



Manual for Forestry and Conservation Models

Nagaland Forest Management Project (NFMP)



Published by

**Project Management Unit (PMU)
Nagaland Forest Management Project**



**CHIEF MINISTER
NAGALAND
KOHIMA**

6th April, 2021

MESSAGE

I am happy to know that the Nagaland Forest Management Project (NFMP), a Japan International Cooperation Agency (JICA) assisted program under Department of Environment, Forest and Climate Change, Government of Nagaland, is bringing out manuals which will ensure dissemination of knowledge and effective implementation of the project.

I am confident that these Manuals will facilitate proper execution of the project activities in a transparent and participatory manner and help guide all stake-holders, ranging from officials to village communities as well as the field NGOs and SHGs.

The Nagaland Forest Management Project (NFMP) is a process driven and result oriented approach through the use of modern scientific technologies including GIS and MIS for planning, implementation and monitoring of various activities and it is being implemented by the Communities in Villages. The concept of implementation is laudable, and I am sure that this will go a long way in improving forest ecosystems, support income generation through rehabilitation of Jhum areas and enhance the livelihood opportunities.

I wish the Nagaland Forest Management Project a grand success.

(NEIPHIU RIO)

Foreword

Forestry and biodiversity conservation are essential for sustainable development and human well-being. It is impossible to exaggerate the significance of forests and biodiversity, since they provide an array of vital ecosystem services, such as carbon sequestration, water management, and habitation for wildlife. They are also critical to the livelihoods of millions of people who depends for food, fuel, and medicine.

However, forests and biodiversity are under threat from a range of human activities, including deforestation, overexploitation, and climate change. Therefore, it is essential to adopt sustainable practices that ensure the conservation and restoration of forests and biodiversity while supporting local livelihoods and economic development.

The publication of Forestry and Biodiversity Manual prepared under the JICA supported Nagaland Forest Management Project (NFMP) is an important step towards achieving these goals. The project covers 11 forest divisions and 185 villages in the state of Nagaland, and it aims to implement five different forestry conservation models, including Jhum Agro Forestry (JAF), Jhum Fallow Forestry (JFF), Jhum Conversion to Forestry (JCF), Jhum Conversion to Community Conservation Area (JCC), Protection and Expansion of Community Conserved Area (PEC).

The manual will help JFMC members, communities, and forest department staff working at various level to understand and adopt new practices of forest and biodiversity conservation. It provides detailed information on forest and biodiversity conservation practices, including ecosystem-based approaches, community-led conservation, and sustainable forest management. It also includes practical guidance on forest planning, monitoring and evaluation, and stakeholder engagement.

The manual is a valuable resource for anyone interested in sustainable forest and biodiversity conservation, from forest officers and practitioners to community members and policy-makers. It will serve as a reference guide for the implementation of the Nagaland Forest Management Project (NFMP) and other similar projects in similar geographies.

I congratulate the Nagaland Forest Department (NFMP) for their efforts in developing this manual and for their commitment to sustainable forest and biodiversity conservation. I hope that this manual will contribute to the conservation and restoration of forests and biodiversity in Nagaland and beyond, and to the well-being of people who depend on them.

Dhramendra Prakash, IFS
PCCF and HoFF
Chief Project Director & CEO

Table of Contents

Message.....1

Foreword.....2

Section A: Background.....6

1. About NFMP.....6

2. User of Manual.....6

3. Organization of the Manual.....6

Section B: Understanding of Forestry & Conservation Models.....8

1. Purpose.....8

2. Target Land Use Systems.....9

 2.1. Active Jhum Blocks.....9

 2.2. Discontinued Jhum Blocks / Abandoned Jhum Blocks.....9

 2.3. Forest Reserve or Conservation Blocks.....9

 2.4. Open/ Degraded Forests.....9

3. Key Aspects of Forestry Models.....9

Section C: Process Initiation..... 12

1. Important Decision Nodes.....12

2. Free Prior Informed Consent (FPIC).....12

3. Chronology of Planning for Forestry Operations.....13

Section D: Sites and Species Selection for Forestry Models.....14

1. Selection of Intervention Models.....14

2. Selection of Sites.....14

 2.1. Landscape Approach.....14

 2.2. Selection of Jhum Fallows for Different Models.....16

 2.3. Selection of Sites for JAF and JFF Models.....16

 2.4. Selection of Sites for JCF and JCC Models.....19

 2.5. Selection of Sites for PEC Model.....20

3. Species Selection for Different Forestry Models.....21

 3.1. JAF and JFF Models.....21

 3.2. JCF, JCC and PEC Models.....23

Section E: Preparatory Treatment Work..... 25

1. Zoning of Jhum Blocks for JAF and JFF Models.....25

2. Clearance of weed and other brushwood.....26

3. Staking and Pit Making.....26

4. Soil Moisture Conservation (SMC).....28

 4.1. Mechanical Barrier.....28

 4.2. Vegetative Barrier.....30

Section F: Plantation and Habitat Improvement Work.....	32
1. Plantation Approach.....	32
1.1. Artificial Regeneration (AR).....	33
1.2. Assisted Natural Regeneration (ANR).....	33
2. Silvicultural Operations.....	34
3. Enhancement of Conservation Values in JCC and PEC models.....	35
4. Plantation Maintenance.....	38
4.1. Mortality Replacement.....	38
4.2. Weeding.....	39
5. Maintenance of Site Treatment Register.....	40
6. Responsibilities.....	41
Section G: Monitoring.....	42
1. Plantation Survival and Growth.....	42
1.2. Monitoring in JFF and JCF Area.....	43
2. ANR Performance.....	44
3. SMC Performance.....	44
4. Monitoring Responsibilities.....	46
Section H: Community Contribution, Fees and Benefit Sharing.....	47
1. Contribution.....	47
2. User Fees.....	47
3. Benefit Sharing.....	47
Section I: Costing of Different Models and Important Operational Steps.....	51
1. Costing of Different Forestry Models.....	51
2. Operational Steps.....	51
Annexure 1: Suggestive Priority Divisions for Different Models.....	55
Annexure 2: List of RET Plant Species of Nagaland.....	56
Annexure 3: List of Indigenous Plant Species for Plantation Models.....	57
Annexure 4: Species Preference Matrix.....	59
Annexure 5: Sample of Site Treatment Register.....	60
Annexure 6: Data Format for Monitoring of Plantation Performance.....	62
Annexure 7: Data format for Monitoring of ANR Performance.....	63
Annexure 8: Data Format for Monitoring of SMC Work Performance.....	64

ABBREVIATIONS

ANR	Assisted Natural Regeneration
AR	Artificial Regeneration
CCA	Community Conserved Area
Cm	Centimetre
CUMG	Common User and Management Group
DMU	Divisional Management Unit
FMU	Field Management Unit
FNGO	Facilitating Non-Government Organization
FPIC	Free Prior Informed Consent
GIS	Geographic Information System
GPS	Global Positioning System
Ha	Hectare
HH	Household
IMP	Indicative Management Plan
JAF	Jhum Agroforestry
JCC	Jhum Conversion to CCA
JCF	Jhum Conversion to Forestry
JFG	Jhum Farmer Groups
JFF	Jhum Fallow Forestry
JFM	Joint Forest Management
JFMC	Joint Forest Management Committee
JICA	Japan International Cooperation Agency
MIS	Management Information System
MoD	Minutes of Discussions
MS	Member Secretary
NFMP	Nagaland Forest Management Project
NTFP	Non-Timber Forest Products
PEC	Protection and Expansion of CCA
PMU	Project Management Unit
RET	Rare-Endemic-Threatened
SALT	Sloping Agriculture Land Technology
SMC	Soil Moisture Conservation
STR	Site Treatment Register
VC	Village Council
VFDF	Village Forest Development Fund

Section A: Background

1. About NFMP

The poverty ratio in Nagaland had increased by 10% from 2004 to 2011 unlike other States¹. This percentage is also higher compared to other North-Eastern States. The high increase in poverty among rural population is due to geographical remoteness, inaccessibility and lack of infrastructure. In such a situation, 60% of the total population in the State relies on natural resources (agriculture and forest) for their living. Forests constitute about 75% of the total geographical area, and within this jhum-farming is the predominant land-use.

The Nagaland Forest Management Project (NFMP), with the financial assistance from Japan International Cooperation Agency (JICA) is being implemented to strengthen the forestry sector of the State, with long term goals of environmental conservation and poverty alleviation. The project will be implemented in 10 years².

The project aims to improve the forest ecosystem by promoting sustainable jhum and forestland management and biodiversity conservation. These are planned to achieve through Joint Forest Management (JFM) approach with harmonized socio-economic development of local communities.

NFMP proposes to undertake forest and biodiversity management work in 185 villages of 11 forest divisions and 22 forest ranges / beats. The project targets to cover 79096 ha area under five different forestry and biodiversity conservation models, focusing jhum lands, forest lands and community conservation areas.

NFMP Objectives

- Strengthening conservation regime through community participation
- Livelihood opportunities for enhanced household incomes through convergence
- Institutional strengthening

2. User of Manual

This manual aims to provide details of different aspects of five forestry models and provide some specific guidelines on issues for field intervention starting from the need of the model, selection of the site, site preparation, species selection for plantation, benefit sharing arrangement etc. Thus, this manual aims to guide JFMC members, frontline staff of Forest Department and technical staffs under NFMP, who will be engaged in the planning and field implementation in project villages.

3. Organization of the Manual

Manual is divided into eight sections. **Section A** provides the background of the project and overall targets under different forestry models. **Section B** describes the objectives of forestry intervention models, and the suitability of different landscape types for these models. It also summarizes the key features of the five proposed models. **Section C** presented the key decision-making areas necessary to focus while implementing the forestry models, this include taking Free and Prior Informed Consent (FPIC). The subsequent sections actually attempt to describe various features of those decision-making process. Thus, while **Section D** presented the various aspects and criteria for site and species selection for different forestry models, **Section E** highlights key preparatory works to be done in each

¹As per the estimates, Nagaland saw the highest rise of 12.1 percentage points in poverty between 2004-05 and 2009-10, followed by Manipur (9.2 percentage points), Mizoram (5.7 percentage points), Assam (3.5 percentage points) and Meghalaya (1 percentage point). Source: https://www.business-standard.com/article/economy-policy/poverty-increases-in-four-ne-states-planning-commission-112032100002_1.html

²Project period is from 2017-18 to 2026-27, with clearly distinguished phases of implementation viz. preparatory phase, implementation phase and consolidation and exit phase.

Manual for Forestry and Conservation Models

intervention site e.g., zoning, land clearance and SMC works. **Section F** detailed out Artificial Regeneration(AR) and Assisted Natural Regeneration(ANR) based plantation strategies, different silvicultural operations, and key maintenance requirements. Community contributions, different types of user-fees and benefit sharing mechanisms are presented in **Section G**. **Section H** provide key costing heads for each model and give a quick guidance -a step-wise operational summary of all the key aspects of intervention.



Planting the Sapling

Section B: Understanding of Forestry & Conservation Models

1. Purpose

Jhum is an integral part of culture, livelihood and food production system in the state. It is important, therefore, to manage it as a sustainable land use system to enhance ecosystem services and boost economic returns.

NFMP objectives, as defined in MoD, clearly emphasize improvement of forest ecosystems by rehabilitating the jhum and other forests areas. It aims to find 'nature-based solutions' for restoring climate resilient jhum and other forest system. Project also aims to apply combination of production and conservation forestry approaches to:

- increase the quality & density of trees in current and fallow jhum areas and
- improve and enhance network of community conservation areas (CCAs).
- concerns of improved income and livelihood are explicitly attached to both these forestry approaches.

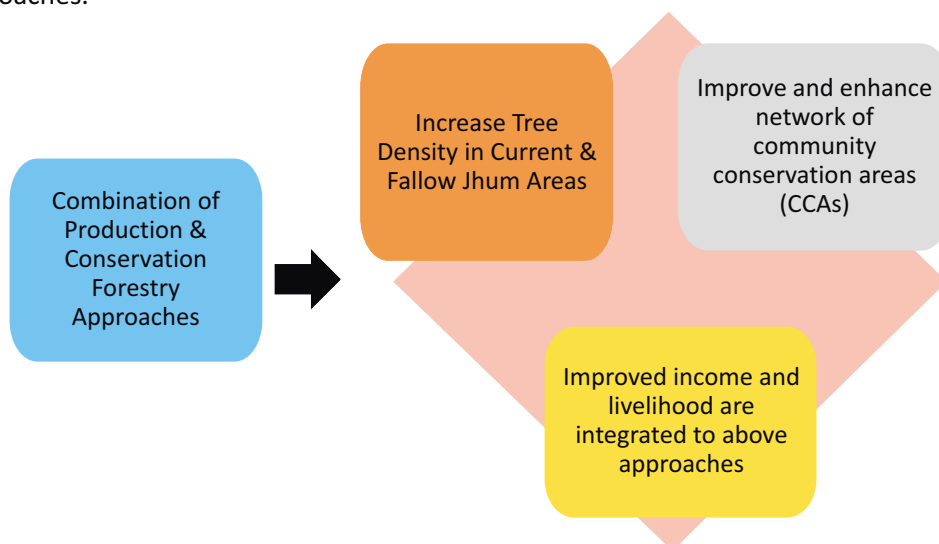


Fig. 1: Objectives of intervention of forestry and conservation models

NFMP proposes to undertake forest and biodiversity improvement work in 185 villages of 11 forest divisions and 22 forest ranges / beats. Project aims to adopt a landscape-based approach in treating a total of 79096 ha area in project villages, underpinning basic ecological and socio-economic cultural nature of the state.

Five different forestry and biodiversity conservation models are proposed to cover the project area. Of these, four models are linked to one or the other types of jhum lands. The model wise total treatment area is given in Table 1.

Table 1: Summary of targets across forestry and conservation models		
#	Model Name	Target Area (Hectare)
1	Jhum Agroforestry (JAF)	10325
2	Jhum Fallow Forestry (JFF)	4594
3	Jhum Conversion to Forestry (JCF)	4594
4	Jhum Conversion to CCA (JCC)	3697
5	Protection & Expansion of CCA (PEC)	55886
	TOTAL	79096

2. Target Land Use Systems

The forestry and biodiversity conservation models are designed to target the restoration and management of our distinct landscape within a village area, covering both the forest and jhum lands. These jhum and forest landscapes are formed mosaic of land-use systems:

2.1. Active Jhum Blocks

These are Jhum patches where cultivation is ongoing. Generally, these blocks have locational (i.e., easy access) or soil and topographical advantages. Such Jhum blocks can be found in three different situations:

- 2.1.1. The jhum blocks where the farmers either already have started farming previous year or are going to start farming in present year.
- 2.1.2. The jhum blocks where the farmers have completed the farming last year and thus moved to a new block.
- 2.1.3. The jhum blocks which are currently under fallow condition but where the farmers will move next after completing the current cycle of farming.

2.2. Discontinued Jhum Blocks / Abandoned Jhum Blocks

These are Jhum blocks where cultivation is discontinued for many years and farmers have no intention of continuing Jhum farming in these patches in future.

The difference between these blocks and fallow period of Active Jhum blocks (i.e., sub-category 2.1.3, above) lies in the '**intention**' of farmers and village council.

A clear understanding and resolution by Village Council and Jhum farmers in identifying and demarcating these blocks is essential.

2.3. Forest Reserve or Conservation Blocks

These are the forest blocks which village community traditionally protect and conserve using social customs, norms and institutions.

These also include those forest blocks which get registered through a MoU between village council and forest department.

Basically, these are community conserved areas (CCAs), where communities impose varying levels of restrictions on extraction of bio-resources, including the hunting of wildlife or removing the trees.

2.4. Open/ Degraded Forests

These are community/ private owned forest patches which are neither part of Jhum blocks nor community conserved areas. However, these patches have potential of bringing under CCA and thus enhance the overall conservation values of the area.

3. Key Aspects of Forestry Models

MoD of the NFMP draws broad outlines for each of the proposed models. Some of the key features of these models are presented in Table 2 and Table 3.

Table 2: Matrix showing key features of different Forestry & Conservation models				
Model Type	Purpose	Applicable landscape & land use	Tree & Biomass Harvesting Option	Benefit Sharing Options
Jhum Agro-forestry (JAF)	<ul style="list-style-type: none"> • Improve tree density in Jhum area • Improve HH Income 	<ul style="list-style-type: none"> • Active Jhum Block • Jhum Cultivation is ongoing in current year 	<ul style="list-style-type: none"> • Selective felling of up to 75% of total raised trees 	<ul style="list-style-type: none"> • Benefits of tree harvesting may go to individual farmers through Jhum Farmer Group (JFG) and JFMC
Jhum Fallow Forestry (JFF)	-do-	<ul style="list-style-type: none"> • Active Jhum Block 	-do-	-do-

Table 2: Matrix showing key features of different Forestry & Conservation models

Model Type	Purpose	Applicable landscape & land use	Tree & Biomass Harvesting Option	Benefit Sharing Options
		<ul style="list-style-type: none"> Jhum fallow cycle starts either current year or one or two year earlier³ 		
Jhum Conversion to Forestry (JCF)	<ul style="list-style-type: none"> Improve tree cover, bio-diversity, food & energy in long-term Jhum fallow areas Improve HH food security and income 	<ul style="list-style-type: none"> Abandoned Jhum Block Fallow Cycle started long back, thus some tree cover already exists 	<ul style="list-style-type: none"> Selective felling of up to 40% of total raised trees Extraction of NTFP items 	<ul style="list-style-type: none"> Benefit of tree harvesting will be shared among VC and JFMC Impose small user fees to collect NTFP items
Jhum Conversion to Conservation Area (JCC)	<ul style="list-style-type: none"> Improve bio-diversity & ecosystem services in long-term jhum fallow areas Improve HH food security and income 	<ul style="list-style-type: none"> Abandoned Jhum Block Fallow Cycle started long back, thus some tree cover already exists 	<ul style="list-style-type: none"> No felling of trees Extraction of NTFP items 	<ul style="list-style-type: none"> Collection of NTFP by poor and dependent families with small user fees
Protection & Expansion of CCA (PEC)	<ul style="list-style-type: none"> Improve bio-diversity & ecosystem services by expanding the network of CCA. Institutionalize and incentivize community-based biodiversity conservation efforts 	<ul style="list-style-type: none"> Forest & Conservation Block Multiple use forests Community Conserved Areas (CCA) 	-do-	-do-

Source: Compiled from project MoD

Table 3: Matrix showing model types across landscape areas

Model Type	Active Jhum Block	Abandoned Jhum Block	Open/ Degraded Forest	Forest Reserves & Conservation Block
JAF	✓			
JFF	✓			
JCF		✓		
JCC		✓		
PEC			✓	✓

As defined by their purpose and objectives, these intervention models fall within a production-conservation continuum. Thus, while, JAF and JFF models promote tree density in active jhum areas with the purpose of harvesting after maturity, the PEC model mainly focusses to strengthen forest and biodiversity conservation practices in the village with no harvesting related benefits. Between these two, the JCF and JCC models situate, where both production and conservation aspects get adequate representation (Fig. 2).



