

Proceedings of the Workshop on Afforestation Models (in Forest Land) under West Bengal Forest and Biodiversity Conservation Project (North Bengal)



Kolkata, 11 February, 2015

**Organised by:
Project Management Unit
&
Project Management Consultants
West Bengal Forest and Biodiversity Conservation Project**

PROLOGUE

Since the JICA assisted West Bengal Forest and Biodiversity Conservation (WBFBC) Project was launched, it has been the endeavour of the Project Management Unit (PMU) to usher in dialogues with the Heads of DMUs and their staff to standardize the field works like plantation models, nursery works and tending works. It is needless to state that standardization of such field practices would lead to the development of the schedule of estimates that could be adopted in similar works either under this or any other project or scheme.

We, in the PMU, were of the firm view that the standardization of the plantation and allied works would require lot of reflection and inputs from experienced officers at various levels specially for analysing the items of works and work output of each type of estimate. The whole idea of standardization of works culminated in organizing workshops for South Bengal followed by North Bengal units, since the field situation and model prescribed in the two areas are completely different.

The workshop organized on 11th February, 2015 for North Bengal was the second workshop where the PMU invited the senior most officers of the Forest Department and also the officers at Circle and Division levels to share their views on the models prescribed under the WBFBC Project. To facilitate and focus the discussion in the common forum towards a meaningful conclusion, we gave some lead suggestions for discussion against each of the models of North Bengal, viz: Technical parameters and Cost estimates of A5, A6 and of plantation models under Biodiversity Conservation Component of WBFBC Project.

Five working groups were constituted from amongst the participants, each group comprising officers of a spectrum of experience and seniority. The topics of the working groups were as follows:

Group 1: Technical parameters of A5 model.

Group 2: Technical parameters of A6 model.

Group 3: Cost Estimate of A5 model.

Group 4: Cost Estimate of A6 model.

Group 5: Technical parameters and cost estimate of plantation models under Biodiversity Conservation Component.

During the deliberations it was also felt that model of afforestation for Chapramari Sanctuary should be delved into and the technical parameters and the cost estimates should be worked as per actual requirement.

It is our pleasure, therefore, to present the proceedings of the workshop covering the key issues and lead suggestions, recommendations of the group, acceptance of the recommendations by the bevy of officers, and the Resulting Technical parameters and Estimates of each of the models. In order to make the set of Estimates complete, we have also included the Estimates for Production of QPM in the present Proceedings, though the same were drawn on the basis of the recommendations and acceptance of the same in the first workshop held on 22.01.15.

The whole hearted participation of every officer at all level was wonderfully cohesive.

Project Management Unit
W.B Forest and Biodiversity Conservation Project

Contents

<u>Sl. No</u>	<u>Subject</u>	<u>Page</u>
1	Introduction	1-4
1.1	Objective of the Workshop	3
1.2	Setting the Context	3
1.3	Technical Sessions	3
2	Background information and key points	5-12
2.1	Model A5: Miscellaneous Plantation in North Bengal as described in the MOD of WBFBC Project	5
2.1.1	Key Points for discussion on A5 Model	6
2.2	Model A6: Plantation of Sal and Associates Species in North Bengal as described in the MOD of WBFBC Project	6
2.2.1	Key Points for discussion on A6 Model:	8
2.3	Estimate of Miscellaneous Plantation in North Bengal (A5 model)	9
2.4	Estimate of Plantation of Sal and Associate Species in North Bengal (A6 model)	9
2.5	Improvement of Wildlife Habitat in Protected Areas as prescribed in MoD	9
2.5.1	Key Points for discussion on Improvement of Wildlife Habitat in Protected Areas:	12
3	Recommendations	13-18
3.1	Group 1: Model A5 : Technical prescriptions for Miscellaneous Plantation in North Bengal	13
3.2	Group 2: Model A6 : Technical prescriptions for Plantation of Sal and Associates Species in North Bengal.	13
3.3	Group 3: Model A5 : Cost Estimates for Miscellaneous Plantation North Bengal	14
3.4	Group 4: Model A6 : Cost Estimates for Plantation of Sal and Associate Species in North Bengal	14
3.5	Group 5: Improvement of Wildlife Habitat in Protected Areas	15
4	Acceptance of Recommendations	19-21
4.1	Acceptance of the Recommendations: Group 1-Model A5-Technical	19
4.2	Acceptance of the Recommendations: Group 2	19
4.3	Acceptance of the Recommendations: Group 3	20
4.4	Acceptance of the Recommendations: Group 4	20
4.5	Acceptance of the Recommendations: Group 5	20
5	Resulting technical prescriptions	22-27
5.1	Technical prescription for Miscellaneous Plantation in North Bengal: A5 Model	22
5.2	Technical prescription for Plantation of Sal and Associates Species in North Bengal : Model A6	23
5.3	Improvement of Wildlife Habitat in Protected Areas	25
5.3.1	Grass and Fodder Tree Plantation in the Plains	25
5.3.2	Bamboo Under-planting in Mahananda	26
5.3.3	Fodder Tree Plantation after Removal of Maling Bamboo in the Hills	26
5.3.4	Fodder tree plantation in Chapramari WLS (Additional)	27
6	Resulting estimates	29-64
6.1	Cost Estimates for Miscellaneous Plantation in North Bengal : Model A5-Hills	29
6.1.1	Estimate for Miscellaneous Plantation North Bengal : Model A5-Hills - Creation	29
6.1.2	Estimate for Miscellaneous Plantation in North Bengal :	31

	Model A5-Hills - Maint. Year 1		
6.1.3	Estimate for Miscellaneous Plantation in North Bengal : Model A5-Hills - Maint. Year 2	---	32
6.1.4	Estimate for Miscellaneous Plantation in North Bengal : Model A5-Hills - Maint. Year 3	---	33
6.1.5	Estimate for Miscellaneous Plantation in North Bengal : Model A5-Hills - Maint. Year 4	---	34
6.2	Cost Estimates for Miscellaneous Plantation in North Bengal : Model A5-Plains	---	35
6.2.1	Estimate for Miscellaneous Plantation in North Bengal : Model A5-Plains - Creation	---	35
6.2.2	Estimate for Miscellaneous Plantation in North Bengal : Model A5-Plains - Maint. Year 1	---	37
6.2.3	Estimate for Miscellaneous Plantation in North Bengal : Model A5-Plains - Maint. Year 2	---	39
6.2.4	Estimate for Miscellaneous Plantation in North Bengal : Model A5-Plains - Maint. Year 3	---	40
6.2.5	Estimate for Miscellaneous Plantation in North Bengal : Model A5-Plains - Maint. Year 4	---	41
6.3	Cost Estimates for Sal Plantation North West Bengal : Model A6	---	42
6.3.1	Estimate for Plantation of Sal and Associates Species:A6 Model- Creation	---	42
6.3.2	Estimate for Plantation of Sal and Associates Species:A6 Model- Maint. Year 1	---	45
6.3.3	Estimate for Plantation of Sal and Associates Species:A6 Model- Maint. Year 2	---	47
6.3.4	Estimate for Plantation of Sal and Associates Species:A6 Model- Maint. Year 3	---	48
6.3.5	Estimate for Plantation of Sal and Associates Species:A6 Model- Maint. Year 4	---	49
6.4	Cost Estimates for Afforestation under Biodiversity Conservation.	---	50
6.4.1	Estimate of Grass and Fodder Plantation	---	50
6.4.2	Estimate of Bamboo underplanting	---	52
6.4.3	Estimate of Plantation after removal of Maling bamboo - Creation	---	55
6.4.4	Estimate of Plantation after removal of Maling bamboo - 1st Year Maintenance (for Hill area)	---	58
6.4.5	Estimate of Plantation after removal of Maling bamboo - 2nd Year Maintenance (for Hill area)	---	59
6.4.6	Estimate of Plantation after removal of Maling bamboo - 3rd Year Maintenance (for Hill area)	---	60
6.5	Estimate for production of Quality Planting Material	---	---
6.5.1	Estimate for production of Quality Planting Material – One Season	---	61
6.5.2	Estimate for production of Quality Planting Material – Two Seasons	---	63

