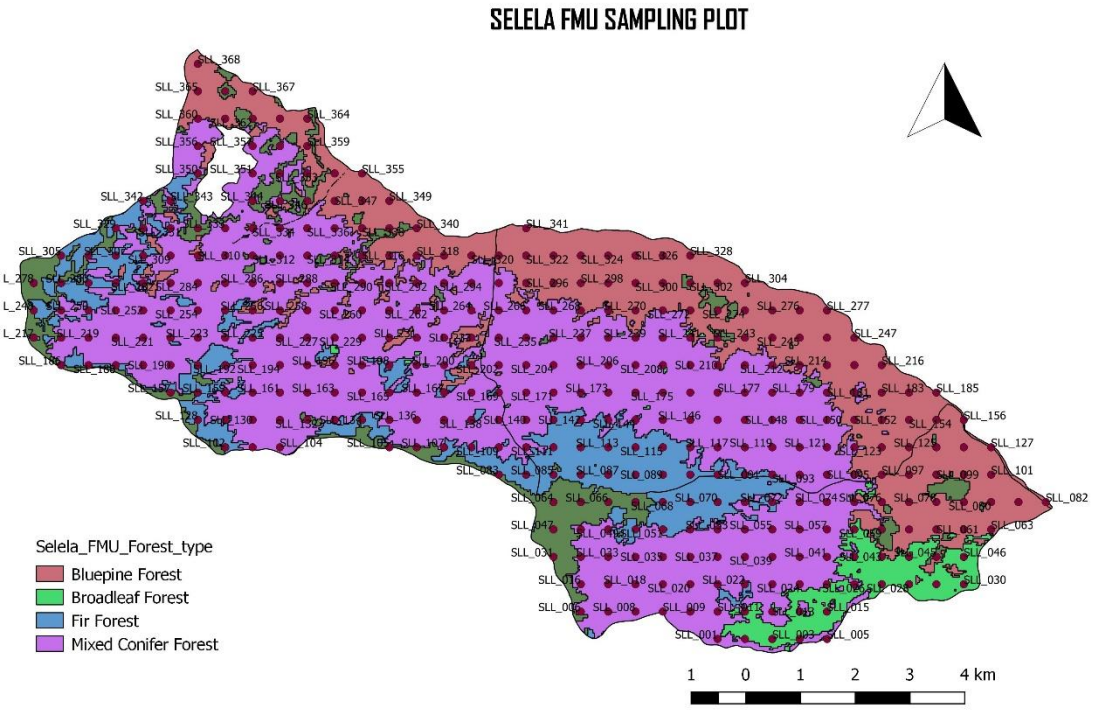
FORM 3.5 is the cumulative data recording form for NWFP extracted from the FMU in a year.

FORM 3.6: Royalty Statement

Form 3.6: Royalty Statement													
Name of the FMU:													
Year	Month	Cable Line No./ Name of Ad-hoc Area	Type of Forest Produce Extracted								Total Amount (Nu.)	Dispatch No. and Date	Remarks
			Logs		Firewood/ Lops & Tops		Poles		Sawn Timber				
			Volume (cft)	Amount (Nu.)	Volume (m3)	Amount (Nu.)	No./ Volume (cft)	Amount (Nu.)	Volume (cft)	Amount (Nu.)			

FORM 3.6 is the form for recording royalty details for timber marked and handed over to NRDCL from both cable lines and ad-hoc areas.

Annexure 17: Selela FMU field inventory works



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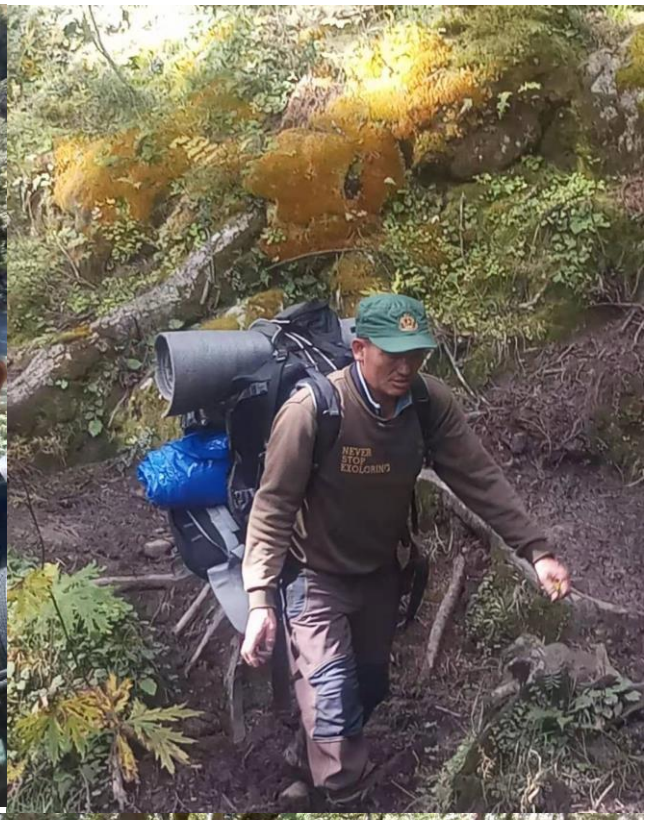

ANNEXURES


CONSULTATION MEETING FOR SELELA
FOREST MANAGEMENT REVISION