Fig. 2: The position of different models along Production - Conservation gradient

³The jhum block which is already covered under JAF model, cannot be considered for JFF model, in subsequent years.

Manual for Forestry and Conservation Models

Clearly, the five models target restoring and management of three main landscape elements of the project villages. The restoration and management have twin objectives, improve forest and biodiversity values of the landscape and bring some positive change in the income of local communities. In each model, main beneficiaries vary and giving opportunity for various segments of the village communities.

The purpose of five forestry and conservation models and the main beneficiaries in each case is presented in Fig. 3.

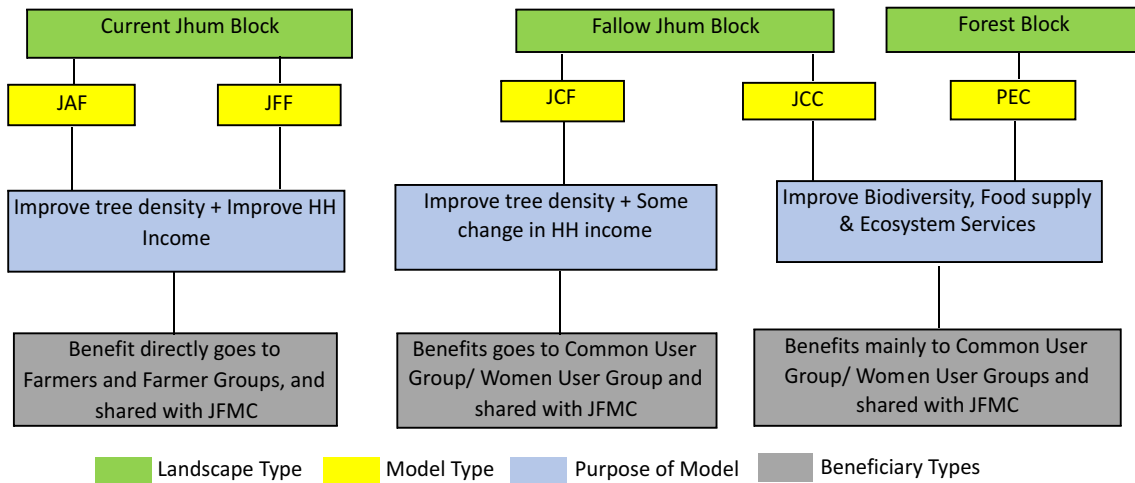
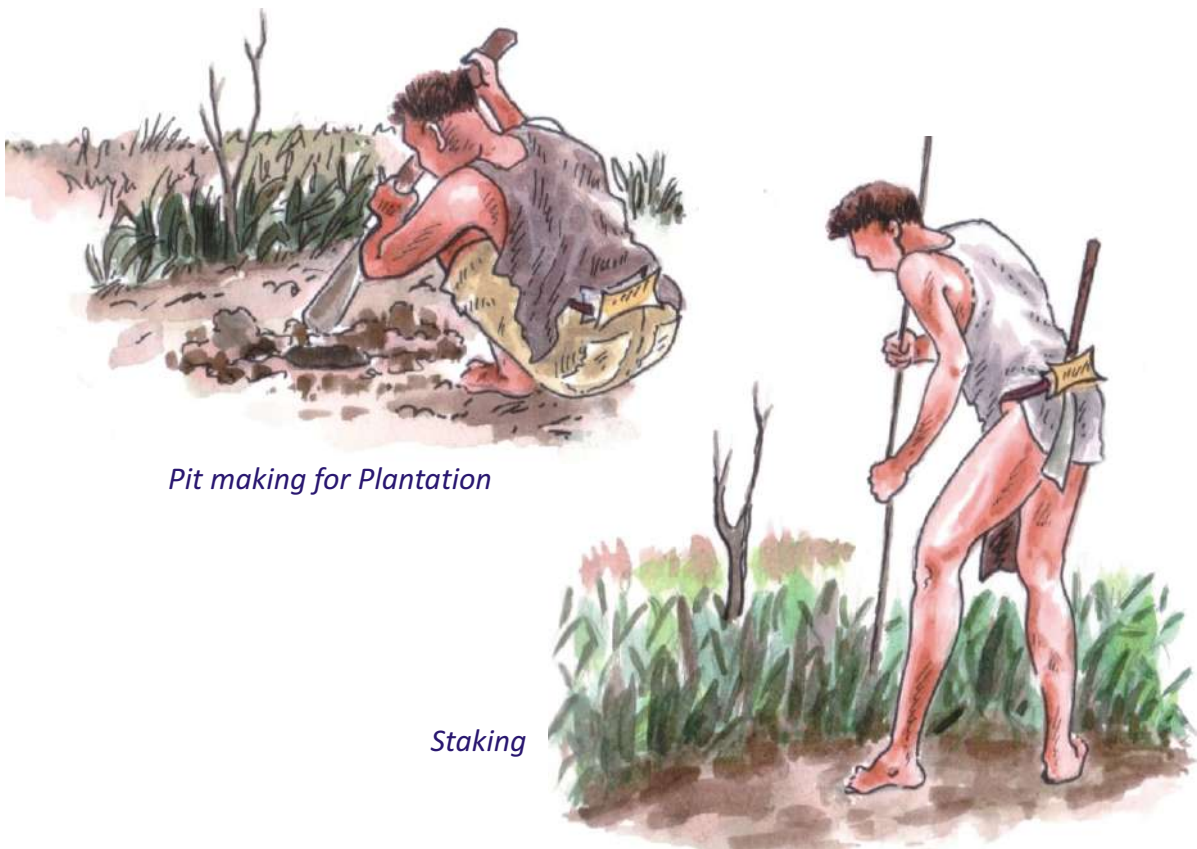


Fig. 3: Schematic diagram showing key aspects of different forestry and conservation models



Section C: Process Initiation

1. Important Decision Nodes

Realizing that in the state of Nagaland, where communities' institutions are quite strong and structured, there are different sets of rules and practices for land, forest and jhum management in different parts of the state.

Particularly, rules are different for privately owned, clan owned and community owned forest and jhum lands for different tribes in different parts of the state.

Due to such variations in tenurial rights on land and resources, project related interventions need flexible decision-making systems.

Rigid or straight-jacketed decision-making process may affect the implementation of different forestry and jhum-fallow management models.

Best option for project is to work in-tandem with local knowledge and decision-making systems and facilitate the process to choose right decisions.

Therefore, while preparing micro-plans on different forestry and conservation models, JFMCs need to take important decisions in consultations with VC, clan representatives and Jhum farmers.

During the course of implementation of different forestry and conservation models, following are the critical points of decision making (Fig. 4):

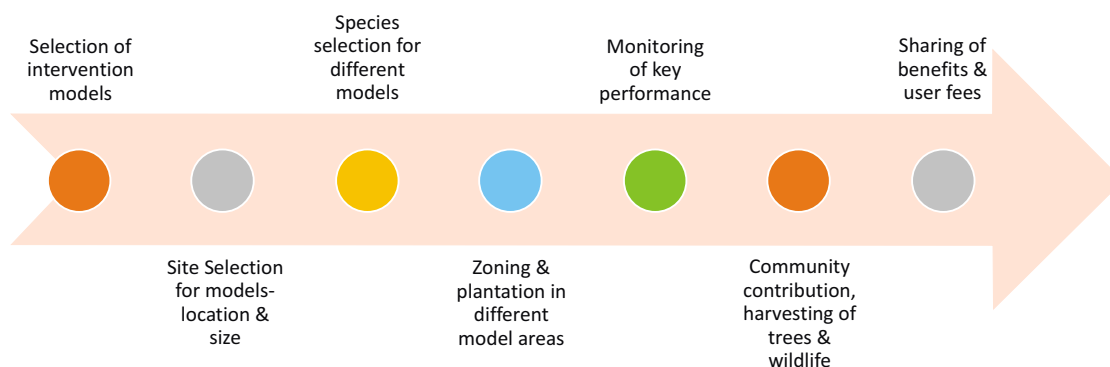


Fig. 4: Key decision -making areas while undertaking forestry and biodiversity intervention models

2. Free Prior Informed Consent (FPIC)

The FPIC aims to create set of conditions as a first requirement of collective community decision-making process. In short, the consent about the project and its activities must seek through collective decision-making process. FPIC is essential to give rights to village communities to 'give or not-give' the consent to the project or some specific aspects of the project, to be taken-up in their village.

Following are the three key elements of getting consent from communities:

- It should be sought in free-will and given voluntarily i.e.,not under any pressure. All community members must feel free to participate regardless of social class, gender or age.
- It should be sought sufficiently prior to the start of actual micro-planning process or intervention takes place. It aims that sufficient time is given to understand, access, and analyze information about project goal, objectives, activities, outputs and outcomes. The time given for this process must respect and take into account the decision-making process of the village communities (including at clan or village council levels)

- It should be sought based on accurate, timely, sufficient and easy to understand information (informed), preferably in local language. Informed means people must be made aware of the positive and potential negative consequences of with or without project activities.

Under NFMP, FPIC is required because many of its objectives and proposed activities have direct links to the land, resources and livelihood impacting issues.

In each village and for each intervention model sites project must seek getting FPIC in a given format at the beginning of the project.

3. Chronology of Planning for Forestry Operations

During the entire process of planning of different aspects of intervention of FCMs, plantation of saplings requires timely decisions. Else, the entire planting season can be lost. The process starts with micro-plan preparation and approval, nursery establishment and raising of saplings and finally plantation of saplings on intervention sites. A suggestive chronology of planning steps is presented in Fig. 5.

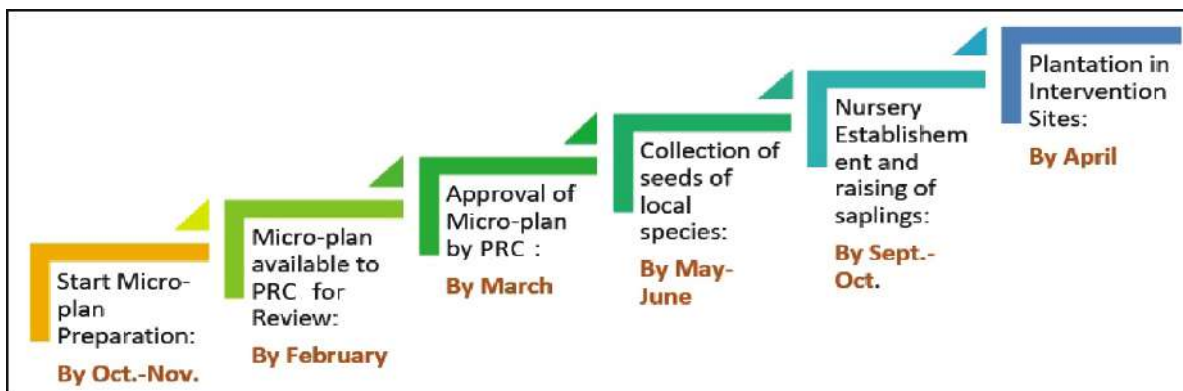


Fig. 5: Suggestive chronology of key planning steps for plantation in intervention sites

It is clear that for effective intervention, process needs to be initiated well in-advance and staggered over a sufficient period of time. Importantly, thus, during the micro-planning exercise, JFMC need to identify sites for different FCMs, visualizing the land-use situations during the year of intervention.



Section D: Sites and Species Selection for Forestry Models

1. Selection of Intervention Models

There is no binding from the project that each village must have all the five proposed models. *So, no compulsion for JFMCs to select intervention areas for all the models in their village.* If in some village some land use is not available, the associated intervention model cannot be proposed. For example, if a village is not engaged in jhum farming anymore, they can't choose model JAF and JFF. Rather they can select more areas under three remaining models.

For planning purpose, therefore, it is important to identify models to be adopted on priority basis in different divisions. Based on understanding of extensiveness of different land use types, mainly the area under active and fallow jhum, and area under forest cover, models which can be taken up on priority for each division can be designed. An indicative priority is given in Annexure 1.

Such prioritization provides opportunities to divisions to focus on only few intervention models, suitable to existing land use system of division. However, the divisions (DMU) can still choose other intervention models, if found important in few villages or in cluster of villages.

Realizing that in each village there may be situation where more than one plot is required to achieve the village level targets for different models, it is important however, that in order to get better result from each of the forestry interventions model, some minimum area of each intervention plot is necessary. Thus, each intervention plot must be around a minimum prescribed size (see Table 4). Following minimum size of each plot, also give advantage in monitoring the change.

Table 4: Indicative size of intervention area for different forestry and conservation models					
Size criteria	JAF	JFF	JCF	JCC	PEC
Average area (Ha) of intervention in each village*	115	50	50	50	350
Minimum area (Ha) of each intervention plot*	50	25	25	25	150
* Suggested numbers are not rigid, but for guiding the planning purpose					

2. Selection of Sites

The decision of selection of areas (jhum blocks and other forested patches) for different forestry intervention models largely rests upon village communities and Village Councils. However, for better outcomes it is important to select the sites in such a manner that forestry interventions complement the gains from each other's.

Two of the key aspects of site selection for different models include:

- Consider landscape approach in selection of sites
- For each model, first identify 2-3 potential sites and then based on different criteria of suitability choose the final site

2.1. Landscape Approach

The distant and isolated intervention areas may function like 'islands' and often face anthropogenic pressure from all sides. It may undermine the long-term ecological and economical gains.

Ideally, at village level, the sites for different intervention models need to be near each other's so that it forms a mosaic of different land-uses in one compact block.

While, selection of intervention sites is to be planned at village level, it is also important to keep in view the prospects of inter-village level planning, provided the neighboring villages is also the part of project. In such situation the two neighboring project villages may identify their respective intervention areas in such a manner so as to create one larger block of intervention areas (Fig.6).

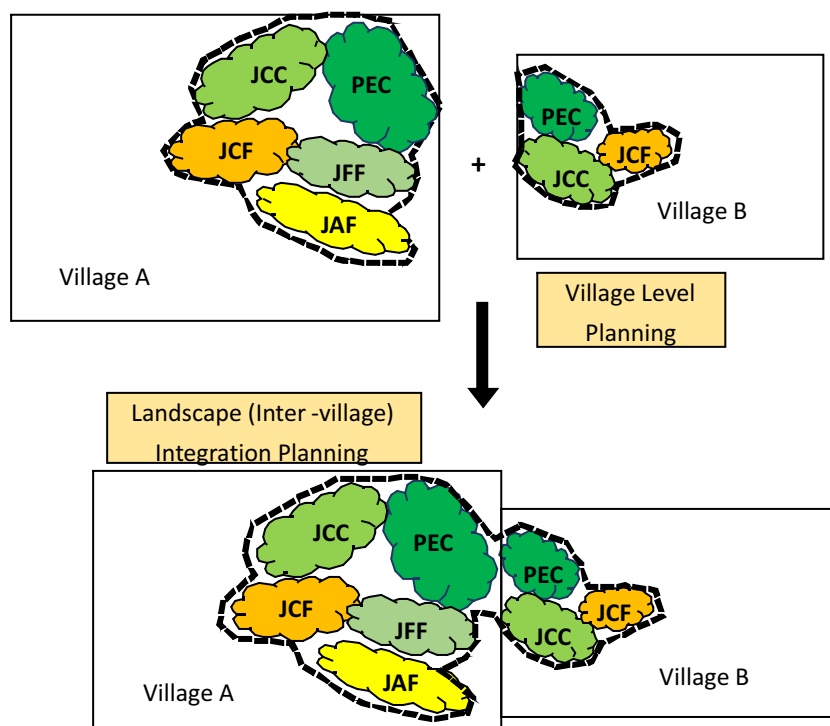


Fig. 6: Diagrammatic representation of landscape approach

The landscape approach of planning may not be always conducive to implement in best desired manners.

But there may be other relatively better suited situations which can be considered on priority basis to get maximum gain from project intervention in a landscape.

Village micro-plan must explore and attempt to work with top priority approach, and only if that is not feasible in the field, subsequent priority situations can be examined for consideration (Table 5).