1. Introduction

The Project Management Unit (PMU) of the West Bengal Forest and Biodiversity Conservation Project (WBFBC Project) was receiving numerous technical queries in respect of planting pattern, species composition and estimated cost for the various models of plantations in forest land of South West Bengal, as included in the Minutes of the Discussion (MOD) under Afforestation Component of the WBFBC Project.

The issues were discussed in detail with the concerned Circle- in -Charges and the Heads of the DMUs concerned. In order to revisit the prescriptions and estimates of various models, as included in the MOD, it was felt necessary to organise Technical Workshops on the Plantation Models and Estimates of the West Bengal Forest & Biodiversity Conservation Project. The Project Management Consultants (PMC) working with PMU, therefore, took the initiative of organising the workshops on “Afforestation Models (in Forest Land) under West Bengal Forest and Biodiversity Conservation Project” to discuss the issues and draft recommendations for modifications, if any, in the Models and estimates.

The first such Workshop was organised for South West Bengal at Sonnet Hotel, Salt Lake, Kolkata on the 22nd of January 2015. The second workshop was, likewise, organised by the Project Management Consultants to the WBFBCP on the 11th of February 2015 at Sonnet Hotel, Salt Lake, Kolkata.

All the Senior Officials of the West Bengal Forest Department, including Heads of Divisional Management Units (DMUs) and Divisional Forest Officers from different districts of North West Bengal and PMC members, including the Team Leader & Afforestation Specialist were invited for participation in the workshop. The Workshop provided an opportunity to formulate specific and implementable recommendations on the issues under debate to the appropriate authority for reconsideration of any modifications in the models or estimates. The list of participants is as follows:

SI	Name Participants	Designation	SI	Name Participants	Designation
1	Sri A. Zaidi	Principal Chief Conservator of Forests, General	2	Sri P. Shukla	Principal Chief Conservator of Forests, Research, Monitoring & Development
3	Sri A.K. Jha	Additional Principal Chief Conservator of Forests, CAMPA	4	Sri N.K. Pandey	Additional Principal Chief Conservator of Forests, Finance
5	Sri S. Dhaundyal	Chief Project Director, West Bengal Forest & Biodiversity Conservation Project.	6	Sri R. R. Pandey	Additional Principal Chief Conservator of Forests, Research and Monitoring
7	Sri S. Sen	Additional Principal Chief Conservator of Forests, Human Resource Development	8	Dr. B.R. Sharma	Additional Principal Chief Conservator of Forests, Wildlife
9	Sri R.K. Mahtolia	Additional Principal Chief Conservator of Forests, North Bengal	10	Sri S. Barari	Project Director Finance, West Bengal Forest & Biodiversity Conservation Project.
11	Sri R.K. Sinha	Chief Executive Officer & Secretary	12	Sri P.T Bhutia	Additional Principal Chief Conservator of

		WBSWDA			Forests, & Chief Conservator of Forests, Northern Circle
13	Sri N.V. Rajasekhar	Additional Principal Chief Conservator of Forests, & Chief Conservator of Forests, Monitoring Circle	14	Sri M. R. Baloch	Chief Conservator of Forests, Hill Circle
15	Sri V.K. Sood	Chief Conservator of Forests, Wildlife North Circle,	16	Sri S. Chaudhuri	Project Director Monitoring & Evaluation, West Bengal Forest & Biodiversity Conservation Project.
17	Sri R. Das	Chief Conservator of Forests, Conservation and Extension	18	Sri P.K. Pandit	Additional Project Director, Implementation, West Bengal Forest & Biodiversity Conservation Project.
19	Sri G. C. Kajuri	Conservator of Forests, North West Circle	20	Sri T. Das	Conservator of Forests, Wildlife North Circle
21	Dr. Anupama	Conservator of Forests, Working Plan & GIS	22	Sri A. K. Samanta	Additional Project Director, Planning & Research, West Bengal Forest & Biodiversity Conservation Project.
23	Sri S. Bandopadhyay	Additional Project Director, Co-ordination, West Bengal Forest & Biodiversity Conservation Project	24	Sri. G. P. Chetri	Divisional Forest Officer, Working Plan North
25	Sri S. Ghatak	Head, Wildlife II Divisional Management Unit	26	Sri. B. R. Sewa	Head, Darjeeling Divisional Management Unit
27	Dr. S. Kulandaivel	Head, Wildlife (HQ) Divisional Management Unit	28	Sri S. K. Anand	Head, Monitoring North Divisional Management Unit
29	Dr. B. R. Holachi	Head, Wildlife I Divisional Management Unit	30	Ms. Minakshi Prasad	Head, Malda Divisional Management Unit
31	Sri S. S. S. Sherpa	Head, Kurseong Divisional Management Unit	32	Sri. K Sarkar	Head, Coochbehar Divisional Management Unit
33	Sri B. Sarkar	Head, Jalpaiguri Divisional Management Unit	34	Sri P. R. Pradhan	Head, Baikuthapur Divisional Management Unit
35	Sri G.K. Chatterjee	Joint Project Director, Co-ordination,	36	Sri Ranjan Mohapatra	Capacity Building Expert, Project Management Consultant, West Bengal Forest & Biodiversity

					Conservation Project
37	Sri. J. P. Van. Kooijk	Team Leader & Afforestation Specialist, Project Management Consultant, West Bengal Forest & Biodiversity Conservation Project	38	Sri Badal Chakraborty	Forest Ranger, West Bengal Forest & Biodiversity Conservation Project

1.1 Objective of the Workshop

Review and where felt necessary adopt rectifications in the Afforestation Models and Biodiversity Conservation technical issues as prescribed in the MOD pertaining to North West Bengal through discussions with higher officials of the WB Forest Department and where necessary amend related Estimates.