Table 5: Suggested priority landscape approaches			
Condition	Priority	Landscape approach description	Planning Requirement
1. Adjoining villages are project villages	I	Maintain habitat contiguity of restored areas under different models and other forested areas in neighbouring project villages	<ul style="list-style-type: none"> Discuss the micro -plans of two villages together FMU/DMU must form a joint 'landscape approach facilitation committee', with few representatives of both the JFMCs to finalize the plan
	II	Maintain habitat contiguity of restored areas under PEC, JCC and JCF models of neighbouring project villages	
2. Adjoining villages are not project villages	I	Maintain habitat contiguity of restored areas under different models and other forested areas within a project village	<ul style="list-style-type: none"> Micro -plan needs to discuss and find out all possible candidate land parcels of current and fallow jhum blocks, abandoned jhum blocks and patches of forest & conservation areas Choose those parcels which can form better contiguity.
	II	Maintain habitat contiguity of restored areas under PEC, JCC and JCF models within a project village	
	III	Maintain habitat contiguity of JAF and JFF within project village	

2.2. Selection of Jhum Fallows for Different Models

As Jhum fallows are of different age, the vegetation and tree cover also varies in these lands. Actually, *longer the fallow period, more the vegetation and tree cover on land.*

Under the project, while all the jhum fallows are eligible for project interventions, it will be desirable to consider the current status of vegetation /tree cover in the old and abandoned fallow block for proposing any intervention models.

Thus, selection of jhum fallow areas for models like JFF, JCF, JCC and PEC need some decision rules based on existing vegetation and tree cover. Some of the indicative rules are presented in Table6.

#	Block Type	Tentative Age of Fallow	Vegetation / Tree Cover	Suitable Forestry Model
1	Active	Fresh: 1 -2 years	Negligible: <10%	JFF
2	Abandoned/ Discontinued	Recent: 3 - 5 years	Little: 10-20%	JCF
3		Old: 5 - 10 years	Moderate: 20 -40%	JCF, JCC
4		Very Old: >15 years	High: >40%	JCC, PEC*

* After notify the area as CCA

2.3. Selection of Sites for JAF and JFF Models

Other than increasing the tree density in active jhum blocks, the site selection for JAF and JFF models must also consider two implicit targets:

- i. Reducing the soil erosion and improving the productivity of jhum lands
- ii. Models must provide economic benefits to the large number of people.

Thus, in order to address the above two main concerns, some additional criteria need to be applied for selecting the site for JAF and JFF model interventions, especially if we have to select the site from a pool of few potential ones in the village.

Following criteria can be applied to select the intervention sites for JAF and JFF models:

- **Size of the jhum block:** Larger the size of the intervention block, larger the area treated for soil erosion and soil fertility & crop-productivity improvements. Also, large land parcel reduces many transaction costs of implementation (see Table 4).
- **Topography:** Flatter the topography of land, easier the implementation of different interventions. However, intervention on slope lands generate larger benefits in terms of minimizing the soil erosion problem, which ultimately improve the fertility of the land in long run.
- **Number of beneficiary families:** Greater the number of jhum farmer beneficiaries in a site, larger will be the impact of the project intervention, which help in subsequent scaling-up of the intervention.
- **Land ownership:** Jhum blocks having private land ownership is better to target the HH benefits with agro-forestry models like JAF and JFF. In such situation, individual farmer will take different decisions for its land parcel. However, this will need intensive consultations with each farmer individually to understand their needs (like species types and their numbers, SMC work, plant management etc.) and future plans (like harvesting of trees).

However, Jhum blocks with community and clan ownership need to formulate the roles and responsibilities of beneficiaries in:

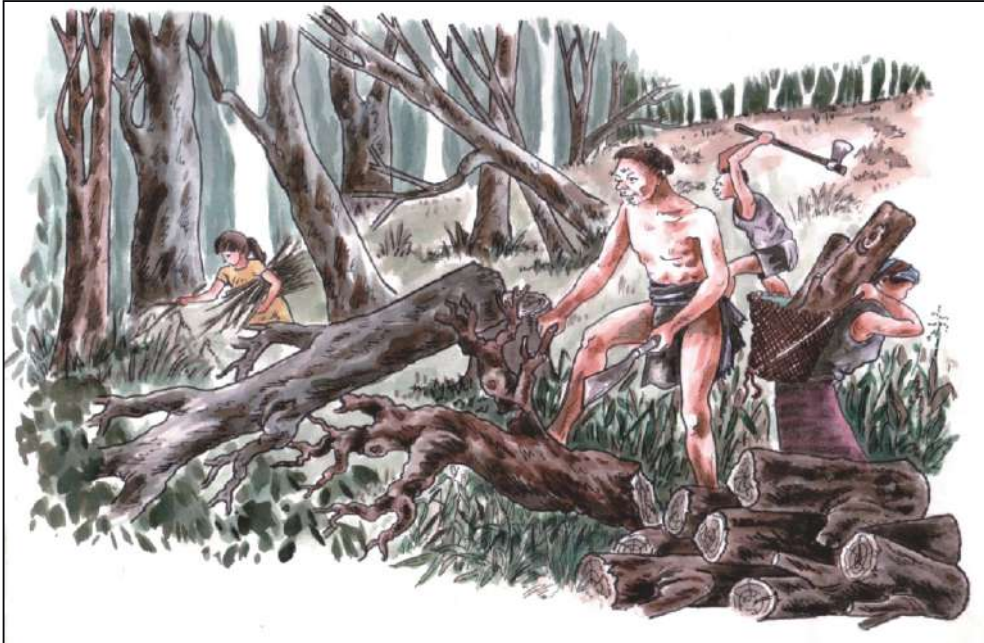
- o selecting different species for plantation
- o deciding the type and scale of SMC works
- o post-plantation maintenance

Manual for Forestry and Conservation Models

- o sharing various usufructs benefits among the members.

Role of Jhum Farmer's Group is particularly important in this situation.

- Neighborhood value: JAF and JFF intervention areas, closer to or contiguous with the intact forest block including the existing CCA or proposed JCF, JCC, and PEC model areas will generate better outcomes in terms of ecological sustainability.



Slashing for new Jhum Field



Preparation of field by burning

It is also important that during micro-plan preparation, the site selection for intervention of JAF and JFF models need to consider the actual year of plantation under these models (Box-1).

Box 1

Site Selection for JAF and JFF Models: Considerations for Microplanning

In general, the micro-plan preparation cycle is such that the plantation can be done only in next planting season. But, in few special cases the plantation may be done in the current planting season itself (i.e., May-August).

Therefore, selection of sites for JAF and JFF interventions differs if the year of micro-plan execution varies, which needs to be considered while preparing the micro-plan.

For the two possible plantation season- next or current, the intervention site can be chosen from two priority selection situations (Table B.1).

Table B.1: Plantation target season and selection of priority sites for JAF and JFF models		
Plantation Season Target	JAF	JFF
Next plantation season (commonly proposed)	<p>1st Priority: Jhum land/ block that are going for cultivation <i>next year</i></p> <p>2nd Priority: Jhum land / block that started jhum cultivation in <i>current year</i> (as farmers will still be there for their second year of jhum)</p>	<p>1st Priority: Jhum land/ block that are going to complete jhum cultivation cycle in <i>current year</i> i.e., land will go to first year of fallow phase, next year</p> <p>2nd Priority: Jhum land/ block that has already in first year of fallow in <i>current year</i> i.e., land will go to second year of fallow phase, next year</p>
Current plantation season (occasionally proposed)	<p>1st Priority: Jhum land / block that are going to start jhum cultivation in <i>current year</i></p> <p>2nd Priority: Jhum land/block that started jhum farming <i>last year</i></p>	<p>1st Priority: Jhum land/ block that has completed jhum cultivation cycle last year i.e., land is already in first year of fallow phase, in current year</p> <p>2nd Priority: Jhum land/ block that has completed jhum cultivation cycle two years back i.e., land is in second year of fallow phase, in current year.</p>



Land preparation

2.4. Selection of Sites for JCF and JCC Models

Jhum Conversion to Forestry (JCF) and Jhum Conversion to Conservation (JCC) models are aimed to restore the abandoned Jhum plots to bring them under permanent forest land use by facilitating the secondary succession processes.

If left undisturbed for a long period, these better augmented forests will create forest structures that support enhanced ecosystem services. People can sustainably use the various goods and services to meet their bonafide needs.

Importantly, the selection of sites for JCF and JCC models must also consider to expand the area of biodiversity-rich forests along with sustained supply of food, energy and forest-based livelihood.

The JCF and JCC models can be implemented only on those Jhum blocks, which are not to be used for jhum purpose in the future. For removing the ambiguity in future tenurial rights of the proposed sites for JCF and JCC models, VC needs to pass a resolution, in consent with concerned owners and stakeholders (like clan, private, community or morung). This is very critical for desired outcomes from these models.



*Land preparation for plantation
In JJCF & JCC models*

Following criteria can be applied to select the intervention sites for JCF and JCC models:

- **Size of the jhum block:** Larger the size of the intervention block, better the species diversity and thus significant increase in flow of ecosystem services. Also, large land parcel reduces many transaction costs of implementation and monitoring (see Table 4)
- **Age of the jhum fallow:** The density and composition of vegetation in the patch of fallow-jhum varies with the age of the fallow. For JCF and JCC models where the focus is on developing

Jhum-fallow patches for forestry and conservation purpose, respectively, the priority should be given to those patches which saw fallow period at least for 5 years (see Table 6).

- **Topography:** Land parcel in flatter or moderately slope area may be good for the implementation purpose. However, for project purpose, it is better to select a complete micro-watershed area which have mosaic of edaphic-topographical conditions. Interventions, thus taken under JCF and JCC models, will ultimately improve watershed and ecosystem and biodiversity services both in tangible and intangible ways.
- **Land ownership:** Fallow Jhum blocks having community or clan ownership is better for JCF and JCC models, which aim to improve natural capital of the village in the long run. It is also not binding that for JCF & JCC models, site is selected from only one ownership type. Thus, if agreed by all parties, the model area can include lands having clan and village ownerships. VC can facilitate such processes of integration of lands of different ownerships. Importantly, once the land is selected for JCF or JCC models, JFMC can take decisions independently on various intervention in such lands.
- **Neighborhood value:** JCF and JCC blocks, closer to or contiguous with the intact forest block including the existing CCA or proposed PEC model areas will make a compact forest block which generate better outcomes in terms of ecological sustainability.

As the benefits from these two models (like NTFP, food, medicine etc.) are mainly collected by women, JFMC can create a women beneficiary group. This women beneficiary group should prioritize intervention areas for JCF and JCC models.

2.5. Selection of Sites for PEC Model

In the project villages the PEC model can be implemented in following land use situations, having different legal and administrative standings:

- Already existing Community Conserved Areas (CCAs) or Community Reserves (CR), recognized by Village Council and Forest and District administrations through a multi-party agreement in the form of MoU.
- In the villages where no CCAs exist, the PEC model can still be implemented by recognizing any new forest area as CCA, by following the process of notifying any area as CCA⁴. The process can be completed either part of micro-plan preparation or can be completed later.

For effectiveness of adoption of PEC models, it can also combine the two - existing and new proposed CCAs so to expand CCA network in the village.

Out of the two situations, since existing CCAs are already demarcated, they need no new selection. In other situation where new site(s) need to be identified for PEC model, selection can be done using some objective criteria.

Following criteria can be applied to select the intervention sites for PEC:

- **Size:** Larger the size of the intervention block, better the species diversity and thus significant increase in flow of ecosystem services. Also, large land parcels reduce many transaction costs of implementation and monitoring (see Table 4).
- **Representativeness:** Protection of sites which represent better in terms of naturalness of native, primary vegetation generate improved outcomes. Also, the area with perennial water

⁴The process of identifying and recognizing any new areas as CCA include: (i) Village council should apply to DFO for need of CCA (ii) DFO direct the R.O. for field verifications (iii) Based on affirmative field report by R.O., a MoU may be signed by the Village Council on behalf of village community and Forest Department (iv) After signing of MoU the area is getting recognized as CCA.

sources (like streams or springs etc.) will add the value to representativeness and enrich species diversity.

- **Land Ownership:** Village community land may be preferred over clan or private land. However, it is not binding that for PEC model, site is selected from only one ownership type. If agreed by all parties, area for PEC model may include lands having village and clan ownerships. VC can facilitate such processes of integration of lands of different ownerships.
- **Neighborhood value:** PEC blocks, closer to or contiguous with the intact forest block or existing CCA areas will be preferred for making a compact protected forest block which generate better outcomes in terms of ecological sustainability. The area which forms the corridor between two existing CCAs must get the high priority in selection.

3. Species Selection for Different Forestry Models

3.1. JAF and JFF Models

Selection of species for plantation work in JAF and JFF models will be determined by two main factors:

- (a) Suitability to grow the trees in the given soil, climate, and physiographic condition (slope and topography) of the intervention plots
- (B) Maturity time and frequency of getting usufruct benefits from the planted trees.

In usufruct terms, farmers can choose combination of species from broad categories (Table 7).

#	Tree Product Type	Approximate time when harvesting can be started	Out-turn frequency
1	Timber producing	20-25 years	Once
2	Pole producing	6-8 year	Once
3	Fuel wood producing	5-7 years	Every 2 nd year (pollarding/coppicing)
4	Fruit producing	4-6 years	Every year
5	Fodder producing	4-6 years	Every year
6	Multipurpose	4-6 years	Every year

The community, in general, have enough knowledge about the suitability of species vis-à-vis the site quality. They also have better understanding about planting and nurturing of many local species. The species for plantation need to be identified from a pool of such species.

While, views of Jhum Farmer Groups (JFG) or Common User and Management Group (CUMG) are critical in species selection, following guiding principles can be applied:

- Select species from a pool of potential native species and thus avoid exotic species
- Select multiple species to avoid monoculture
- Select species of varying maturity period and varying usufruct benefits (i.e., Multi-purpose)

One of the major limitations in species selection lies in the availability of planting materials of desired species in the Village Nursery. Thus, advance planning is needed to understand the demands of beneficiaries.

Some of the potential tree species for plantation purpose under JAF and JFF model is given in Table 8.

#	Species	Local Name	Type	Elevation Zone
1	<i>Acrocarpusfraxinifolius</i>	Mandhani	Deciduous tree	Middle to high (1000 -2000m)
2	<i>Albizia procera</i>	Koroi	Deciduous tree	Low (<1000 m)
3	<i>Aleuritemontana</i>	Tung	Deciduous tree	Middle to high (1000 -2000m)

4	<i>Alnus nepalensis</i>	Alder	Deciduous tree	Middle to high (1000 -2000m)
5	<i>Artocarpus chaplasi</i>	Sam	Evergreen tree	Low (<1000 m)
6	<i>Chukrasia tabularis</i>	Bogipoma	Deciduous tree	
7	<i>Duabanga grandiflora</i>	Khokon	Deciduous trees	Middle to high (1000 -2000m)
8	<i>Dysoxylum procerum</i>	Lali/ Lalipoma	Evergreen, understory	Middle to high (1000 -2000m)
9	<i>Gmelina arborea</i>	Gomri, Thobvu	Deciduous tree	Low (<1000 m)
10	<i>Spondias axillaris</i>	Naga Neem/ Hog-plum	Deciduous tree	Middle to high (1000 -2000m)
11	<i>Malus baccata</i>	Wild Apple/ Crab Apple	Deciduous tree	Middle to high (1000 -2000m)
12	<i>Macaranga denticulata</i>	Kapu	Deciduous tree	
13	<i>Melia composita</i>	Ghora Neem	Deciduous tree	Low (<1000 m)
14	<i>Mesua ferrea</i>	Mangetong / Nagor	Deciduous, understory	Middle to high (1000 -2000m)
15	<i>Micheliachampaca</i>	Tita Chap/ Aroshu	Deciduous trees	Low (<1000 m)
16	<i>Parkia roxburghii</i>	Yongchak/Tree Bean	Deciduous trees	Low (<1200 m)
17	<i>Phoebea goalpensis</i>	Bonsum	Evergreen tree	
18	<i>Prunus cerasoides</i>	Cherry	Deciduous tree	Middle to high (1000 -2000m)
19	<i>Samanea saman</i>	Rain Tree	Deciduous tree	Low (<1000 m)
20	<i>Schima wallichii</i>	Mecho		
21	<i>Tectona grandis</i>	Teak	Deciduous tree	Low (<1000 m)
22	<i>Terminalia myriocarpa</i>	Hollock, Eva	Semi-evergreen tree	Low (<1000 m)
23	<i>Trewia nudiflora</i>	Bhelkar	Deciduous tree	Low (<1000 m)

Source: Information collected from the field and review of literature

List of species to be planted, nurtured and retained along with their number has to be finalized during micro-plan preparation, after intensive consultation with the beneficiaries (Jhum Farmer Group or Common User Group).

Considering the prescription of maximum harvesting of 75% of planted trees at the time of maturity from JAF and JFF intervention areas, it is appropriate to choose between timber/pole and fruit bearing species in the similar proportion i.e., around 75% plants of timber/pole giving species and around 25% plants of fruit bearing species.



SMC work and seed broadcasting

The exotic species like Rubber and coffee, which may be economically very lucrative, must be avoided for plantation under JAF and JFF models. This is not going along with the objective of the models, as it will change the land use of the existing jhum land to non-jhum land in future. In fact, JAF and JFF models aims to improve current jhum blocks through locally grown indigenous forest

tree species of timber value (e.g., Khokon) or NTFP value like edible fruits (e.g., Yongchak). By adopting mono culture plantation of Rubber, the project will deviate from its core idea of promoting production forestry for the jhum fallows⁵. On the other hand, exotic species like Coffee can be considered in JCF model area, but only in the form of mixed plantation. Nevertheless, these can be considered case by case and only after consultation with and approval from PMU.

3.2. JCF, JCC and PEC Models

Interventions through these models aim to restore secondary forests areas, of different age. The principles of selection of species for these models must follow:

- Species rich planting i.e., in no situation less than 10 species are planted in the intervention patches. Higher the number of planting species, greater the chances of creating functional diversity, leading to better ecosystem functioning.
- Of total selected species for plantation, at least 2-3 species can be identified from the list of rare, endangered and threatened (RET) plant species of the state. A list of RET species of Nagaland is presented in Annexure 2.
- Additionally, in each project village, a list of locally important plant species, whose population is significantly declined over the years, need to be prepared during the micro-planning exercise with the help of knowledgeable villagers, especially the traditional healers. A few of those species must be planted in JCF, JCC and PEC intervention areas.
- Species creating dense crown-cover are preferred in these models as the shade suppresses the herbaceous exotic weeds.
- In addition to trees, species of shrub, bamboo, tubers, grass etc. can also be incorporated as part of plantation scheme.
- ***In case of JCF intervention area, where harvesting of maximum 40% of planted trees at the time of maturity is prescribed, it is appropriate to choose around 40% plants of timber/pole giving species and around 60% plants of NTFP values mainly the fruit bearing species, not necessarily horticultural crops but of multipurpose values, preferably the indigenous fruit bearing species (like Yongchak).***

A list of potential native tree species which can be considered for plantation in the JCF, JCC and PEC models is presented in Annexure 3.

While a species preference method is given in Annexure 4, a suggestive list of common tree species to be planted under different models is given in Table 9.

Model	Plantation Focus	Important Species	Decision Maker
JAF	Tree	<i>Alnus nepalensis, Macaranga denticulata, Schimawallichii, Grewia, Quercus serrata, Trema orientalis, Sapiumbaccatum, Albizzia procera, Bischoffia javanica, Phoebe goalparensis, Emblica officinalis, Duabhang grandiflora, Parkia roxburghii</i>	Jhum Farmer Group; User Group
JFF	Tree, Shrub, climber, herbs/ tubers	<i>Alnus nepalensis, Macaranga denticulata, Schimawallichii, Grewia, Melia composita, Chukrasia tabularis, Duabhang grandiflora, Albizzia procera, Michelia champaca, Lannea, Tithonia diversifolia, Parkia roxburghii</i>	Jhum Farmer Group; User Group; Women's participation is important

⁵Strikingly, the project MoD also omitted the Rubber species for plantation purpose

Manual for Forestry and Conservation Models

JCF	Tree (for timber & NTFP), shrub, climber, herb, tubers etc	<i>Melia composita</i> , <i>Chuk rasiatabularis</i> , <i>Albizia procera</i> , <i>Duabhanga grandiflora</i> , <i>Micheliachampaca</i> , <i>Sterculia villosa</i> , <i>Emblica officinalis</i> ; <i>Artocarpus chaplasha</i> , <i>Trema orientalis</i> , <i>Lannea</i> , <i>Canariumresiniferum</i> , <i>Tithonia diversifolia</i> , <i>Parkia roxburghii</i>	Women's participation is important
JCC, PEC	Tree for NTFP/ Fruit, Shrub, herb, tubers etc	Rare and Endangered Species, Bamboo, shrub, tuber, grass; Species for food and shelter for wildlife	Women's participation is important



SMC work with Staking



Staking

Section E: Preparatory Treatment Work

1. Zoning of Jhum Blocks for JAF and JFF Models

Being located on hill slopes, majority of Jhum blocks have topographical and elevational variations, and thus function like a mini-watershed area.

The elevational gradient of jhum blocks resulted into slopes of different degrees. Thus, for the treatment purpose, entire jhum blocks can be delineated ocularly into three zones e.g., upper, middle and lower.

Due to physiographic and topographical variations, the three delineated zones may need different types of treatments including the selection of planting species and their density, and SMC work.

Thus, relatively intensive treatment (plantation and SMC work) is required to 'vulnerable' upper zone than in the 'much-settled' middle and lower zones of jhum blocks (Fig.7).

This concept of zoning can particularly be applied in case of JAF, JFF and to some extent JCF models, where the lands need treatment to control soil erosion to get better productivity from jhum crops.

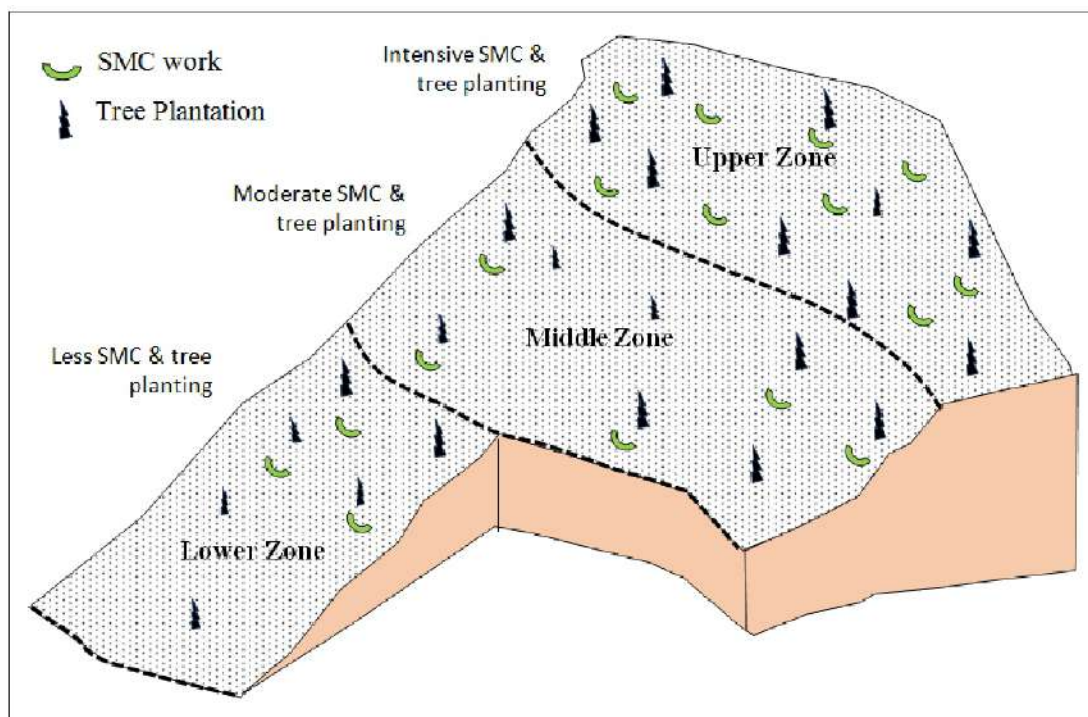


Fig. 7: Schematic diagram of a JAF/JFF land parcel with three zones and treatment plan

The zonal plans for JAF and JFF intervention areas cannot be made by individual jhum farmers. Instead, the exercise of zoning of jhum blocks need to be planned by JFMC. Based on requirement of each zone, JFMC must provide number of saplings of different plant species to the farmers operating in different zones. JFMC must also identify needs of different SMC works in each zone.

The zone-based treatment plan may generate different quantity of benefits to different farmers, which need to be discussed among all the parties viz. land owners (like clan, morung etc.), jhum farmers, VC and JFMC.

2. Clearance of weed and other brushwood

- In the intervention area of JAF, the practice of weed and brushwood clearance is done as part preparation of jhum land for cultivation. However, in case of JFF and JCF, the clearance is based on the site condition.
- On hill slopes, weeds and brushwood need to be cleared by cutting the main stems.
- Avoid uprooting of weeds and brushwood so as to avoid or minimize the soil erosion.
- While clearing the site for planting, retain all indigenous species of trees that are naturally growing in the area. They should not be cut and burned.

3. Staking and Pit Making

- In case of JAF, JFF and JCF models, the Jhum Farmer Group or Common User Group must mark the actual planting location within intervention area by putting stakes.
- Stakes of different sizes need to be prepared from locally available plants (e.g., bamboo stems) and staking need to be done to make it visible from a distance.
- Alignment and spaces for placing of stakes can be decided by farmers, based on the size, slope and existing vegetation conditions of the intervention area.

For effective plantation of saplings, the orientation and dimension of pits are quite important.

While planting the saplings, pits need to be made along the contour lines. Small soil mounds can be created at the edge of planting pits, in down slope side (Fig. 8). It helps in extending the moisture availability for saplings.

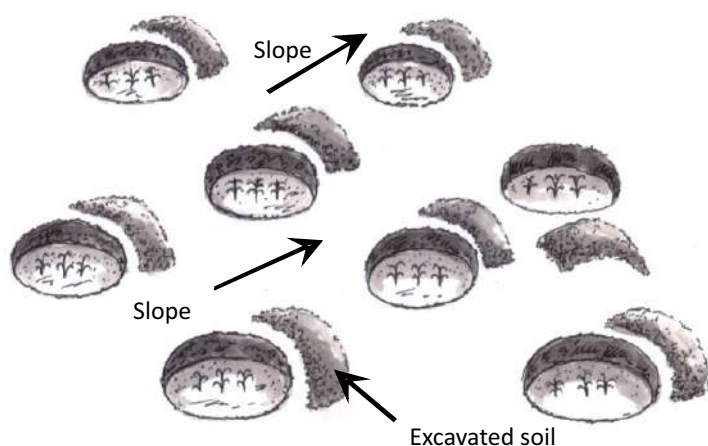


Fig. 8: Schematic diagram of pit making on slope land



Fig. 9: Dimension of Pit

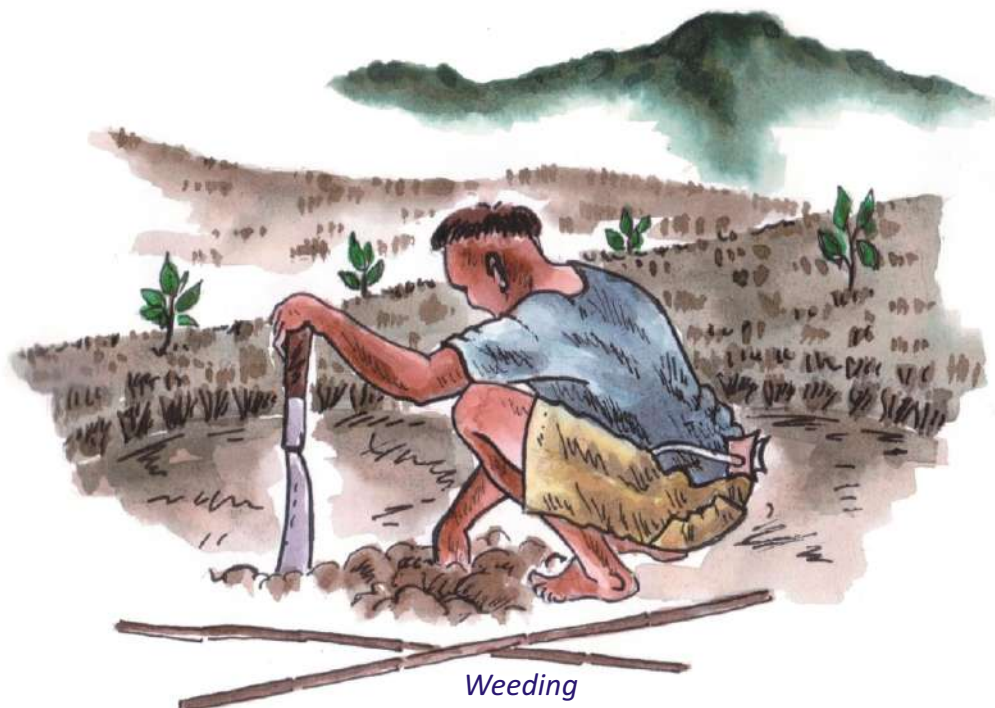
x = Diameter of polybag
y = Height of the polybag

Following are the key aspects of dimension of pits for sapling plantation:

- For sapling plantations, standard dimension of pits is of 30 cm x 30 cm x 30 cm. However, the pit dimension can be altered if the length of sapling and roots are longer.
- Thumb rule is, the width of the pit for all polybag saplings must be twice the diameter of the polybag or at least 15 cm wider than the root system of naked-root saplings. The depth of the planting hole must be 3-5 cm deeper than the length of the sapling or to accommodate entire root-mass of the sapling (Fig.9).
- For better conditioning, the pits need to be made at least 10 days before the actual plantation.

Manual for Forestry and Conservation Models

- Keep the top and bottom dug soil separately, and at the time of plantation, they must be filled in their respective positions.
- Since the jhum lands are prepared by slashing and burning of plant biomass, soils are generally found acidic in nature. So, while doing plantation, it will be effective to mix 5-10 gm of lime powder and some organic farmyard manure in the soil, before it is filled back.



Small sized naked-root saplings and the wildlings may not require pits to plant. Rather, they can be directly planted by quickly making a deep-enough wedge (depend upon the size of the sapling) in the soil. Insert the rooted part of the planting material in the wedge and compact the soil around the sapling so that they get tightly fixed (Fig. 10). This is well known method and people in project villages must be aware of this.

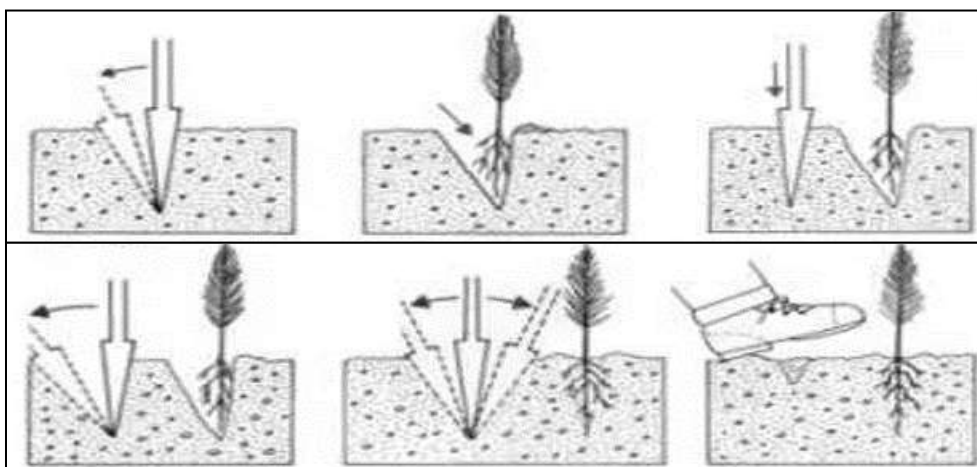


Fig. 10: Schematic diagram showing method of planting naked roots and wildlings



Planting, Staking and SMC work

4. Soil Moisture Conservation (SMC)

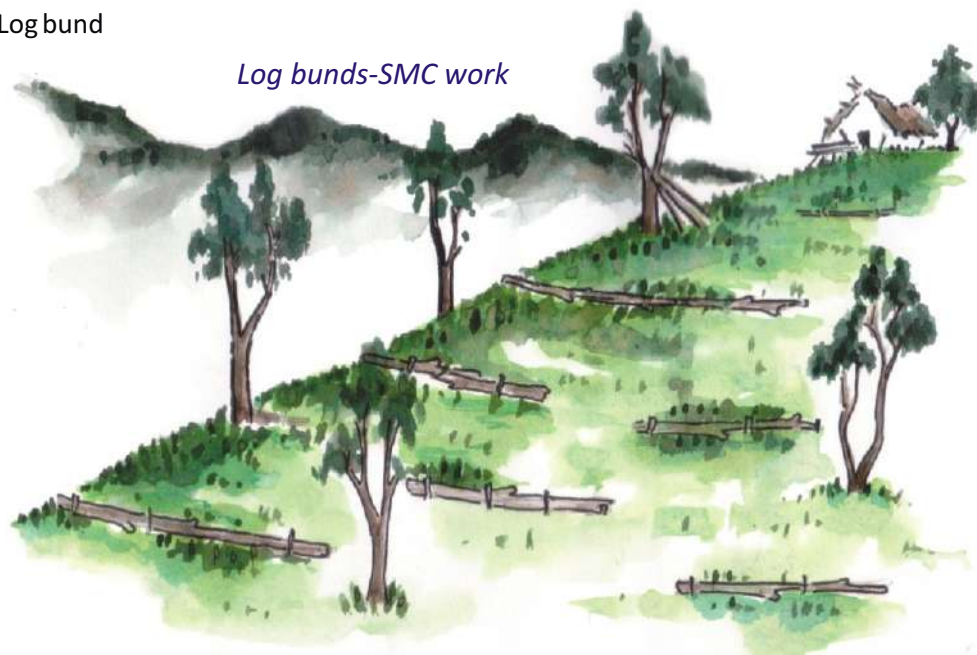
Soil moisture conservation work need to be done according to site condition (slope, existing vegetation, soil texture etc.). Appropriate combination of mechanical and vegetative barriers needs to be tested to cut-down the rainwater run-off from intervention areas.

4.1. Mechanical Barrier

Following well known methods of mechanical barriers can be applied based on the site conditions of intervention areas:

- Staggered Trench
- Stone-bunds
- Log bund

Log bunds-SMC work



The farmers can construct boulder and stone barriers to check soil erosion. They can also use logs, poles and bamboos, besides creating earthen bunds. The use of these methods needs to be based on local availability of materials and necessary modification (Box.2).

Bamboo bunds-SMC work on slopes



Box 2

Traditional Soil Conservation Method

Echo is the traditional soil conservation system practiced, by farmers in all districts of Nagaland. It is an age-old practice and Echo is the local name used by Lotha community. Echo is constructed by using locally available materials like bamboo or wood log etc. It is constructed by placing wood logs randomly across the slope in jhum field and generally last up to 3 years or sometimes up to 5 years. The logs are placed across the steep slope at an average vertical interval of 3-4m or depending on the degree of the slope as locally practiced to reduced soil erosion and conservation of moisture. Proper installation of Echo ensures to check the soil erosion and the runoff water. In the field condition, the crops can grow at better rate along the Echo installed area, which results from the capturing of more moisture and nutrients by the Echo system.

Using the same traditional materials and inputs, there is a modified echo system. In this, logs are placed along the contour lines. The modified system diverts runoff during rain to grass-lined waterways, thereby retaining eroded soil.



4.2. Vegetative Barrier

Jhum farmers have practice of planting crops and vegetables in rows across the slope in the jhum field to check soil erosion. For example, crops like maize, millets, jobs-tears (Keshi) are used as vegetative barriers. While such methods are cost effective, being annual in nature their impact is limited. For better results, vegetative barriers or hedgerows need to be of perennial species. Also, it will be ideal if those plants belong to Leguminosae (or Fabaceae) family, so they can enrich nitrogen in the soil.