1.2 Setting the Context

Shri A. Zaidi, Principal Chief Conservator of Forests (PCCF), General, in his opening remarks observed that the workshop was an opportunity to delineate a proper approach to afforestation models, nursery, etc. and rationalizing operations so that it could be followed for other schemes. He was of the view that there could be some additionalities in other schemes, if required.

PCCF General added that the standardized operations and estimates acceptable to all, that would be followed in the Directorate once these are finalized in the workshop. He expected active participation from all the participants, so that a positive outcome could be achieved from the workshop.

Shri P. Shukla, Principal Chief Conservator of Forests, Research, Monitoring and Development, expressed his complete agreement with the views of PCCF General and expressed that all the models should be in conformity with the standard prescriptions. Shri Shukla was of the view that WBFBC Project has given an opportunity to analyse performance of older plantation models. The mid-term evaluations of the performance of the prescribed models also need to be done. He expressed that species selection should be done based on local and climatic conditions and therefore some leverage should be given to the local field officers for selection of the species.

Shri S. Dhaundyal, Chief Project Director, West Bengal Forest and Biodiversity Conservation Project, in his remarks said that during interaction with field officers many issues have arisen which pointed out some gaps in the prescriptions of the models. There are few deviations in the prescriptions with reference to the Working Plans of North Bengal districts, like spacing, spp selection etc., which needs to be looked into. While analysing the prescriptions and estimates it appears that some of the items of work prescribed are unnecessary and few others are missing. These and also the habitat management in the Protected Areas of North Bengal need a relook.

1.3 Technical Sessions

Participants were assigned to different Work Groups for deliberations and drafting of recommendations on specific issues. The main issue discussed were:

1. Technical prescriptions for Miscellaneous Plantation in North Bengal, Model A-5
2. Technical prescriptions for Plantation of Sal and Associates Species in North Bengal, Model A-6
3. Cost Estimates for Miscellaneous Plantation in North Bengal (A5 model)
4. Cost Estimates for Plantation of Sal and Associate Species in North Bengal (A6 model)
5. Technical prescriptions and Estimates for Improvement of Wildlife Habitat in Protected Areas

The Work Groups for each issue discussed during Workshop on Afforestation Models (in Forest land) under WBFBC Project on 11.02.2015 were as follows:

Work Groups for each Issue discussed during Workshop on Afforestation Models (in Forest land) under WBFBC Project on 11.02.2015:

Group 1	Group 2	Group 3	Group 4	Group 5
A5 Model - Technical	A6 Model- Technical	A5 Model - Estimate	A6 Model - Estimate	Biodiversity Conservation - Technical & Estimate
Sri P. Shukla	Sri R.R. Pandey	Sri N.V. Rajashekhar	Sri S. Sen	Sri A.K. Jha
Sri N.K. Pandey	Sri R.K. Mahtolia	Sri M.R. Baloch	Sri A.K. Samanta	Dr. B.R. Sharma
Dr. P.T. Bhutia	Dr. V.K. Sood	Sri R. Das	Sri B. Sarkar	Sri T. Das
Sri G.P. Chhetri	Dr. Anupama	Sri G. C. Kajuri	Sri P.R. Pradhan	Smt. S. Ghatak
Sri R.K. Sinha		Sri S. Anand	Sri S.S.S. Sherpa	Dr. B.R. Holiachi
Sri P.K. Pandit		Ms. M. Prasad		Sri S. Bandyopadhyay
		Sri. B.R. Sewa		Dr. S. Kulandaivel
		Sri K. Sarkar		

In the first session, the Groups deliberated on issues assigned to them and drafted recommendations. The recommendations were presented by each group to the house in the second session and each recommendation was debated. In the final plenary session, the accepted recommendations were presented.

2. Background information and key points

2.1 Model A5: Miscellaneous Plantation in North Bengal as described in the MOD of WBFBC Project

Objective: Production of Industrial wood for meeting the requirements of wood based industries like plywood, veneering, saw mills and also to meet the demand of timber for construction .Smallwood, poles and firewood production will also be augmented.

General Description - In North Bengal, plains and hills, on account of grazing, damage due to floods, change of river courses, infestation by weeds, landslides, encroachments, illicit felling, etc, there are sizable extent of blanks and degraded lands though in small pockets. Such areas shall be afforested under this model.

Minimum Target Management Area per JFMC: 10 ha

Maximum Target number of JFMC: 105

Area: 8 Forest Divisions under 3 Districts

Target Area: A5 Miscellaneous Plantation in North Bengal

Afforestation Model	Area Proposed (ha)	Minimum viable area (ha)	Maximum number of JFMC	District to be covered	Division
A5. Miscellaneous Plantation in North West Bengal	1,050	10	120	Darjeeling	Kurseong Darjeeling
				Jalpaiguri	Baikunthapur Jalpaiguri Wildlife-III BTR East BTR West
				Malda	Malda

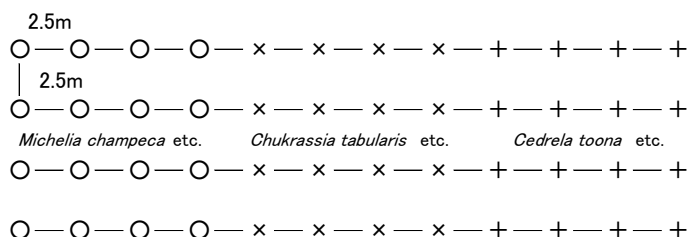
Soil & Climate: Alluvial plains of Teesta, Torsha, Mahananda. Deep to moderate alluvial deposit of course to fine loamy texture with problems of water logging and Terai soil of the Himalayan foot hills having moderately deep alluvium deposit, faces severe flood hazards.

Species: *Schima wallichii*, *Michelia champaca*, *Amoora rohituka*, *Amoora wallichii*, *Gmelina arborea*, *Cedrela toona*, *Terminalia tomentosa*, *Terminalia myriocarpa*, *Terminalia myriocarpa*, *Chukrassia tabularis*, *Kajelia pinnata*, *Duabanga sonneritoides*, *Cinnamomum cecidodaphne* etc. Sites prone to water logging may be planted with *Bischofia javanica*, *Terminalia arjuna* etc

In the middle hills the principal species will include *Machilus spp.*, *Michelia spp.*, *Alnus nepaulensis*, *Betula alnoides*, *Engelherdia spp.*, *Bucklandia populanea* etc

Extent- 1,200 ha of such land has been proposed for afforestation under this model.

Technique- Endemic species as mentioned above are proposed for planting under this model. The planting area has to be cleaned thoroughly. Planting pits of size (0.60 m x 0.45 m)/2 x 0.45 m x 0.45 m will be dug at a spacing of 2.5 m x 2.5 m (1,600 plants / ha). Soil work has to be completed by early May at the latest. 1 year + seedlings raised and tended in Central/Modern Nursery (QPM), will be planted in pits to be completed by the last week of May. The creation cost provides for 4 tending operations subsequently 3 tending operations will be done in 1st year maintenance. 2nd and 3rd year has provisions for two tendings.



NB. Planting species will be determined through discussion with JFMC
 A5 Miscellaneous Plantation of Miscellaneous Species in North Bengal

Management: Silvicultural operations and final felling will be done as per Working Plan prescription. Revenue will be shared as per the extant rules.

Survival Rate (target) - The survival rate for this model may be fixed as follows -

1st year: 85%

3rd year: 80%

5th year: 75%

2.1.1 Key Points for discussion on A5 Model:

1. The proportion of major associates: The MoD prescribes planting of endemic species, in blocks of 16 plants for each species.
2. The planting pattern: The MoD prescribes planting at a spacing of 2.5 m x 2.5 m (1,600 plants / ha). The approved Working Plan prescribes planting of Teak stumps at 2 m x 2 m in 1st to 8th line & miscellaneous species at 2 m x 2 m (2500 plants/ha) in 9th to 16th line with a suggestion of bringing down the percentage of teak. The working plan also suggests planting of 1-year old seedlings raised from well identified seed source.
3. Ex-situ conservation of rare & endangered species : A point has arisen during informal discussions in various fora that the A5 plantation area is the place where rare and endangered spp should be planted for biodiversity conservation.
4. QPM: Plantable age of seedlings: The MoD prescribes that 1 year old nursery grown QPMs should be planted.

2.2 Model A6: Plantation of Sal and Associates Species in North Bengal as described in the MOD of WBFBC Project

Objective: Production of quality construction timber by using endemic species like Sal (*Shorea robusta*) mainly and other associates like Pakasaj (*Terminalia crenulata*), Panisaj (*Terminalia myriocarpa*) etc. and mixed hard wood timber for plywood / saw mills and veneering industries. This will also augment production of small timber, poles, posts and firewood.

*General Description-*In North Bengal, plains and foothills, on account of grazing, damage due to floods, change of river courses, infestation by weeds, encroachment, illicit felling, etc, there are sizable extent of blanks and degraded lands though in small pockets. Such areas shall be afforested under this model

Minimum Target Management Area per JFMC: 10 ha

Maximum Target number of JFMC/EDCS: 54

Area: 7 Forest Divisions covered by 2 Districts

Target Area: A6 Plantation of Sal and Associates Species in North Bengal

Afforestation Model	Area Proposed (ha)	Minimum viable area (ha)	Maximum number of JFMC/EDCS	District to be covered	Division
Sal & associate Plantation in North Bengal	540	10	60	Darjeeling	Darjeeling Kurseong
				Jalpaiguri	Baikunthapur Jalpaiguri Wildlife-III BTR East BTR West

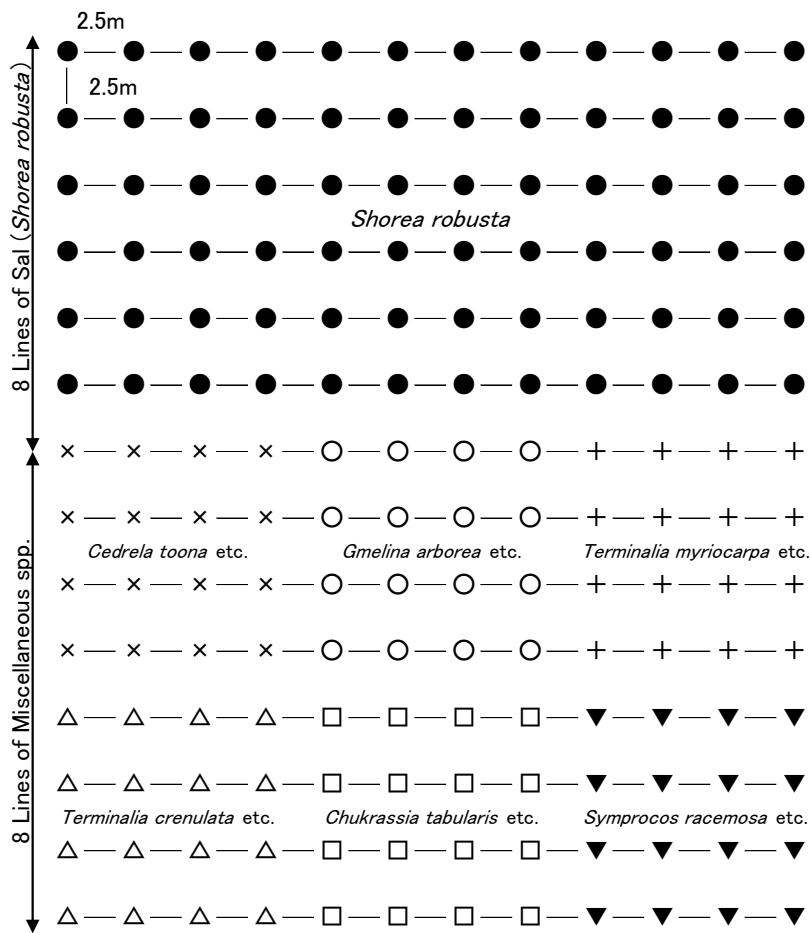
Soil & Climate: Alluvial plains of Teesta, Torsha, Mahananda. Deep to moderate alluvial deposit of course to fine loamy texture with problems of water logging and Terai soil of the Himalayan foot hills having moderately deep alluvium deposit, faces severe flood hazards.

Species: Sal and its associate species such as *Schima wallichii*, *Symplocos racemosa*, *Chukrassia tabularis*, *Cedrela toona*, *Gmelina arborea*, *Amoora rohituka*, *Amoora wallichii*, *Terminalia myriocarpa*, *Terminalia crenulata*, *Chukrassia tabularis* etc.

Plantation areas under this model will be available mostly near the Forest Village JFMC/EDCS and benefit will go to the members. This will ensure protection and maintenance of the plantation and also will be in consonance with the Working Plan prescription.

Extent: 600 ha of such land are proposed for afforestation under this model.

Technique: Endemic species as specified above are proposed for planting in this model. The planting area has to be cleaned thoroughly. Planting pits of size (0.60 m + 0.45 m)/2 x 0.45 m x 0.45 m will be dug at a spacing of 2.5 m x 2.5 m (1,600 plants / ha). Soil work has to be completed by early May at the latest. 1 year + seedlings raised and tended in Central/Modern Nursery (QPM), will be planted in pits to be completed by the last week of May. The creation cost provides for 4 tending operations subsequently 3 tending operations will be done in 1st year maintenance. 2nd and 3rd year has provisions for two tendings.



NB. Sal associate species will be determined through discussion with JFMC
 Figure - A6 Plantation of Sal and Associates Species in North Bengal

Management: Mechanical thinning will be carried out at 5th year. 1st silvicultural thinning will be done at 15th year and the 2nd one at 30th year. Rotation may be fixed at 60 years or as may be prescribed under working Plan. The area will come under the Miscellaneous Working Circle of the Working Plan.