Some of the potential leguminous species useful in creating hedgerows in Jhum lands (particularly in JAF and JFF models) are:

- Indigofera zollingeriana
- Senna occidentalis
- Tephrosia candida
- Mimosa himalayana
- Mucuna pruriens

In many regions Sloping Agriculture Land Technology (SALT) models successfully demonstrated creation of vegetative barriers (hedgerows) of nitrogen fixing plants along the contours to control soil loss and surface run-off of rain water while improving soil fertility through nitrogen-fixation.

The simple thumb rule for making mechanical or vegetative barriers is: *steeper the slope and higher the rainfall, closer the distance between the two rows of barriers.*



Stone bunds-SMC work

Box 3: Wild Sunflower - Potential of Vegetative Barrier

Tithonia diversifolia (wild sunflower) is one of the potential species which can be planted in few rows across the contour, particularly on the ridge parts of the JAF, JFF and JCF intervention areas. The use of *Tithonia* species in controlling the weedy *Imperata cylindrica* grass was successfully demonstrated under NEPED projects. In addition, the biomass from regularly pruned hedgerows can be used as mulching material, which on decomposition, improve soil nutrient and organic matter.



An experimental trial was conducted after the harvest of the second year jhum. The field was divided into two plots, one plot was slashed during March and *Tithonia* stems were planted at a spacing of 1m x1m during the onset of monsoon and the other plot was kept without *Tithonia*. Both the plots were left fallow for 4 years and then the two plots were again slashed for jhum cultivation for two years. The result found an increased level of organic Carbon in the *Tithonia* treated plots. Also, the paddy yield (in q/ha) was increased from 7.4 and 1.2 for control plots for 1st and 2nd year of jhum, respectively to 17.6 and 15.5 in treated plots for the 1st and 2nd Year of jhum cultivation. Additionally, the treatment with *Tithonia* shows dramatic suppression of weeds in jhum fallow fields.

Despite reports of many positive results, the species is not getting the confidence of jhum farmers due to its invasiveness and thus difficult to manage their spread, especially when labor availability is quite low.



Planting in Gaps

Section F: Plantation and Habitat Improvement Work

1. Plantation Approach

Based on the objective of interventions like harvesting of trees after maturity or conservation of forests and biodiversity, project proposes maintaining varying tree densities in five different models. However, in each model type different types of planting materials are prescribed (Table 10).

Table 10: Proposed tree density in different models as prescribed in MoD

Model	Target Area (ha)	Proposed Tree Density (No. per ha)	New Plants to be Raised through AR (No. per ha)				Plants to be raised through ANR (No. per ha)
			Total	Polybag Sapling	Naked Root Sapling	Other Planting material (cutting, suckers, wildlings, bamboo culms etc)	
JAF	10325	800	400	200	200	0	400
JFF	4594	1250	625	156	156	313	625
JCF	4594	625	625	156	156	313	0
JCC	3697	625	625	156	156	313	0
PEC	55886	200	200	50	50	100	0

While project proposed different tree density to be maintained in the intervention areas, the spacing between tree and planting geometry is difficult to maintain, mainly because of random presence of existing plants in the plantation area. Thus, the proposed tree density for each model is for guiding purpose and can be altered slightly according to site quality and availability of open spaces for plantation.

In JAF and JFF model areas, it is also important to keep spaces for non-tree species i.e., crops. Local knowledge of farmers about species needs to be explored to decide spacing of planting the saplings.



Planting polybag saplings

In general, two complementary approaches are proposed to achieve the tree density in the intervention areas:

- Plantation or Artificial Regeneration (AR), and
- Assisted Natural Regeneration (ANR)

1.1. Artificial Regeneration (AR)

Under AR, following four types of planting materials can be used:

- Nursery grown polybag saplings
- Nursery grown naked root saplings
- Collection and replanting of naturally germinated saplings, wildlings, cuttings etc. (Fig.11).
- Direct seeding

In all above cases, it is important to plant only those saplings or seeds which fits to the criteria of 'good quality'.

A detailed account of the raising good quality saplings in village nurseries is given in a separate 'Nursery Manual'.

As standard protocol, saplings must have a minimum height and stem thickness (as reflected through collar diameter)⁶. Saplings with height and collar-diameter ratio of 80 cm: 1 cm are preferred. In simple terms, planting saplings should have minimum height of 1' (one-foot) and pencil-thick stem diameter⁷.



Fig.11 : Collection of naturally germinated saplings

1.2. Assisted Natural Regeneration (ANR)

ANR is a standard method to hasten the establishment of secondary forest by protecting and nurturing the saplings that are naturally present in the area. In a sense, ANR aims to accelerate, rather than replace, natural succession process.

The deforested area with seed sources nearby and tree seedlings found beneath the thick ground cover of grass and other herbaceous species, are the potential sites for ANR. Jhum fallow lands are thus ideal sites for ANR intervention.

In the JAF intervention area, where the lands get cleared and burned for jhum cultivation, scope of adopting ANR practices may be quite low. However, in case of JFF and JCF and in few degraded patches within JCC and PEC intervention area, the scope of ANR operations can be explored to improve tree cover through natural succession.

⁶A 'collar' in plant sapling is the point where the root and shoot get differentiated and used as the location for measuring stem diameter and the reference base for measuring the height of the sapling.

⁷In case of Nagaland, which receives good rainfall during the entire growing season of plants, even smaller saplings of 10" height can also be planted in special circumstances, provided weeds around planted saplings are managed properly.

Some of the methods to assist the growth of natural regeneration in intervention areas may include:

- Identifying and marking of naturally grown saplings by staking (Fig. 12).
- Remove the weeds / unwanted plants within a circle of 50-cm radius from around the base of all natural seedlings and saplings.
- Suppressing the grass mainly the *Imperata cyllindrica* to further reduce competition and the risk of fire. Preferred way is by 'pressing' or 'lodging' the grasses, with the help of a wooden board approximately 15 to 30 cm wide and 1 to 1.2 m long. Use the board to press the grass hard by body weight (Fig. 13).



Fig.12 : Staking of naturally grown saplings and coppices

- make micro catchment (in crescent/trough shape) around the selected saplings, root stocks etc., by soil readjustment so extra soil moisture is available to them for growth
- manuring with pig-wastes
- tending of coppice / pollarded stems
- special protection measures against livestock grazing, especially for the saplings of rare and threatened tree species
- create fire-breaks in high fire risk areas.

2. Silvicultural Operations

Silviculture operations provide two major functions i.e., tending and harvesting. In case of five forestry and biodiversity conservation models, the main focus lies in tending operations. Followings are some of the applicable silvicultural operations in the model intervention areas:



Fig.13 : Management of grasses around saplings

- Coppicing is to regenerate multiple stems from the main tree stump near the ground level. This can be applied in JAF and JFF model intervention areas, where most of the trees are cut to clear the land for jhum farming.
- Stump dressing to allow emergence of better coppice shoots
- Pollarding and Lopping
- Nurturing new Regeneration
- Removal and control of weeds

In JCF, JCC and PEC model areas, to facilitate new regeneration, in addition to above silvicultural operations, following thinning operations can be taken up:

- Crown thinning, to create opening for the light for ground cover
- Low thinning: The removal of trees from the lower crown classes in order to favour those in the upper crown classes.

As per approved costings, the silvicultural operations need to be continued for total three years - one year of plantation and two years of maintenance operations.

A brief summary of relevant silvicultural operations in model intervention areas is presented in Table 11.

Silvicultural Operations	Description	End Products
Regeneration strategy: gap planting and enrichment planning	Planting saplings of tree /shrub species in open patch to improve the canopy cover and growing stock	Improve canopy and density; enrich biodiversity
Selective harvesting	Occasional cutting of trees for special use	Poles, firewood
Weeding/cleaning	Removing unwanted vegetation, which is competing with the growth of young regenerated or newly planted seedlings.	Timber, firewood, fodder, grasses
Pruning	Cutting of branches from large or mature trees	Foliage, firewood, materials for hut construction
Lopping	Harvesting of leaves of small branches and twigs	Foliage for livestock bedding and fodder
Coppice Management		
Singling	Maintain a single stem from a coppiced stump	Foliage, firewood, fodder
Cut back operations	Dressing of older malformed stumps in order to promote new shoots	Firewood, fodder, manure
Cutting of multiple shoots	When repeated cutting is done to remove malformed and damage trees of the coppice species, a good coppice crop consisting of multiple shoots is produced such shoots are thinned in multiple shoot operation and best shoot is retained.	Firewood, foliage, fodder

3. Enhancement of Conservation Values in JCC and PEC models

In the area selected for JCC and PEC model, the overall focus needs to be on wildlife habitat improvement. As thumb-rule, creating mosaics of different habitats ensure higher wildlife diversity.

While raising saplings of trees is one of the key activities in all the five models, in the case of PEC, specifically, the requirement of planting of trees needs to be properly examined and optimally used only to fill some critical canopy gaps.

The planting of saplings of trees in PEC intervention area needs to be avoided in following conditions:

- the area having more than 70% canopy cover
- the open area (forest blanks) having potential of restoring patch of grassland

The selection of species for planting purpose in JCC and PEC can be derived from following three requirements:

- a. The planting can be used to regenerate and recover some of the rare and threatened plant species of the region. So, special focus can be made in selecting few rare, endemic and threatened (RET) plant species and increase their population in intervention areas through planting the saplings or seeding efforts.

- b. Some of the culturally important plant species, whose population is declined drastically in the project village, can also be raised in the JCC and PEC intervention areas. JFMC through consultative process can identify some of those species.
- c. Some of the plant species which are important for wildlife needs like for food, nesting and shelter/ roosting purpose and whose overall population are declined in the village, can be identified and raised in JCC and PEC intervention areas.

Actually, keeping in view the larger purpose of these model, the focus should be on various habitat improvement work not on the plantation activity.



Sapling planting in forest gaps

For improving the habitat values of the area, some of the other interventions can also be considered in JCC and PEC areas. These include:

- measures to improve soil moisture and to control soil erosion like staggered trenches, stone bunds, vegetative barriers, gully plugs etc. can be taken up in some critical parts of the intervention areas
- Regenerating small patches of grassland within intervention areas, especially in some of the forest blanks
- Create groves of bushy species in some of the open forest blanks.
- Developing water holes and salt-licks in appropriate sites.
- In PEC intervention area, if required, patrolling trails, rest sheds and watch towers can be constructed at some strategic locations, with locally available materials.

For JCC and PEC intervention areas, JFMC can form a team of youth volunteers for regular patrolling and monitoring of the area.



Patrolling and monitoring of forest areas

For management effectiveness point of view, JFMC with the help of DMU team need to prepare a conservation management plan (CMP) for PEC. The CMP may incorporate following aspects:

- Assess the biodiversity status in PEC area. Prepare checklist of RET species among the taxa like plants, birds, insects, spiders, butterflies, herpetofauna etc.
- Document traditional knowledge about various uses of plants and animals found in the PEC
- Regeneration status of important tree species
- GPS based mapping of biologically significant sites including rocky-scape, springs, snags, water ways, water bodies, dens, roosting sites etc.
- Assessment of key threats
- Zoning of PEC for the targeted work
- Prepare Habitat improvement plan (like plantation, creating water holes, creating grass patches etc.)
- Plan for species recovery
- Prepare protection plan including patrolling.
- Prepare monitoring plan including the use of Camera Traps and survey along fixed transects etc.
- Define the roles and responsibilities of village communities in data collection, patrolling, monitoring etc.

For the preparation of CMP, respective DMUs may seek support from Resource Organization on Jhum and Biodiversity (ROJB) and Nagaland State Biodiversity Board (NSBB). Collaboration and support from School of Science, Nagaland University may also be garnered for preparation of CMPs.

4. Plantation Maintenance

4.1. Mortality Replacement

In each forestry and conservation model, project made budget provisions for mortality replacement of saplings. Considering the overall threats to the planted saplings in different parts of the state, about 20% of sapling mortality can be expected and thus accounted-for, in the project.

The mortality replacement can be done in following manners:

- (a) In the plantation year itself, species wise mortality of saplings needs to be enumerated in 100% of each intervention area⁸. If the plantation is done in the first month of rainy season, the mortality assessment needs to be done at mid or nearest to mid rainy season.

Thus, mortality or casualty replacement must be done in a period so that the replaced sapling get at least 1 to 1.5 months of rainy season to establish themselves.

As thumb rule, casualty replacement should be avoided in the last month of the rainy season.

- (b) In subsequent year (i.e., one year after plantation), mortality of saplings needs to be enumerated in atleast 50% of each intervention area. The assessment needs to be done at least one month earlier to normal period of monsoon, i.e., in the months of March - April. The dead saplings must be replaced by new saplings after getting first sufficient rain-shower i.e., by May-June.

Box 4

Mortality Replacement by 'One-plus-three' Plantation Model

In some sites, particularly in the areas where probability of mortality of saplings is high, another approach can be adopted. This is known as 'One-plus-Three' method.

In this method, in addition to planting ONE SAPLING in each pit, THREE SEEDS of different species can also be sown in the soil mounds around each pit.

In the second year during the mortality assessment, those healthy saplings which are raised from the seeds on the mounds, can be extracted and used for mortality replacement. These, about year-old saplings, get well adapted to the soil condition of the intervention area and thus have good chance of survival.

Even if those are not required for mortality replacement, the weaker of the three saplings can be removed from the mound, so that to facilitate the growth of remaining saplings.

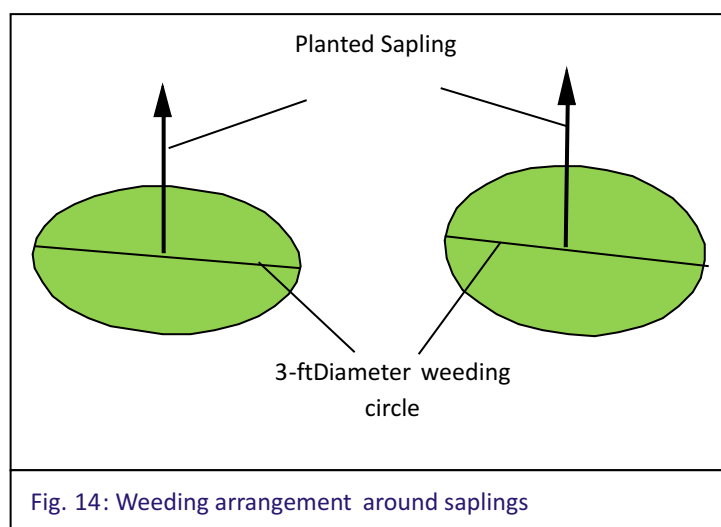
For the record, it is also important to identify the cause of mortality of saplings. Some of the common causes of mortality may include:

- Wrong selection of species, not considering the soil, altitude, temperature and rainfall.
- Planting of weak and damaged saplings. Only high-grade saplings from nurseries need to be planted. Avoid planting the saplings which are damaged during the transportation.
- Improper pit making and use of poorly aerated soils
- Wrong time of planting of saplings i.e., planting too early or too late
- Inadequate removal of weeds and other hinderances

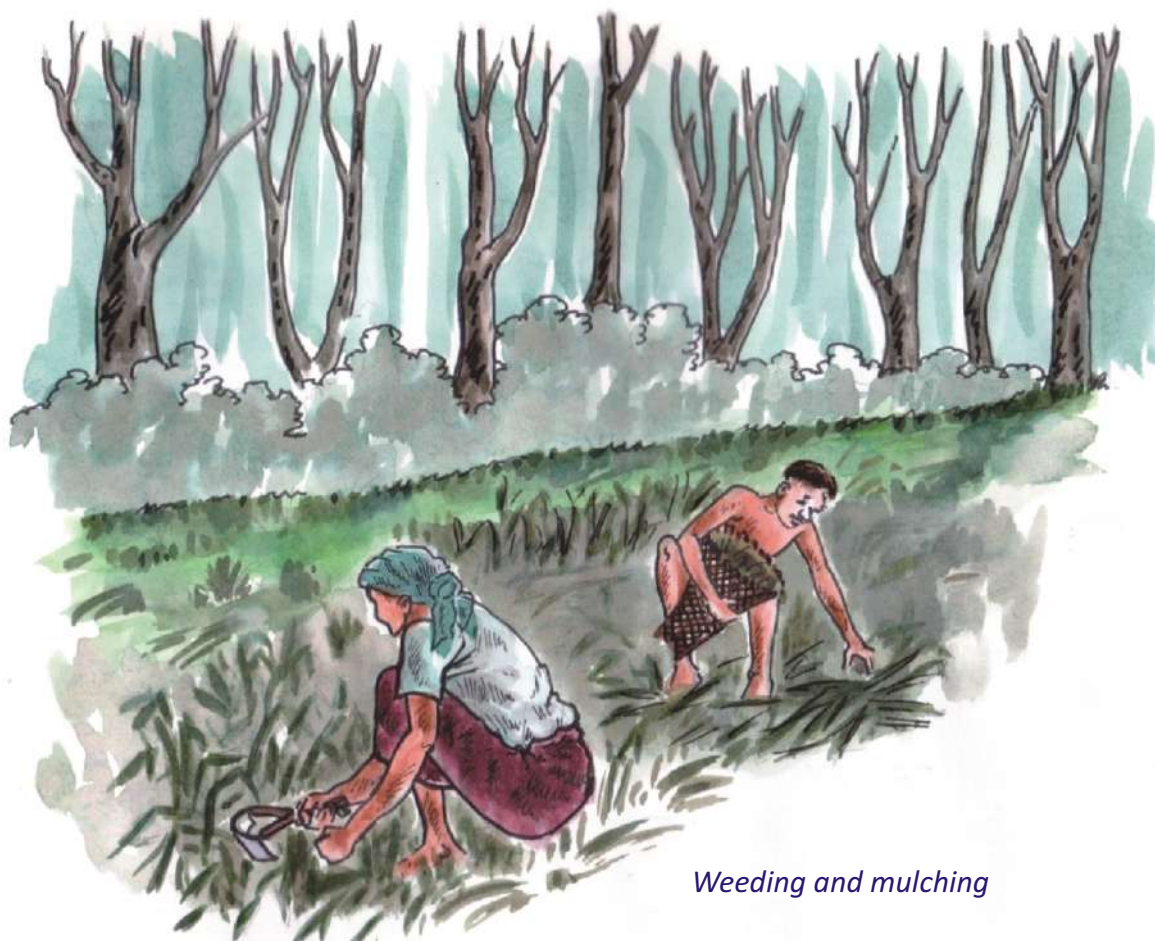
⁸The purpose of 100% enumeration of saplings is to record the total casualty of sapling so that they can be replaced as part of maintenance operation of plantation. It is important to note that this is different than the monitoring of survival percentage, which is normally done using statistically effective sampling approach.