Survival Rate (target) - The survival rate for this model may be fixed as follows
 - 1st year: 85% 3rd year: 80% 5th year: 75%

(i) Within the block of Miscellaneous spp.(comprising 20% area), up to 6 quick growing & hardy local associate species can be tried

2.2.1 Key Points for discussion on A6 Model:

1. The proportion of Sal & associates: The MoD prescribes 50:50; Sal 8 lines alternating with Miscellaneous 8 lines.
2. Planting pattern of Sal and Miscellaneous: MoD suggests 8 lines Sal alternating with 8 lines Miscellaneous species.
3. Ex-situ conservation of rare & endangered species : A point has arisen during informal discussions in various fora that the A6 Sal plantation area is the place where rare and endangered spp should be planted for biodiversity conservation
4. Cutting trenches of size 0.60m x 0.45m inside the plantation area and boundary where necessary @ 100 m per hectare

5. QPM: Plantable age of seedlings: The MoD prescribes that 1 year old nursery grown QPMs should be planted.

2.3 Estimate of Miscellaneous Plantation in North Bengal (A5 model)

The estimates provided in the MoD have considered some standards of pit size, spacing, labour and material, which are either not always attainable, or requires review based on the field conditions and output of labour. Therefore basic discussions on these aspects were long due. Apart from this, it was felt that some changes are required so far as the prescriptions of spp. proportion, ex-situ conservation, planting pattern, etc. are concerned. These are also technical dimensions which would require discussion for proposing any modification. In fact the changes in technical parameters would have a direct bearing on the estimates. Thus revising the estimates has assumed much importance.

2.4 Estimate of Plantation of Sal and Associate Species in North Bengal (A6 model)

It has been long felt that the prescription given against model A6 like spp. composition, proportion of main and other miscellaneous spp., planting pattern and also plantable age of seedlings of main spp. need review, since many of them did not match with existing practice or are not practicable. Also the rates given in the detailed estimates and work output would require review for making it perfectly implementable. Threadbare technical discussion was therefore necessary to frame recommendations suggesting modification of estimates.

2.5 Improvement of Wildlife Habitat in Protected Areas as prescribed in MoD

To sustain the healthy populations of large herbivores, particularly Rhinoceros, Elephant and Gaur, in the protected areas in the North Bengal and reduce the possible man-animal conflict, the Forest Department has been conducting wildlife habitat management through the creation and restoration of grassland with/without planting bamboos, fruit trees and other fodder trees, which increase the food base for those animals. The methodology has been consolidated as a sort of guidelines and the plots for this scheme are confined to Habitat Improvement Zone in the protected areas, contained in their management plans. It is an accepted management practice to thin out the overhead canopy by cutting down old plantation stock, such as Teak and Simul, and by girdling (i.e. cutting upto phloem layer). After that, grass slips of desirable species are planted and the grassland is maintained by eradicating climbers/weeds and cutting/burning the old stalks in the fourth year after planting. In the seventh year, the old grasses are uprooted and the area is replanted with fresh grass slips.

However, this scheme has not been fully implemented in the protected areas mainly due to the lack of funds. By this project, it is proposed to enhance the current scheme in seven protected areas: Gorumara NP, Jaldapara WS, Buxa TR, Mahananda WS, Neora Valley NP, Singhalila NP and Senchal WS. The total target area shall be 335 ha in six years: 200 ha for grass and fodder tree plantation, 60 ha for bamboo under-planting and 75 ha for fodder tree plantation after bamboo removal.

Proposed Activities for Habitat Improvement

Type of Work	PA (Division)	Area (for each PA)	Area (sub-total)	Duration
Grass and fodder tree plantation in the plains	Gorumara NP (WII)	40 ha (20 ha/year)	200 ha	5 years (3-7 th year)
	Jaldapara WS (WIII)	60 ha (30 ha/year)		
	Buxa TR (BTR-E/W)	100 ha (50 ha/year)		
Bamboo under-planting in Mahananda	Mahananda WS (WI)	60 ha (10 ha/year)	60 ha	5 years (3-7 th year)
Fodder tree plantation after bamboo removal in the hills	Singhalila NP (WI)	15 ha (5 ha/year)	75 ha	6 years (3-8 th year)
	Senchal WS (WI)	45 ha (15 ha/year)		
	Neora Valley NP (WII)	15 ha (5 ha/year)		
Total	7 PAs	335 ha	335 ha	

(Note) WI: Wildlife Division I, WII: Wildlife Division II, WIII: Wildlife Division III, BTR-E: Buxa Tiger Reserve (East), BTR-W: Buxa Tiger Reserve (West)

Divisional Forest Officers (DFOs) responsible to each protected area will supervise all the activities for habitat improvement, including the site selection, under their jurisdiction. The field works will be planned and implemented by Range Officers (ROs) and Beat Officers (BOs) following the command structure. Monitoring of the plantation will be made by the Monitoring (North) Division in line with the protocol. Most of the labour required for the field works will be hired from the members of EDC/JFMC that are located around the protected areas through the JFM approach.

Grass and Fodder Tree Plantation in the Plains

The plains of Gorumara NP, Jaldapara WS and Buxa TR provide the suitable foraging ground for large herbivores. In the first two protected areas, which are relatively small in size, restoring the open grasslands is critically important to sustain the population of rhinoceros in particular. However, many such areas have been getting shrunk due to the natural succession with the rapid growth of colonising tree species. At the same time, the numbers of the threatened species have been increasing due to the success of conservation effort by the Forest Department for the past decade. Thus, the shortage of open grasslands has become more serious management issue for recent years. In the case of Buxa TR, recovering the original habitat on old teak plantation sites is also useful in facilitating the reintroduction of rhinoceros and maintaining the elephant population.

After canopy opening of plantation areas, grass slips will be put at 1 m x 1 m spacing (10,000 plants/ha) and in some plots, fodder tree seedlings will be planted at 10 m x 10 m spacing (100 plants/ha). The grass species planted are: Dhadda, Chepti, Malsa, Madhua, Ekra (*Saccharum* sp.), Nal (*Arundodonax*), Khagra (*Pharagmites karka*), Bhuttaghash (*Coixlachrymajobi*), Banspati (*Setaria* sp.), Purundi (*Alpinia alughas*), etc. The tree species planed are: Sissoo (*Dalbergiasissoo*), Chapalish (*Artocarpuschaplasha*), Kumbi (*Careya arborea*), Chalta (*Dilleniaindica*), Jogdumur (*Ficushispida*), etc. In addition, old grassland of over seven years old will be revitalised by similar operation only in Jaldapara WS. The plot size of one plantation is 1 ha in minimum.

Bamboo Under-planting in Mahananda

Mahananda Sanctuary is located in a key area for elephant conservation. Herds of elephant stay in the foothills longer than other areas along migration routes before crossing to Nepal and after coming back to West Bengal. During the stay, they raid paddy fields or maize farms, damaging crops and house properties seriously. It was reported by a department officer that bamboo under-planting was so effective that it can keep the herds inside the forests one to two weeks longer than the area without bamboo stands; which

reduced the time of elephant spent in the agricultural land.

After canopy-opening of plantation areas, bamboo seedlings will be planted at 4 m x 4 m spacing (625 plants/ha) and in some plots, fruit tree seedlings will be planted at 10 m x 10 m spacing (100 plants/ha). The bamboo species planned are all indigenous: Bhalubans (*Dendrocalamus sikkimensis*), Choya bans (*Dendrocalamus hamiltonii*), Mala bans (*Bambusa nutans*), Kalaimakla (*Bambusa vulgaris*) and Muli bans (*Melocanabaccifera*). The plot size of one plantation is 1 ha in minimum.

Fodder Tree Plantation after Removal of Maling Bamboo in the Hills

In the hill areas over 2000 m in altitude, hill forests are grown consisting of wet hill forest, wet temperate forest, moist temperate forest and sub-alpine forest; a part of which is included in the biodiversity hotspot of Himalaya. The hill forests, however, have been facing undesirable habitat conversion due to prolific invasive spread of Maling bamboo (*Arundinaria maling*) in degraded forests mainly due to the past illegal logging and frequent forest fire.

To recover the original flora and fauna in the hills, maling bamboo will be replaced by fodder trees, such as Khaniu (*Ficus cunia*), Gogun (*Ficus nepalensis*), Lepchakowla (*Machilus edulis*), Buk (*Quercus lamellosa*), Pipli (*Bucklandia populnea*), Kapasi (*Acer campbelli*), etc. Maling bamboo will be thoroughly cleaned from plantation sites and seedlings raised at field nurseries will be planted out at 2.5 m x 2.5 m spacing (1600 plants/ha). The minimum plot size is 1 ha for one plantation.

Estimate as per the MoD

Component / Activities		
	M.D.	Material(Rs.)
2.A1 Grass and fodder tree plantation in Gorumara NP, Jaldapara WS and Buxa TR	13550	1950
Advance Work – Year 1		
Cleaning, tree girdling and control burning of the area	12	
Preparation of mother beds	8	
Collection of grass seeds / slips and tree seeds	8	
Shifting of slips and seedlings to different beds	10	
Making of sheds for beds	12	
Weeding/ cleaning of beds	8	
Watering of beds	8	
Manuring /application of organic pesticide/fungicides	4	
Cost of implements like measuring tape, ropes, axe, lime powder, sickle etc	0	
Sub total	70	
2.A2 Bamboo under-planting in Mahananda WS	13500	8000
Advance Work - Year 1		
Cleaning, tree girdling and control burning of the area	12	
Preparation of nursery beds	8	
Collection of bamboo offsets and planting in mother beds	8	
Shifting of culms to other beds	10	
Making of sheds for beds	12	
Weeding/ cleaning of beds	8	
Watering of beds	8	
Manuring /application of organic pesticide/fungicides	4	
Cost of implements like measuring tape, ropes, axe, lime powder, sickle etc	0	
Sub total	70	
2.A3 Fodder tree plantation after removal of maling bamboo in Neora	13550	1950

Valley NP, Singhalila NP and Senchal WS		
Advance Work - Year 1		
Cleaning and control burning of the area	12	
Preparation of mother beds	8	
Collection of tree seeds	8	
Shifting of seedlings to different beds	10	
Making of sheds for beds	12	
Weeding/ cleaning of beds	8	
Watering of beds	8	
Manuring /application of organic pesticide/fungicides	4	
Cost of implements like measuring tape, ropes, axe, lime powder, sickle etc	0	
Sub total	70	

2.5.1 Key Points for discussion on Improvement of Wildlife Habitat in Protected Areas:

1. Review of Estimate for raising Grass and Fodder Tree plantation in plains
2. Planting of Bamboo: As per MoD, after canopy-opening of plantation areas, bamboo seedlings will be planted at 4 m x4 m spacing (625plants/ha).
3. Planting of Tree species in Grass-land: As per MoD, after canopy-opening of plantation areas, fruit tree seedlings will be planted at 10 m x 10 m spacing (100 plants/ha.)

3. Recommendations

3.1 Group 1: Model A5 : Technical prescriptions for Miscellaneous Plantation in North Bengal

1. Planting should be done at a space 2x2 in plain and 2.5x2.5 in hills.
2. Teak should be planted to the extent of 50% of area and other miscellaneous species to the extent of 50% by area.
3. For ease of management, not more than 6 to 10 miscellaneous spp. may be planted.
4. The A5 model should be classified into sub-models as proposed below:
 - 50% teak and 50% miscellaneous in suitable area in plains and foothills
 - Khair, Sissoo, Simul, Sirish combined in riverine Working Circle.
 - Hill areas to have appropriate species in place of teak and miscellaneous species.
5. DFO to be allowed to decide on model as per available area in the concerned Working Circle.
6. About 10% area should be dedicated for planting trees like Latur, Dumur, Bahera, Chalta, and other endangered species like Malagiri, Bahera, etc. at the center of each plantation, wherever feasible.
7. About 10% area should be dedicated for planting trees like Lator, Dumur, Bahera, Chalta, and other endangered species like Malagiri, cane etc. at the center of each plantation.
8. QPM of rare species, including cane, to be decided, raised and supplied by Silviculture Division.
9. For hills, QPM should be at least 2 year old. In plains, some QPM may be one season old. Teak should be stump planted.
10. Block size may be 20 x 40 m for each species. Not more than 10 species should be planted in a particular plantation area.
11. Species like Champ, Gamar and Bahera to be scattered uniformly over whole area (10 m apart) and should not be planted in block.

3.2 Group 2: Model A6 : Technical prescriptions for Plantation of Sal and Associates Species in North Bengal.

1. Plantation in A6 model should have 50% Sal and 50% Miscellaneous species. However, instead of 8 lines of Sal alternating with 8 lines of Miscellaneous species, 6 lines of Sal alternating with 6 lines of Miscellaneous species should be planted.
2. The associates of Sal to be planted should be selected much before preparation of the QPM, in consultation with the CF/DFO Working Plan, keeping in view the specific site conditions.
3. While selecting the, due weightage must be given to indigenous endemic and endangered associates of Sal and fodder and fruit bearing species suitable for wild life and local population.
4. Keeping in view the growth rate, the endangered and endemic species may be planted at the center of each miscellaneous block for ensuring better protection.
5. The spacing for planting Sal and Miscellaneous should be 2 m X 2 m, keeping in view the final structure of the plantation after mechanical thinning followed by silvicultural thinnings.
6. The age of seedlings used for infilling should be in conformity to the year in which it is to be infilled, i.e., 1 year with 1-year old seedling, 2 year with 2-year old seedling and so on.
7. Deviation may be allowed for replacing Sal rows with other suitable species in areas where there is a depression and the land configuration is not fit for Sal.
8. Within the block of Miscellaneous spp., sub blocks, measuring 12 m X 40 m may be planted with one species comprising about 120 individual plants. Miscellaneous species should include Chilune, Champ, Panisaj, Gokul, Lasune, Lali, Kawla, Sinduri, Latur, Dumur, Bahera, Chalta, Malagiri, Bahera, Garjan, etc.
9. Few blocks should be planted with trees like Lator, Dumur, Bahera, Chalta, and other endangered species like Malagiri, cane etc. at the center of each plantation. QPM of rare species, including cane, to be decided, raised and supplied by Silviculture Division.
10. It is suggested that site specific soil and moisture conservation intervention should be effected along contour, keeping in view the drainage of the area.