4.2. Weeding

- Weeding is vital to ensure maximum growth of seedlings and to increase the chances of survival. Weeds around planted saplings need to be removed from the circular area of at least 3-foot diameter (Fig. 14).
- Weeding need to be carried out before saplings get suppressed.
- Initial weeding needs to be carried out 2 months after planting.



Weeding around saplings



Weeding and mulching

5. Maintenance of Site Treatment Register

The forestry and conservation work demands long term commitments, which sometime seek 15-20 years of continuous engagement of different stakeholders. Unless simple yet systematic recording and documentation of different interventions is done, the process may fiddle out soon.

Thus, each JFMC must maintain a Site Treatment Register (STR), separately for each of the five forestry models intervention sites.

STR will be maintained by the JFMC President and Secretary (Forester) and will be reviewed by FMU and DMU Heads.

The register will be created immediately after the demarcation of forestry and conservation model sites and will remain till management interventions and resource extraction practices, continues.

Each register must record the timing (dates) and other details of various activities in the treatment area.

The STR will be updated every quarterly to record and document various interventions made in raising protecting and maintaining the plantation work.

FMU will review some of these STRs and submit the report to DMU. DMU will review the observation reports submitted by FMU and submit their observation report to PMU.

Broadly, each STR should record following:

- Brief history of land use
- Number of naked-root, polybag and wildling saplings planted, for different species
- Type and quantity of SMC interventions undertaken
- Mortality of species and their replacement
- Silviculture operations like pollarding, coppicing
- Maintenance work like weeding, fire management, fencing etc.
- Habitat improvement works (especially in JCC and PEC models)

A Sample Site Treatment Register is given in Annexure 5.

6. Responsibilities

The mortality replacement and weeding are critical aspects of the maintenance of the plantation. Also, preparing and maintaining the site treatment register for each FCM intervention block provide important insights for progression of work in plantation areas. Suggested responsibilities of JFMC, FMU and DMU in maintenance of plantation related work is presented in Table 12.

Table 12: Suggested hierarchical roles and responsibilities for plantation maintenance work			
Parameter	JFMC	FMU	DMU
Responsible Person	<ul style="list-style-type: none"> • JFMC Secretary (Forester) • JFMC President 	<ul style="list-style-type: none"> • FMU Head 	<ul style="list-style-type: none"> • DMU Head
Survival assessment and Mortality replacement			
Coverage	<ul style="list-style-type: none"> • Cover 100% intervention sites under each FCM type • Cover 100% & 50% of intervention area of each FCM type in plantation year (i.e., Year 0 and Year1, respectively) 	<ul style="list-style-type: none"> • Cover at least 50% intervention sites under each FCM type 	<ul style="list-style-type: none"> • Cover at least 25% intervention sites under each FCM type
Frequency	<ul style="list-style-type: none"> • Once in a year 	<ul style="list-style-type: none"> • Once in a year 	<ul style="list-style-type: none"> • Once in a year
Weeding around planted saplings			
Coverage	<ul style="list-style-type: none"> • Cover 100% intervention sites under each FCM type • Cover 100% intervention area of each FCM type 	<ul style="list-style-type: none"> • Cover 50% intervention sites under each FCM type 	<ul style="list-style-type: none"> • Cover at least 25% intervention sites under each FCM type
Frequency	<ul style="list-style-type: none"> • Once after 2 months of plantation 	<ul style="list-style-type: none"> • Once after 2 months of plantation 	<ul style="list-style-type: none"> • Once after 2 months of plantation
Maintenance of Site Treatment Register (STR)			
Coverage	<ul style="list-style-type: none"> • Maintain STR for 100% intervention sites of each FCM type 	<ul style="list-style-type: none"> • Review all the STRs of each FCM type. • Submit the FMU level observation report to DMU 	<ul style="list-style-type: none"> • Review all the observation reports of all FMUs • Submit DMU level Report to PMU
Frequency	<ul style="list-style-type: none"> • Once every 3 months 	<ul style="list-style-type: none"> • Once in six months 	<ul style="list-style-type: none"> • Once in six months

Section G: Monitoring

Earlier sections described various interventions associated with Forestry and Conservation Models (FCMs). These interventions include land preparation, species selection, plantation and silvicultural operations, maintenance etc. However, one of the important aspects for success of those models depends upon periodical monitoring system.

It is important to note that the monitoring system, described in this section, is different than the ex-ante (baseline) and ex-post (midline and endline) evaluation. Those are normally done by engaging an impartial third-party agency. Essentially this section provides protocols for periodical monitoring of changes in FCM intervention areas due to plantation, ANR and SMC works. This will be conducted internally by engaging JFMCs, FMUs and DMUs.

Thus, for FCM point of view, following three components need to be monitored internally:

- Plantation Performance (survival and growth)
- ANR Performance (diversity and growth)
- SMC Performance (intactness of structures)

1. Plantation Survival and Growth

Monitoring of plantation survival and the growth of the plants are essential for JAF, JFF and JCF intervention areas because of their production and harvesting model. In JCC and PEC, where the plantation is done mainly to fill the gaps in relatively denser forest patches, focus is on conservation, not allowing harvesting of planted trees. Thus, monitoring of survival and growth of planted trees may not be of much relevance in JCC and PEC models.

Following points are important for designing the monitoring protocols for JAF, JFF and JCF models:

- After the plantation year (i.e., Year-0), the mortality replacement of sapling gets completed by next year (i.e., Year-1) (See Section F-4.1). Therefore, monitoring of survival and growth of planted saplings can be initiated after Year-1.
- The monitoring of plantation will be done once in a year for next three years i.e., Year-2 to Year-4, considering plantation year as Year-0.
- In case of JAF, JFF and JCF models, plantations are not done in rows. So, they are not maintaining fixed spacing. In such situation, traditional method of using sample plots for monitoring the survival and growth may not work.

So, keeping above considerations in view, following are suggestive approach to undertake monitoring of performance of plantation in JAF, JFF and JCF models.

1.1. Monitoring in JAF Area

In JAF block, planting of number of plants of different species varies from one farmer's field to other, due to varying size of jhum area each farmer cultivates, which range between 0.5 to 1.5 ha.

Thus, for the monitoring purpose following approach can be adopted:

- In each JAF intervention area, which varies from 20 to 50 ha, choose some jhum farmers, who are ready to volunteer to collect data from the parcel of land which they cultivate and where they did plantation under the project.
- As a thumb rule, number of farmers can be selected using telescopic-slab approach, as follows: for up to 25 ha of intervention area = 2 farmers; 25 to 40 ha = 3 farmers and, more than 40 ha = 4 farmers.

- Once the volunteer farmers are identified, the GPS coordinates of boundary of their land parcels will be recorded, for future reference.
- The entire lands parcel of each of the volunteer farmer will be considered as sample plot. Since the size of land parcels of individual farmers are not large, varying around 0.5 to 1.5 ha, it is not difficult to sample the entire plot.
- In each of the sample land parcel, volunteer farmer will record following information:
 - o Species wise number of planted saplings
 - o Height of the planted saplings
 - o Girth of the planted saplings, only if they attain 1.5-meter height.
- Frequency of monitoring of plantation performance will be done once in a year, preferably in the month of February and March.
- JFMC President and FMU Head will coordinate the exercise with volunteer farmers.

1.2. Monitoring in JFF and JCF Area

In JFF and JCF intervention blocks, planting of number of saplings of different species varies, due to varying size of the intervention area (although in terms of density of saplings, they are almost equal). It is assumed, however, that within an intervention block, the planted saplings are distributed nearly uniformly. So, the random sampling approach provides equal chance to all the planted saplings to get enumerated. In general, the average size of intervention blocks for JFF and JCF is around 25 ha. Unlike JAF, the plantation is not done by individual farmers but generally by community, as group.

Thus, keeping above in view, for the monitoring purpose in JFF and JCF intervention blocks, following approach can be adopted:

- In each of the JFF and JCF intervention area, data will be collected in sample plots of 0.1 ha size (i.e., 31.6m x 31.6m).
- As a thumb rule, number of sample plots can be selected using telescopic-slab approach, as follows: for up to 20 ha of intervention area = 5 sample plots; 20 to 30 ha = 7 sample plots and, more than 30 ha = 9 sample plots.
- Sample plots will be located through stratified random approach. In the present case, upper, middle and lower reaches of the intervention block will be considered as three sampling strata. The, sample plots need to be distributed in the three strata, approximately equally.
- To locate sample plots at random, enumerators will generate double random numbers. For this, enumerator will walk first random number of steps (e.g., 50, 60 or 70 steps, which can be found by picking the folded paper chit blindly). At this point, enumerator will draw another random number and walk that many steps (e.g., 25, 35, 45 steps). The sample plot will be located at the finally reached point.
- To determine the direction of walk randomly, enumerator may spin a stick on the ground and enumerator will walk in the direction where the stick finally orient itself.
- Once the enumerator identifies the location of sample plots, their GPS coordinates will be recorded, for future reference.
- In each sample plot, the enumerators (i.e., members of JFG, CUG or JFMC) will record following data:
 - o Species wise number of planted saplings
 - o Height of the planted saplings
 - o Girth of the planted saplings, only if they attain 1.5-meter height.

- Frequency of monitoring of plantation performance will be done once in a year, preferably in the month of February and March.
- In JFF and JCF intervention areas, the monitoring of plantation performance will be the responsibility of volunteer members of Jhum Farmer Group or Common User Group. In the event of no such groups exist, the responsibility will be on JFMC. JFMC President and FMU Head will coordinate the exercise with volunteer members of JFG or CUG.

Formats for data collection from sampling area is presented in Annexure 6.

2. ANR Performance

The monitoring of performance of ANR related interventions in FCMs is important to assess changes in the growth and survival of naturally grown tree seedlings. ANR is mainly adopted in JAF, JFF and JCF models. In each of these models, randomly located sample plots will be used to record the diversity, survival and growth of the naturally grown tree seedlings.

For monitoring purpose, in each of the three FCM types, scheme of use of sample plots will be as follows:

- **JAF model area:** One sample plot of 10m x 10m size will be nested within the selected farmer's land parcels, used for plantation survival and growth monitoring (see section 1.1). The sample plot for ANR monitoring can be located near the central part of the land parcel. The GPS coordinates of the sample plot will be recorded, for future reference.
- **JFF and JCF model areas:** One sample plot of 10m x 10m size will be nested within the larger sampling plots (of 0.1 ha size) used for plantation survival and growth monitoring (see section 1.2). The sample plot for ANR monitoring can be located near the central part of the larger sample plot of 0.1 ha size.

The GPS coordinates of the sample plot will be recorded, for future reference.

In all the sample plot of 10m x 10m size, all the naturally grown seedlings and saplings of tree species will be identified and enumerated for two parameters:

- o Species wise number of naturally grown saplings
- o Height of the naturally grown saplings

Frequency of monitoring of ANR performance will be done once in a year, preferably in the month of February and March. So, basically it will be done simultaneously with the monitoring of plantation performance.

The responsibilities of data collection to monitor ANR performance will be on same sets of people/institutions, proposed for plantation survival and growth monitoring (see section 1.1 and 1.2).

Formats for ANR related data collection from sampling areas is presented in Annexure 7.

3. SMC Performance

In the field, it is the intactness of the SMC structures, which produce desired outcomes of increased soil moisture and reduce soil losses. With wear & tear in the SMC structures, over a period of time, the benefits start declining.

Thus, for monitoring of SMC works in different FCM areas, the 'intactness' of the SMC interventions will be considered. In the present context, the intactness means the physical state in which SMC structures exist in the field.

Manual for Forestry and Conservation Models

Accordingly, in the target FCM intervention area, this indicator of intactness will be used to monitor the level of wear & tear (=weathering) in each of the SMC works like stone bund, log bund, staggered bund, vegetative barriers etc.

The monitoring of SMC work will be done in the same land parcels or intervention areas which are selected for monitoring of plantation and ANR activities.

For monitoring of intactness of SMC works, following approach will be adopted:

- In FCM intervention area, enumerators will use transect walk of 65-steps (i.e., approx. 50 meter) in a straight line across the contour.
- Depending upon the size of FCM intervention area, the number of 65-step walks will be ranging between 3 to 12, covering upper, middle and lower parts of the intervention areas.
- In JAF area, for each land parcel of volunteer farmer, three transect of 65-step walk will be done. In JFF and JCF area, number of transect walks will be determined using telescopic-slab approach, as follows: for up to 20 ha of intervention area = 6 transects; 20 to 30 ha = 9 transects and, more than 30 ha = 12 transects. " During each transect walk, enumerators will take note about the wear & tear of all the SMC works come across within two meters on both sides of the walk line.
- Enumerators will subjectively rank every SMC work which they come across, in one of the five classes of intactness, as follows:
 - Fully or 100% intact
 - Mostly or around 75% intact
 - Partially or around 50% intact
 - Less or around 25% intact
 - Fully collapsed or 0% intact

The entire sampling design for SMC work monitoring is presented in Fig. 15

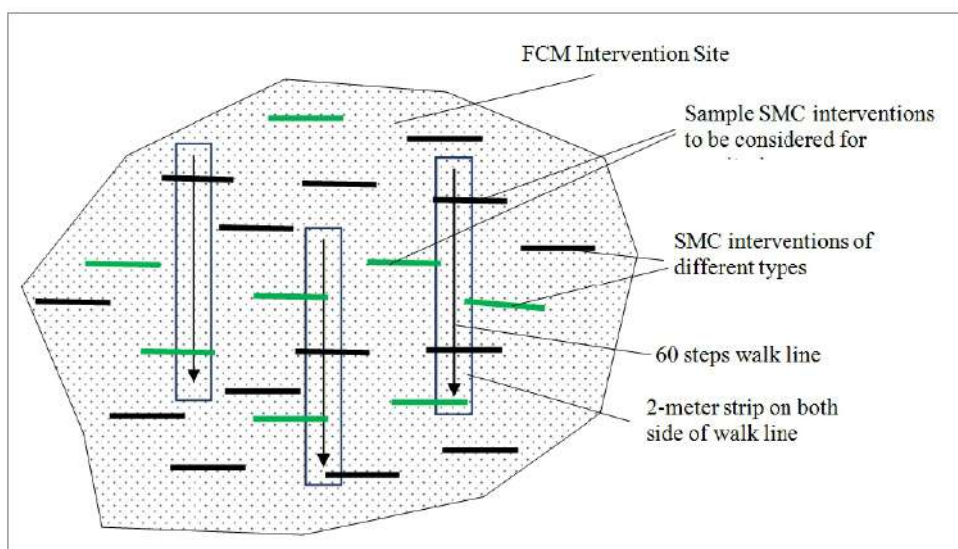


Fig. 15: Sampling Scheme for Monitoring of SMC Works

The responsibility of monitoring of SMC work will be on the same farmers and groups, who are engaged in plantation and ANR performance monitoring (see sections 1.1 and 1.2).

JFMC President and FMU Head will coordinate the monitoring exercise with volunteer farmers (for JAF) and members of JFG or CUG (for JFF and JCF).

Formats for SMC intactness related data collection from each transect walk is presented in **Annexure 8**.

A summary of key aspects of monitoring of performance of different interventions is presented in Table 13.

Parameters	Plantation	ANR	SMC
Frequency	Once in a year	Once in a Year	Once in a Year
Monitoring Months	Feb-March	Feb-March	Feb-March
Main Approach	Species wise number, height and girth of Planted Saplings in sample land parcels (for JAF) and in 0.1 ha size sample plots (for JFF and JCF)	Species wise number and height of naturally grown saplings in 10m x 10m sample plots .	Assess the intactness of SMC structures in one of the five ranking classes in transect of 65-step walk across the contour

For the JCC and PEC intervention area, where the management focus is on biodiversity enhancement, intensive monitoring protocol for biodiversity elements is required. Considering the highly technical requirement for data collection on different elements of biodiversity, including the methodology, need of equipment and analysis of data, it will require a specialist group to implement the monitoring protocols. For the purpose, therefore, a separate manual will be required.

4. Monitoring Responsibilities

In addition to above-described methodological approaches for monitoring of plantation, ANR and SMC interventions, it is important to describe the responsibilities of all the three field level institutions- JFMC, FMU and DMU- in executing the monitoring protocols and compiling the report from collected data.

Proposed responsibilities of JFMC, FMU and DMU in internal monitoring of plantation, ANR and SMC related works is presented in Table 14.