11. Sal should be directly sown in the plantation area in lines as per the existing prescription of Working Plan. For miscellaneous species, 1 Year old seedlings should be planted. However, one growing season old seedlings of a few fast growing miscellaneous species may be considered for planting.

3.3 Group 3: Model A5 : Cost Estimates for Miscellaneous Plantation North Bengal

The estimate of Model A5 provided in the MOD was reviewed by the group based on practical experience with regard to output of labour, cost of materials etc. of field level officers and the proposed changes in the prescriptions. The draft estimate is placed below:

3.4 Group 4: Model A6 : Cost Estimates for Plantation of Sal and Associate Species in North Bengal

The estimate of Model A6 provided in the MOD was reviewed by the group based on practical experience with regard to output of labour, cost of materials etc. of field level officers and the proposed changes in the prescriptions. The draft estimate is presented below:

I.	Part -A					
	1	Survey and demarcation of the plantation area	man-day	1		216
	2	Cost of initial cleaning burning and uprooting of stumps in the plantation area	Man-day	25		5400
	3	Cost of alignment of pits and staking	Man-day	2	900	1332
	4	Soil works by digging planting pits of size (0.30+0.35)/2 x 0.3 x0.3 m ³	man-day	10		2160
	5	Cost of insecticide, fertilizer including carriage (cowdung manure) At the time of mulching)	LS		4000	4000
	6		LS		500	500
	7	Contingencies	LS			0
	Sub Total of I			38	5400	13608

II.	Part-B					
	8	Cutting trenches for drainage purpose	man-day	8		1728
	9	Filling up of planting pits with dug up pulverized soil	man-day	8		1728
	10	Cleaning the plantation area before planting especially line cleaning	man-day	6		1296
	11	Transporting of potted seedlings including carriage from central nursery to planting site	man-day	3	1000	1648
	12	Transplanting of potted seedlings 1250 per Ha	Man-day	12		2592
	13	Infilling of vacancy created due to field mortality including carriage	man-day	4		864
	14	1st cleaning, weeding	man-day	15		3240
	15	2nd mulching, cleaning, weeding including application of fertilizer	man-day	25		5400
	16	3rd mulching, cleaning, weeding	man-day	15		3240
	17	4th mulching, cleaning, weeding	man-day	12		2592

	18	Cutting firelines 3 m wide to prevent accidental fire	man-day	4		864
	19	watch and ward	man-day	20		4320
	20	Making live hedge fencing	man-day	5		1080
	21	Cost of insecticide, fertilizer including carriage	L.S		2000	2000
	22	Cost of materials like Ipomoea sp for live hedge fence	L.S		500	500
	24	Contingencies Rope/tin/watering can/thatch & carriage of seedling etc	L.S			0
				137	5500	35092
		Sal Sowing (Three rows in each line)				
	1	Hoeing of Sal Lines	Man-days	15		3240
	2	Supply of Sal Seeds (100 kg / Ha @ 50/= per kg.)	Kg		5000	5000
	3	Dibbling of sal seeds in rows	Man-days	6		1296
	4	Hand Cleaning of Sal Lines (two to three times as per requirement)	Man-days	25		5400
				46	5000	14936
		Abstract		md	mat	amt.
		Part-A		63	5400	13608
		Part-B		157	5500	35092
		Sal Sowing		60	5000	14936
				280	15900	63636
		contingenceis				364
		Grand Total				64000

3.5 Group 5: Improvement of Wildlife Habitat in Protected Areas

1. Species preferred by Rhinos should be planted at Gorumara and Jaldapara.
2. Tall grasses are not advisable for planting because they grow beyond browsing height in two years.
3. Planting should be targeted near water bodies.
4. The grass species should be selected for plantation from the species mentioned in MoD, based on the edaphic and soil condition of the site of plantation.
5. A water hole/wallow pool should be created in or near each plantation to provide for water even in lean periods.
6. Controlled fire operations including creation of fire lines should be done to avoid accidental fire that may threaten the entire plantation and the animals.
7. Removal of undesirable species and encouragement of desirable species is recommended.
8. For better grassland management, advice from expert institutes and agencies should be taken to determine the suitable management practices including the species choice such as CFGRI-Jhansi, WII etc.
9. There should be provision for fodder plantation maintenance on 4th year also.
10. No Monoculture should be encouraged.
11. In any fodder plantation only upto 20% of the area should be planted with Dhadda, with remaining 80% of other species.

12. In open areas, grass slips will be put at 1 m x 1 m spacing (10,000 plants/ha). Fodder tree seedlings should not be planted as prescribed in the MoD.

The estimate Afforestation under Biodiversity Conservation provided in the MOD was reviewed by the group based on practical experience with regard to needs, output of labour, cost of materials etc. of field level officers and the proposed changes in the prescriptions. The draft estimate and proposed changes in the prescribed program activities and suggested priorities concerning areas of intervention are presented below:

Component / Activities	M.D.	Material (Rs.)
Grass and Fodder Plantation in the Plains	13608	3392
Advance Work – Year 1		
Cleaning, tree girdling and control burning of the area	10	
Preparation of mother beds	10	
Collection of grass seeds / slips & processing	8	100
Shifting of slips to different beds	10	
Making of sheds for beds (cost of covering with thatch and removing there after seed)	2	600
Weeding / cleaning of beds	8	
Watering of beds	9	
Manuring / application of organic pesticide / fungicides	4	500
Cost of power fencing (with existing energizer)	2	1592
Cost of implements like measuring tape, ropes, axe, lime powder, sickle etc.	0	600
Sub Total	17000	3392

Bamboo Under-planting in Mahananda

Component / Activities	M.D.	Material (Rs.)
2.A2 Bamboo under-planting in Mahananda WLS (61/8324)	13176	8324
Advance Work – Year 1		
Cleaning, tree girdling and control burning of the area	10	
Preparation of nursery beds	5	
Collection of bamboo offsets and planting in mother beds	8	2800
Shifting of culms to other beds	10	
Making of sheds for beds	6	1600
Weeding / cleaning of beds	8	
Watering of beds	8	
Cost of power fence (with existing energizer)	2	1592
Manuring / application of organic pesticide / fungicides	4	1632
Cost of implements like measuring tape, ropes, axe, lime powder, sickle etc.	0	700
Sub Total	21500	8324

Fodder Tree Plantation after Removal of Maling Bamboo in the Hills

The species to be planted in different PAs are as follows:

Senchal WLS: Champ (*Machilus cathcathai*), Utis (*Alnus nepalensis*), Pipli (*Symingtonia populunea*), Buk (*Quercus lamellose*), Phalant (*Quercus lineate*), Korla (*Machilus udulis*), Maya (*Eriobrya petolata*), Kapasi (*Acer campbelli*), Lek Chandan (*Daphnophyllum himalayensis*).