Parameter	JFMC	FMU	DMU
Responsible Person	<ul style="list-style-type: none"> JFMC Secretary (Forester) JFMC President 	<ul style="list-style-type: none"> FMU Head 	<ul style="list-style-type: none"> DMU Head
Coverage	<ul style="list-style-type: none"> Visit & cover 100% intervention sites of JAF, JFF and JCF types Visit & cover 100% of all the sample sites selected for data collection 	<ul style="list-style-type: none"> Visit & oversee all the intervention sites of JAF, JFF and JCF types in at least 50% of JFMCs within FMU jurisdiction 	<ul style="list-style-type: none"> Visit & oversee all the intervention sites of JAF, JFF and JCF types in at least 50% of JFMC areas which are covered by FMUs within DMU jurisdiction
Frequency	<ul style="list-style-type: none"> Once in a year (Feb-March) for three consecutive years (Year 2 to Year 4) 	<ul style="list-style-type: none"> Once in a year (Feb -March) for three consecutive years (Year 2 to Year 4) 	<ul style="list-style-type: none"> Once in a year (Feb -March) for three consecutive years (Year 2 to Year 4)
Reporting	<ul style="list-style-type: none"> Prepare annual monitoring report for JAF, JFF and JCF models and submit to FMU 	<ul style="list-style-type: none"> Review all the monitoring reports of JFMCs Prepare and submit FMU level report, including the observations of FMU head for the sites he/she visited, to DMU 	<ul style="list-style-type: none"> Review all the monitoring reports of FMUs Prepare and submit DMU level report, including the observations of DMU head for the sites he/she visited, to PMU

Section H: Community Contribution, Fees and Benefit Sharing

1. Contribution

As part of reciprocal commitments and to enhance sense of ownership, implementation of forestry and conservation models must encourage people's contributions, both from individual and community level beneficiaries. The contributions can be accounted in terms of labor.

- ***In case of JAF, JFF and JCF models the labour contribution must come from individual beneficiaries or from collectives like Jhum Farmer Group or Common User Group.***
- ***In case of JCC and PEC models the labour contributions must come from the community as beneficiaries. Specifically in PEC, the labour contribution of community may also come from protection and patrolling of area.***

In both the cases, however, it is essential to monetize the labor-days contribution of community and must be properly recorded in the JFMC's account books.

2. User Fees

JFMC in consultation with VC can decide 'user fees' for extracting benefits of NTFP, medicinal plants, fuel wood and other forest products particularly from the JCF, JCC and PEC model areas. JFMC need to create a Forest Sustainability and Development Fund (FSDF). The collected user-fees will be deposited in this fund. The JFMC at the time of micro-plan preparation, need to discuss this and make provision for this.

The user fees can be of three types:

- a. nominal membership fees to use the area and extracting NTFP resources
- b. some percentage of total sale value of the NTFP items, if the collected items are sold in market.
- c. entrance fees from tourists and visitors for trekking etc, particularly from PEC model areas. If agreed, VC can authorize JFMC to collect entrance fees from tourists and visitors from other forest areas like existing CCAs.

JFMC need to make rules for the utilization of these collected funds. However, some of the potential areas of utilizing these funds may include:

- soil and moisture conservation work
- plantation of Rare and Threatened species
- maintenance of patrolling paths
- removal of weeds
- logistic support to volunteer youths

3. Benefit Sharing

Raising the plantation and undertaking various SMC works in jhum fallows, and restoration of forested landscapes would result in many tangibles as well as intangible benefits to JFMC members and village community as a whole. Thus, different types of monetizable benefits may flow from the different forestry model types (Fig.16).

Benefits	JAF	JFF	JCF	JCC	PEC
Wage	✓	✓	✓	✓	✓
Tree Wood	✓	✓	✓		
Tree NTFP	✓	✓	✓	✓	✓
Forest Food		✓	✓	✓	✓
Non-tree NTFP		✓	✓	✓	✓
Ecotourism				✓	✓

Fig. 16 : Matrix showing some of the potential benefits across the forestry models

As per MoD, harvesting of planted trees at maturity can be allowed only from JAF, JFF and JCF intervention areas. The prescribed harvesting arrangement of raised trees are:

- JAF: Maximum 75% of total planted trees
- JFF: Maximum 75% of total planted trees
- JCF: Maximum 40% of total planted trees
- JCC: No harvesting of trees
- PEC: No harvesting of trees

At the time of maturity, farmers may take decision about harvesting of trees (for small timber or poles) or retain them for getting continuous flow of benefits including the NTFP items like fuelwood, fodder, fruits, medicines etc.

In order to avoid unnecessary confusion later on, it is essential that these harvesting arrangements must be described during the process of getting Free Prior Informed Consent (FPIC).

However, the harvesting and benefit sharing related decision can be finalized later on by local community and village institutions like Gaon-Bura, Village Council, Clan bodies etc. JFMC need to facilitate these decision-making processes in consultative modes. The harvesting and benefit sharing arrangements must not be in conflict with the State's JFM Notification -2018 (Box 5).

This process needs to be completed before the start of actual treatment of selected patches for respective forestry and conservation models.

While harvesting rules can be finalized collectively by JFMCs and VCs, it is important to deliberate upon the legal provisions of harvesting of trees from non-forest areas under Nagaland Tree felling Act (2002)⁹.

⁹ The Tree Felling Act provides a framework for registration of Tree Plantations in non- forest areas including the community, clan or individual lands, and for harvesting of the planted trees but not less than 5-year-old trees. For this, Village Council need to issue a certificate of ownership of Tree Plantation and on the basis of this certificate concerned DFO accords the permission to cut the trees and allow for commercial trading within and outside State by providing transit passes. Also, according to Supreme Court order (as part of Godavarman case) all movement of timber is prohibited across the North East States.

Harvesting rules for each forestry models need to be deliberated upon and finalized by JFMC and beneficiary groups and approved by VC.

Box 5

Benefit Sharing: No Conflict with JFM Notification

The State has made a notification on Joint Forest Management in 2018 (No. FOR/NFMP-39/03/17/484 dated 19 December 2018) and clearly proposed that JFM will be promoted in both the Government and non-Government lands, through three-tier institutional arrangements. At village level, the Joint Forest Management Committees (JFMCs) will be executing agency.

JFM notification clearly suggested that in the case of non-Government lands, entire benefits of forestry operations will be vested with the 'land-owners'. Thus, under NFMP, the benefits of plantation and other interventions derived from current and abandoned jhum blocks, actually vested with land owners (e.g., clan, private, community or morung). The permissible harvesting limit of 75% of total planted trees in JAF and JFF models, and 40% in JCF model, are thus not overriding the principles of JFM notification.

In the other two models, JCC and PEC, no harvesting of planted trees is allowed. However, in order to avoid any conflict in future, it is essential that the site selected for implementation of JCC and PEC models, must not be considered for plantation through FDA under JFM mode.

Depending upon the land ownership type (clan, community, private etc.), beneficiaries may differ for different model types. Importantly, the benefit sharing must be based on the principles of equitable distribution among the participating members, land owners (e.g., clan) and JFMC.

Thus, *inter alia*, following major beneficiary types can be considered:

- Land owners (e.g., Clan)
- Jhum Farmer Group
- Common User Group/ Women User Group
- JFMC (for Forest Sustainability and Development Fund, FSDF)

In case of JAF, JFF and JCF the realized benefits can be shared among the individual farmers or Jhum Farmer Group, who plant and nurture the trees. However, the benefit sharing arrangements need to be discussed, a priori, with the actual land owners.

Importantly, in all the five models, some parts of the benefits need to be shared with JFMC mainly to create **Forest Sustainability and Development Fund (FSDF)**.

In addition, in all the five model intervention areas, scope of extracting seasonal NTFP items, both for bonafide household and small trade needs, must be accommodated for the Common User Groups (CUG) or Women User Groups (WUG).

An indicative summary of benefit sharing arrangement across the five forestry and conservation models is presented in Table 15.

Table 15: Summary of benefit sharing mechanism from model intervention areas

Model Type	Land Owner	Beneficiaries			Benefit Sharing Arrangement
		Jhum Farmers or Jhum Farmer Group	Community (Common User Group/ Women User Group)	JFMC	
JAF	√	√	√	√	Benefits of all products harvested from trees shall be shared among the Jhum farmer /Jhum farmer Group . A <i>priori</i> discussion is essential with Land owners
JFF	√	√	√	√	Depending upon type of land ownership and participation of farmers, various benefits can be shared between the, Jhum Farmers Group, Common User Groups including Women User Group and JFMC. JFMC/VC can decide the mechanism.
JCF	√		√	√	Various benefits can be shared between community through Common User Groups including Women User Group and JFMC. JFMC/VC can decide the mechanism.
JCC			√	√	
PEC			√	√	

Section I: Costing of Different Models and Important Operational Steps

1. Costing of Different Forestry Models

Table 16: Summary of costing of plantation and maintenance operations in different forestry models

Description	JAF	JFF	JCF	JCC	PEC
Planting Details					
Density of Trees to be maintained (No./ ha)	800	1250	625	625	200
Density through ANR (No./ ha)	400	625	NA	NA	NA
Density through plantation (No./ ha)	400	625	625	625	200
Seeding, Wildings, Cuttings, Suckers	NA	313	313	313	100
Polybag raised	200	156	156	156	50
Naked root	200	156	156	156	50
Casualty Replacement	20%	20%	20%	20%	20%
Daily Wage Rate (Rs.)	189.2	189.2	189.2	189.2	189.2
1st Year Operations					
Survey & Demarcation & Map Preparation	2	2	2	2	2
Clearance of brushwood & stacking of debris	4	6	6	6	6
Preparation of stakes, staking i/c alignment	4	4	4	4	4
Digging of Pits (30 cm x 30cm x 30 cm)	5	8	8	8	3
Planting of saplings including transport to planting site	12	19	19	19	6
Soil Moisture Conservation works	10	25	20	20	0
Silvicultural Operations	24	24	24	24	24
Collection & planting of local materials (suckers, wildings, cuttings etc.) & seed dibbling	0	19	19	19	6
Assisted regeneration of herbs, shrubs, climbers etc	0	0	0	0	0
2nd Year Maintenance Operations					
Silvicultural Operations	18	18	18	18	18
Casualty Replacement (20%)	4	8	8	8	5
Soil Moisture Conservation	5	10	10	10	0
3rd Year Maintenance Operations					
Silvicultural Operations	18	18	18	18	18
Soil Moisture Conservation	5	5	5	5	0
Overall Cost					
Total Man -days (Number / ha)	111	166	161	161	92
Labour cost (Rs. / ha)	21,001	31,407	30,461	30,461	17,406
Sapling cost: polybag and naked root etc including mortality replacement (Rs. / ha)	4752	4313	4313	4313	1428
Total Cost Plantation and Maintenance (Rs/ha)	25,753	35,720	34,774	34,774	18,834

2. Operational Steps

For quick guidance, a step-wise operational summary is presented in Table17.

Table 17: Step-Wise operation for forestry model interventions

Objective	SN	Key Steps	Description	Facilitators
Getting Free, Prior, Informed Consent (FPIC)	1.	Awareness about the project and different aspects of forestry models	FPIC is essential to give rights to village communities to give or not-give consent to the project to be taken-up in their village. For this series of awareness program need to be taken up. Through these series of awareness programs, all the important village institutions like Gaon Bura, Village Council, Village Youth Group, Village Women Group etc. are informed about the project's objectives, approach, time span, budget etc.	FMU, FNGO
Selection of relevant FCMs in village	2.	Getting FPIC	Once agreed on various aspects of the project, the Village Council and other traditional institutions (like Gaon Bura or Clan Chiefs etc.) will provide their consent for hosting the project in their village. The consent will be provided in a given format, specifying key aspects of the project. Community will have right to withdraw its consent at any stage of project implementation.	FMU, FNGO
	3.	Understanding the FCMs	Training and orientation of staff and members of DMU, FMU, VC, JFMC and FNGO about the objectives and long-term goal of adopting different FCMs. This is critical because lack of clear understanding of all the five FCMs may land up into selection of wrong model in wrong area.	PMU
	4.	Understanding of Village Landscape.	As part of Micro-planning exercise, by using village land-use map and satellite imageries, provided by PMU, to delineate landscape of (i) active jhum areas, (ii) recently jhum fallows, (iii) long time fallows (iv) exiting CCAs, if any and (v) intact forest tracts having potential to convert into CCAs.	FMU, FNGO
	5.	Zeroing down to FCMs and Landscapes in Village	Based on delineated landscapes on map, JFMC in consultations with VC, decide which FCMs are implementable in village. They can decide not to choose any specific FCMs in the village due to unavailability of suitable land-use.	FMU, FNGO
Targeting the Sites and Area of FCMs	6.	Identification of potential sites for each FCM type	Once the models are decided to implement, JFMC in consultations with VC, will identify few potential sites for each model. And, then by applying multiple- criteria, the final intervention site for each model will be identified.	DMU, FMU & FNGO
	7.	Identification of Implementation Patches for different FCMs.	Once the sites are identified for different FCMs, a joint field survey / reconnaissance team will be formed with representation of FMU, VC and JFMC members. The survey team will visit each of the landscape identified for a particular FCM. Within the selected landscape, survey team will choose and marked the tentative intervention area using GPS. Ideally, the boundary of actual intervention area should follow some natural features, like along the ridge of the slope, drainage line.	DMU, FMU
	8.	Checking & correcting major deviations and discrepancies	The GPS coordinates of selected patch will be used to visualize its location in Google Imageries. The location of the patch will be checked for (i) its accuracy of position vis-à-vis village boundary (ii) existing and past land use history, topographical features etc. The area of selected patch will also be estimated. In case there is major deviation from village boundary and significant discrepancies in extent of intervention area (e.g., too small area is selected), the boundary of the patch needs to be realigned following Step # 7.	DMU, FMU

	9.	Finalization of Actual Intervention / Treatment Area	Once the Step-6 is over, new GPS readings will be used again to check the location on Google earth imageries, to check any remaining major discrepancies. If there is none, area and location of the selected patch, will be considered as final for intervention.	DMU, FMU
Securing the Beneficiaries & Management of FCM treatment areas	10.	Recognition of Beneficiary/ User/ Management Groups	Once the model wise site selection gets finalized, JFMC in consultation with VC will identify and finalize the list of beneficiaries for each model intervention areas. Depending upon the model, JFMC will form Common User and Management Groups like Jhum Farmer Group (for JAF and JFF models) or Common User Groups or Women User Groups (for JCF, JCC and PEC models).	FMU, FNGO
	11.	Resolution for land use and resource extraction rights	Once the model wise intervention areas and beneficiaries associated to each model is finalized (Step # 9 & Step # 10), JFMC, on behalf of beneficiaries will seek resolutions from VC on three counts: (i) no jhum farming in the area selected for JCF, JCC and PEC models; (ii) permissible and non-permissible activities in the treatment areas in each model intervention areas, and (iii) granting authority to JFMC for day-to-day work and management in the intervention areas.	DMU, FMU, FNGO
Species Selection	12.	Identification of Species	For each FCM, species selection will be done through consultations with identified beneficiaries (Jhum Farmers Group, Land owners). Considering the views of women beneficiaries will be essential. It is important to explain to the beneficiaries about the benefit-sharing arrangements, particularly for JAF, JFF and JCF models.	FMU, FNGO
Preparatory Work	13.	Zoning of intervention area	In case of JAF, JFF and to some extent JCF, JFMC with the help of beneficiaries can delineate three zones, according to the physiological situation of the site. This is important for plantation and SMC work	FMU, JFMC
	14.	Cleaning of Land	In case of JAF and JFF, weed and other brushwood need to be cleared by cutting, not by uprooting. Also, avoid removing the stones and small rocks from the field. This way soil losses can be minimized.	FMU, FNGO
	15.	Soil Moisture Conservation work	Mechanical and vegetative barriers can be made appropriately, mainly in JAF and JFF model areas, and to some extent in JCF and JCC areas. PEC intervention areas, which already have dense vegetation cover, may not need SMC work. Traditional method like 'Echo' making (placing wooden logs along the contour lines) may be effective solution.	FMU, JFMC
	16.	Pit making	For planting of saplings, pits of appropriate dimensions (30x30x30 cm) need to be made beforehand. Considering the slopes of the land, pits must be made along the contour lines. For small naked root saplings, adequately deep wedge can be made at the time of planting.	FMU, FNGO
Plantation	17.	Types of planting materials	Four main approaches can be followed. Planting nursery raised polybag or naked-root saplings; collecting naturally grown seedling, wildings and cuttings and replanting in the intervention areas; direct dribbling of seeds or broadcasting the seeds (like in case of grasses); assisting the naturally regenerated saplings/ coppicing in the intervention areas to successfully establish. Although ANR is prescribed only in JAF and JFF models, it can also be attempted in JCF and JCC model areas if there is enough scope, depending upon the site quality and vegetation structure.	FMU, JFMC

18.	Silvicultural Operations	In all model intervention areas, undertaking various silvicultural operations is essential to improve the vegetation structure. As per MoD, the silvicultural operations need to be continued for entire intervention cycle i.e., one year of plantation and two years of maintenance operations.	FMU, JFMC
19.	Casualty Replacement	Assessment of survival of planted sapling need to be done twice. First, after two months of plantation and, second in the month of March in succeeding year. After each assessment cycle, about 20% casualty replacement need to be done.	FMU, JFMC
20.	Enhancement of Conservation values	In case of JCC and PEC models, special efforts need to be done to enhance the conservation values. The plantation of few Rare-Endemic-Threatened (RET) species of the state and few species of wildlife needs like food, nesting etc, can be taken up. Developing grass patches and dense groves of bushy species in the suitable forest blanks can create habitat mosaics. Preparing an indicative management plan for each of these sites is important for improving the outcomes.	DMU, FMU, FNGO
Monitoring	21. Formation of monitoring Team	For JAF, the enumerators must be volunteer farmers who did the Plantation, ANR activities and SMC works in their land parcels. For JFF and JCF models, enumerators will be identified from JFG, CUG, and JFMC.	FMU, JFMC
	22. Training of enumerators	Training of enumerators about the approach and methodology for monitoring	DMU, FMU
	23. Periodical data collection on relevant parameters	Collect data on plantation survival and sapling growth (height and Girth of saplings); number of naturally grown saplings and their growth as part of ANR supporting activities, and level of intactness of SMC structures. The data collection for each of the parameters need to follow sampling approach.	JFMC, FMU, DMU
	24. Reporting	Submit the monitoring reports at JFMC, FMU and DMU level	JFMC, FMU, DMU
Community engagement	25. Contribution and User Fees	Community contribution in project activities must be accounted in terms of labour days they provide during the course of various activities around forestry models like site preparation, SMC works, silviculture operations, patrolling, etc. These need to be accounted properly for individual beneficiaries and community beneficiaries. Appropriate structure of charging 'user fees' need to be developed. The collected user fees will be deposited in a specially created Village Forest Development Fund.	FMU, FNGO
	26. Benefit Sharing System	The mechanism of sharing of various benefits flows from different forestry models need to be explained at the time of taking FPIC. As per MoD, from JAF and JFF models benefits to participating farmers will be in the form of harvesting of 75% of total planted trees. While in the case of JCF the same will be from harvesting of 40% of planted trees. In case of JCC and PEC benefits are mainly from NTFP and other ecosystem services. For benefit sharing, Jhum Farmer Group, Common User Group and Women User Groups need to be promoted.	FMU, FNGO

Annexure 1: Suggestive Priority Divisions for Different Models

Based on MoD, and review of status of jhum and forest areas in different divisions, each division can prioritize forestry models for the intervention. A suggestive priority for each division is given in Table A.2.1.

Division	No. of Project Villages	JAF	JFF	JCF	JCC	PEC	No. of Priority Models in each Division
Mon	19						3
Dimapur	7						3
Kiphire	18						3
Kohima	16						3
Longleng	9						3
Mokokchung	18						3
Peren	13						3
Phek	20						3
Tuensang	25						3
Wokha	20						3
Zunheboto	20						3
No. of Divisions where the model may apply on priority basis		5	6	7	6	9	

Further, considering that interventions under different models are re-prioritized for each division, in order to achieve the total project targets for each model, the target area for each project villages in priority divisions also need to be revised.

The targets under different intervention models will be reviewed at mid-term project appraisal and if found necessary, targets can be revised accordingly.

Annexure 2: List of RET Plant Species of Nagaland

Species	Common Name	RET status
<i>Acranthera tomentosa</i>		Endemic to North-east
<i>Aquilaria agallocha</i>	Agar	CITES Appendix -II
<i>Arundinaria graminifolia</i>	Bamboo orchid	
<i>Chaerophyllum orientalis</i>		Endemic to north-east
<i>Crotalaria meeboldii</i>		
<i>Cymbidium eburneum</i>		
<i>Cymbidium tigrinum</i>		
<i>Dipterocarpous macrocarpous</i>	Hollong	
<i>Gleditsia assamica</i>		
<i>Kalanchoe roseus</i>		
<i>Livistona jenkinsiana</i>		
<i>Mesua ferra</i>	Nahar	
<i>Michelia punduana</i>		
<i>Ophiorrhhi zagracilis</i>		
<i>Panax gensing</i>	Gensing	only in Tuensang
<i>Rhododendron Spp.</i>		
<i>Shorea assamica</i>	Makai	

Annexure 3: List of Indigenous Plant Species for Plantation Models

#	Species Name	Local name	Remark
1	<i>Acrocarpus fraxinifolius</i>	Mandhani	Economically Important Indigenous plants
2	<i>Agathis lanceolata</i>		
3	<i>Ailanthus grandis</i>	Borpat	
4	<i>Ailanthus integrifolia</i>		
5	<i>Albizia lebeck</i>	Black Siris	Economically Important Indigenous plants
6	<i>Albizia procera</i>	Koroi	Economically Important Indigenous plants
7	<i>Aleurite montana</i>	Tung	
8	<i>Alnus nepalensis</i>	Alder	Economically Important Indigenous plants
9	<i>Alstonia scholaris</i>		
10	<i>Altingia excelsa</i>	Jutuli	
11	<i>Anthocephalus chinensis</i>	Kadam	Economically Important Indigenous plants
12	<i>Aquilaria agallocha</i>	Agar	Economically Important Indigenous plants
13	<i>Artocarpus chaplasha</i>	sam	Wild Fruit Plants
14	<i>Artocarpus lakoocha</i>		
15	<i>Arundinaria graminifolia</i>	Bamboo orchid	Rare Orchid
16	<i>Asculus assamica</i>		
17	<i>Bauhinia purpurea</i>		
18	<i>Bauhinia variegata</i>	Bauhinia	Economically Important Indigenous plants
19	<i>Berberis micropetala</i>		Endemic Plants
20	<i>Berberis wardii</i>		Endemic Plants
21	<i>Betula alnoides</i>		Economically Important Indigenous plants
22	<i>Bombax ceiba</i>	Cotton tree / Semul	Economically Important Indigenous plants
23	<i>Calamagrostis nagensis</i>		Endemic Plants
24	<i>Calamus tenuis</i>	Rattan cane	Economically Important Indigenous plants
25	<i>Callicarpa arborea</i>	Mukhuang	Economically Important Indigenous plants
26	<i>Canarium resiniferum</i>	Dhuna	Economically Important Indigenous plants
27	<i>Canarium strictum</i>		
28	<i>Capillipedium nagense</i>	Grass	Endemic Plants
29	<i>Capillipedium pteropechys</i>	Grass	Endemic Plants
30	<i>Cedrela serrata</i>	Hill toona	Economically Important Indigenous plants
31	<i>Cephalotaxus griffithii</i>	plum-yew	Economically Important Indigenous plants
32	<i>Chaerophyllum orientalis</i>		Endemic Plants
33	<i>Chukrasia tabularis</i>	Bogipoma / Pogipoma	Economically Important Indigenous plants
34	<i>Cinnamomum zeylanicum</i>	Dalchini	Economically Important Indigenous plants
35	<i>Cryptomeria japonica</i>	Dhupi	Economically Important Indigenous plants
36	<i>Debregesia longifolia</i>	Wild Rhea	Economically Important Indigenous plants
37	<i>Dillenia indica</i>		Wild Fruit Plants
38	<i>Dipterocarpous macrocarpous</i>	Hollong	Economically Important Indigenous plants
39	<i>Duabanga grandiflora</i>	Khokon	Economically Important Indigenous plants
40	<i>Dysoxylum procerum</i>	Lali/ Lalipoma	
41	<i>Elaeocarpus lanceifolius</i>		
	<i>Elaeocarpus floribundus</i>	Majeblam	Wild fruit plants
42	<i>Emblica officinalis</i>	Aonla/Lolosu	Wild Fruit Plants
43	<i>Exbucklandia populnea</i>		Economically Important Indigenous plants
44	<i>Fermian acolorata</i>	Naga peanu t	Wild Fruit Plants
45	<i>Ficus auriculata</i>	Fig	Wild Fruit Plants
46	<i>Ficus cunia</i>	Fig	Wild Fruit Plants
47	<i>Garcinia lanceifolia / tinctoria</i>	Sungsulani	Shrub
48	<i>Gmelina arborea</i>	Gomri	Economically Important Indigenous plants
49	<i>Gymnocladus assamicus</i>	Soap-pod tree	Economically Important Indigenous plants

50	<i>Hovenia dulcis</i>	Coral Tree	Economically Important Indigenous plants
51	<i>Ilex excelsa</i>		Economically Important Indigenous plants
52	<i>Juglans regia</i>	Walnut	Wild Fruit Plants
53	<i>Kydia calycina</i>	Pula	Economically Important Indigenous plants
54	<i>Lagerstroemia parviflora</i>		Economically Important Indigenous plants
55	<i>Laporte acrenulata</i>	Devil Nettle	Economically Important Indigenous plants
56	<i>Litsea acitrata</i>	Mejankosi	Economically Important Indigenous plants
57	<i>Macaranga denticulate</i>	Kapu	Economically Important Indigenous plants
58	<i>Magnolia campbellii</i>		
59	<i>Magnolia rubra</i>		
60	<i>Malus baccata</i>	Wild Apple/ Crab Apple	Wild Fruit Plants
61	<i>Mangifera indica</i>	Am	Wild Fruit Plants
62	<i>Mangifera sylvatica</i>	Am	Wild Fruit Plants
63	<i>Mansonia dipikae</i>		
64	<i>Melia composita</i>	Ghora neem	Economically Important Indigenous plants
65	<i>Mesua ferra</i>	Nahar	
66	<i>Michelia champaca</i>	Tita Chapa	Economically Important Indigenous plants
67	<i>Morus laevigata</i>	Bhola	Economically Important Indigenous plants
68	<i>Panax gensing</i>	Gensing	Medicinal
69	<i>Parkia roxburghii</i>	Yongchak/Tree Bean	Economically Important Indigenous plants
70	<i>Parkia speciosa</i>		
71	<i>Phoebe goalparensis</i>	Bonsum	Economically Important Indigenous plants
72	<i>Pimpinella evoluta</i>		Endemic Plants
73	<i>Pimpinella flaccida</i>		Endemic Plants
74	<i>Pinus kesiya</i>		Economically Important Indigenous plants
75	<i>Pongamia pinnata</i>		Economically Important Indigenous plants
76	<i>Prunus cerasoides</i>	Cherry	Wild Fruit Plants
77	<i>Prunus nepalensis</i>	Cherry	Wild Fruit Plants
78	<i>Quercus serrata</i>	Oak/ Phibo	Economically Important Indigenous plants
79	<i>Rhododendron macabaenum</i>		Rhododendron
80	<i>Rhododendron wattii</i>		
81	<i>Rhus semialata</i>	Naga tenga	Wild Fruit Plants
82	<i>Rubus ellipticus</i>	Raspberry	Wild Fruit Plants
83	<i>Samanea saman</i>	Rain Tree	
84	<i>Sapium baccatum</i>		
85	<i>Schimawallichii var khasiana</i>	Mecho	Economically Important Indigenous plants
86	<i>Shorea assamica</i>	Makai	Economically Important Indigenous plants
87	<i>Sinobambusa elegans</i>		Endemic Plants
88	<i>Spondias axillaris</i>	Naga Neem/ Hog -plum	Economically Important Indigenous plants
89	<i>Spondias mangifera</i>	Amra	Wild Fruit Plants
90	<i>Sterculia villosa</i>	Udal	Economically Important Indigenous plants
91	<i>Stereospermum chelonoides</i>		
92	<i>Taxus baccata</i>		Economically Important Indigenous plants
93	<i>Tectona grandis</i>	Teak	Economically Important plants
94	<i>Terminalia myriocarpa</i>	Hollock	Economically Important Indigenous plants
95	<i>Tetrameles nudiflora</i>		
96	<i>Themeda huttonensis</i>		Endemic Plants
97	<i>Toona ciliata</i>		Economically Important Indigenous plants
98	<i>Trewia nudiflora</i>	Bhelkar	
99	<i>Xanthoxylum rhetsa</i>	Badrang/ Indian Pepper	Economically Important Indigenous plants
100	<i>Zanthoxylum acanthopodium</i>	Mechinga	Economically Important Indigenous plants
101	<i>Zanthoxylum alatum</i>	Darmar	Economically Important Indigenous plants

Annexure 4: Species Preference Matrix

The social and ecological preference of species from the list of potential species need to be ascertained separately for each village and for different models.

For this, the beneficiaries of each intervention area of different models can prepare a species preference matrix. There are many ways to do the species preference matrix. One simple method to do this is explained below.

- a. Make list of all the potential species for specific models
- b. All the beneficiaries of the model will identify different social and ecological use values of potential species
- c. For each species compute the total number of uses
- d. For each species, record number of beneficiaries out of the total (say 7 out of total 10 beneficiaries) who wish to plant species
- e. Find the total score for each species by adding the total use value and number of beneficiaries.
- F. Higher the total score of species, higher the preference rank of the species

A hypothetical situation of this exercise by ten beneficiaries is presented in Table A.5.1.

Table A.5.1: A Hypothetical Computation of Species Preference by beneficiaries#

#	Species	Local Name	Social-ecological Value									Ts	Nb	Sc	Final Rank
			Tc	Tf	Po	Fu	Fo	Md	Fr	Wl	Rr				
1	<i>Acrocarpus fraxinifolius</i>	Mandhani	1		1	1						3	6	9	3
2	<i>Albizia procera</i>	Koroi	1									1	8	9	3
3	<i>Aleurite montana</i>	Tung						1			1	2	7	9	3
4	<i>Alnus nepalensis</i>	Alder				1	1	1				3	8	11	2
5	<i>Artocarpus chaplasa</i>	Sam					1			1		2	10	12	1
6	<i>Chukrasia tabularis</i>	Bogipoma		1				1	1	1		4	4	8	4
7													

Tc: Timber for Construction, Tf: Timber for Furniture; Po: Pole, Fu: Fuel Wood, Fo: Food for Pig/other livestock; Fr: Edible Fruit; Md: Medicine; Wl: Use by wildlife; Rare: Species is found less in the area
 Ts: Total Social Ecological Score; Nb: number of beneficiaries proposed the species; Sc= total Score;

Annexure 5: Sample of Site Treatment Register

Nagaland Forest Management Project (NFMP) Site treatment Register (Separate for each Intervention area)			
Reporting Date	Name of JFMC	Name of FMU	Name of DMU

Basic Information

Forestry-Conservation Model (FCM)	Land Ownership (Community, Clan, Private, Government)	Area of Plantation Block (ha)	Plantation Block ID(as given in MIS)

Brief History of the Plantation Block (Write in the box below):

What was the land-cover and land-use at the time of start of treatment?

Treatment Map

Insert the Treatment Plan Map of the Plantation Block. If different zones/ sub-blocks are made for plantation, mark those.

Any Alteration in area from last reporting quarter (Explain):

Advance Work - Land Clearance

Land Clearance Work			Clearance Extent (Approximate) of Total Plantation Block						
Started Date	Completed Date	Methods (Fire/ Cutting/ Uproot / Other)	Not cleared (0%)	Up to 25%	Up to 33%	Up to 50%	Up to 66%	Up To 75%	100 %

Advance Work - SMC Work

Date of Work	Work Item (Staggered trench, bunds, log bunds, vegetative barriers etc)	Number/ Area Made	Extent Covered (Approx % of total block)	Remarks (if any)

Manual for Forestry and Conservation Models

AR Planting Details (Provide details of work done since last reporting quarter)

Date	Species	Planting material (Naked Root/ Polybag/ Wildlings/ direct Seed dibbling/ Other)	Number of saplings planted

ANR Work Details (Provide details of work done since last reporting quarter)

--

Silvicultural Operations (Provide details of work done since last reporting quarter)

Date of Work	Work Item (Pollarding, Lopping, stump dressing, coppice maintenance, thinning, etc)	Main Species Targeted	Extent Covered (Approx % of total block)

Mortality and Replacement Details (Provide details of work done since last reporting quarter)

Date	Species	Number of saplings planted (as casualty replacement)	Type of Planting material used for casualty replacement (Naked Root/ Polybag/ Wildlings/ Other)	Remarks

Habitat Improvement Work (Provide details of work done since last reporting quarter)

Date of Work	Work Item (Fire line creation, weed removal, water hole creation, patrolling path creation etc)	Extent Covered (Approx % of total block)	Remark

Plant removed/harvested Details (Provide details of work done since last reporting quarter)

Date	Species	Number of trees removed / harvested	GBH of Cut Trees (in cm)	Number of trees pollarded /lopped

Extreme events/ calamities (Provide details of events happened since last reporting quarter)

Date	Events (Heavy rains, frost, land slide, fire etc)	Description	Key Impacts

Annexure 7: Data Format for Monitoring of ANR Performance

(A) JAF Model

Name of Village		Name of FMU & DMU	
Name of Volunteer Farmer		Year & Month of Plantation	
Area of Land Parcel (in acre)		Date of Monitoring	
Name and Designation of JFMC Member and FMU Staff present during the data / information collection			
Sampling area covers : One 10m x 10m Plot within the farmer's land parcel			
GPS Coordinates of the sampling plot:			
Species of Natu rally Grown Tree Sapling	Height of individual Sapling (cm)	Remark	
e.g. Alder	25, 45, 20, 23, 105...		
<i>Macaranga denticulata</i>	35, 29		

(B) JFF and JCF Models

Name of Village		Name of FMU & DMU	
Model Name (JFF/ JCF)		Year & Month of Plantation	
Area of Land Parcel (in acre)		Date of Monitoring	
Name of Enumerators (name of JFG and CUG members)			
Name and Designation of JFMC Members and FMU Staffs present during the Data collection			
Sampling area: One Sample Plot of 10m x 10m size, nested within sample plot of 31.6m x 31.6 m			
Plot Number:			
GPS Coordinates of the Sample Plot (10m x 10m) :			
Species of Naturally Grown Tree Sapling	Height (cm) of individual sapling	Remark	

Disclaimer:

The contents of this document have been prepared by Nagaland Forest Management Project Society (NFMPs) for use under JICA supported Nagaland Forest Management Project (NFMP) implementation. This document has been prepared with reasonable skill, care and due diligence and information based on the observations, field visits and interviews with stakeholders. The views expressed in this document are primarily to be used for NFMP implementation. Neither NFMPs nor any shareholder undertakes any responsibility arising in any way whatsoever to any person or organization in respect of information set out in this document, including any errors or omissions therein arising through negligence or otherwise however caused.

This manual can be downloaded at www.nfmpjica.org




Printed at : KPS Press

**D. Block, Opp. Election Office
Kohima - 797001 : Nagaland.**

☎ : 0370-2291097

Email : kpspress123@gmail.com



ABOUT NAGALAND FOREST MANAGEMENT PROJECT

The Project is an Externally Aided Project supported by an International Agency i.e. Japan International Cooperation Agency (JICA) aiming to improve forest ecosystem and support income generation by rehabilitation of Jhum area and provision of livelihood support, thereby contributing to sustainable forest and environmental conservation and livelihood improvement in the target villages in Nagaland State. The project has a target to cover 185 villages involving all Districts of the state and 22 Forest Range & Beats and will be spread over a period of 10 years.

This project has following three components:

- * Forestry interventions and biodiversity conservation
- * Livelihood improvement and community development &
- * Institutional strengthening