Singalila NP: Rhododendron sps, Katus (*Castanopsis hystrix*), Hemlock (*Tsug brunoniana*), Champ (*Machilus cathcathai*), Silver fir (*Abies densa*), Utis (*Alnus nepalensis*), Pipli (*Symingtonia populunea*), Oaks like *Quercus lamellose*, *Quercus lineate* etc.

Neora Valley NP: The hill forests in Neora Valley NP have been facing undesirable habitat conversion due

to prolific invasive spread of Maling bamboo (*Arundinaria maling*) in degraded forests/ blank areas mainly due to dying of old very matured top canopy trees like Buk, Katus etc.

To recover the original flora and fauna in this PA, maling bamboo will be replaced by fodder trees preferred by Red Panda and other herbivores as fodder and also as shelter trees as follows:

Quercus spp., Tenga (*Sorbus cuspidata*), Kapasi (*Acer campbelli*), Kawla (*Machilus odoratissima*), Thekifal (*Actinde collasasa/ strigosa*), Bhalu chinde (*Scheffera impressa*), *Rhododendron* sp., Katus (*Castanopsis* sp), Siliinge (*Osmanthus suavia*)

Maling bamboo will be thoroughly cleaned from plantation sites and seedlings raised at field nurseries will be planted out at 2.0 m x 2.0 m spacing (2500 plants/ha). The minimum plot size is 5 ha for one plantation.

Young planted seedling are required to be covered with shades during winter to avoid dying due to black frost.

Component / Activities	M.D.	Material (Rs.)
2.A3 Fodder tree plantation after removal of maling bamboo in Noera Valley NP, Singhalila NP and Senchal WLS (64/4176)	13824	4176
Advance Work – Year 1		
Cleaning and control burning of the area	10	
Preparation of mother beds	5	600
Collection of tree seeds	8	
Shifting of seedlings to other beds	10	
Making of sheds for beds (poly shade)	8	600
Weeding / cleaning of beds	8	
Watering of beds	9	1976
Cost of beds (fencing with existing energizer)	2	
Manuring / application of organic pesticide / fungicides	4	400
Cost of implements like measuring tape, ropes, axe, lime powder, sickle etc.	0	600
Sub Total	18000	4176

Fodder tree plantation in Chapramari WLS (Additional)

Though the MoD does not prescribe any treatment in Chapramari WLS, it is recommended that being in the vicinity of Gorumara WLS, the management of Chapramari is essential for better wild life management. It was recommended that Fodder tree plantation in Chapramari WLS with following species may be taken up under the Project:

Lator (*Artocarpus chaplasha*), Amaloki (*Emblica officinalis*), Bahera (*Terminalia bellerica*), Kumbi (*Careya arborea*), Chalta (*Dillenia indica*), Jogdumur (*Ficus cunia*), Badrase (*Eleaocarpus varunua*), Dudhila (*Ficus nemuralis*), Gayo (*Bridelia retusa*), Gogun (*Saurauia roxburghii*), Kabara (*Ficus laccor*), Kimbu (*Morus levigata*), Khoksa (*Ficus hispida*), Sindhure (*Mallatus phillipinensis*).

As per the site condition, 8 to 10 species from the above mentioned list should be planted at a spacing 2.5 m X 2.5 m in an intimate mixture. Six to nine months old seedling/cutting should be used for planting.

Grass and Fodder Plantation in the Plains			
Work	Man days	Material	Total
Creation Yr 2	32400	22000	54400
Maint Yr 3	10800	1000	11800
Maint Yr 4	6480	400	6880

Bamboo Underplanting in Mahananda			
Work	Man days	Material	Total

Creation Yr 2	41040	22000	63240
Maint Yr 3	10800	1000	11800
Maint Yr 4	6480	400	6880

Fodder Tree Plantation after Removal of Maling Bamboo in the Hills			
Work	Man days	Material	Total
Advance Yr 2	15120	1600	17000
Creation Yr 3	43200	6000	49200
Maint Yr 4	15120	1600	17000
Maint Yr 5	15120	1600	17000

4. Acceptance of Recommendations

4.1 Acceptance of the Recommendations: Group 1-Model A5-Technical

1. The A5 model should be classified into sub-models as below:
 - A5 for Plain areas - 2500 plants per ha at 2 m x 2 m spacing. .
 - A5 for Hill areas - 1600 plants per ha at spacing 2.5 m x 2.5 m
2. Teak which has been prescribed in the Working Plans should be planted in few sub-blocks by stump cutting or by seedlings prepared through stump cutting in model A5 for Plain areas. .
3. Khair, Sissoo, Simul, Sirish combine should be planted under model A5 in Plain areas in riverine Working Circle.
4. For A5 model for Hill areas the selection of species should be made from the representative species of different altitudinal zones.
5. For higher hills, QPM should be at least 2 year old.
6. In plains, some QPM may be one season old.
7. Block size may be 20 x 40 m for each species.
8. Each block should be planted with only one species. However, in each plantation area not more than 10 species should be planted.
12. Species like Champ, Gamar and Bahera to be scattered uniformly over whole area (10 m apart) and should not be planted in block.
13. Few blocks should be planted with rare and endangered species including cane.
14. QPM of rare species, including cane should be raised and supplied by Silviculture Division,

4.2 Acceptance of the Recommendations: Group 2

1. Plantation under A6 model should have 50% Sal and 50% Miscellaneous species, with 6 lines of Sal alternating with 6 lines of Miscellaneous species.
2. The spacing should be 2 m X 2 m for Miscellaneous species.
3. Sal should be sown in lines 2 m apart. Each line should have 3 rows 15 cms apart, and the sowing of each row should be done with different lots of Sal seeds.
4. Sal seedlings in sown lines should be maintained at a spacing of 1 m x 2 m in the 3rd year.
5. Failure in Sal sown lines should be replanted in 1st year / 2nd year with Sal seedlings to be planted at 2 m x 2 m spacing upto an extent of 20% of the Sal area. The age of seedlings used for infilling should be in conformity to the year in which it is to be infilled, i.e., 1st year with 1-year old seedling, 2nd year with 2-year old seedling.
6. Deviation may be made for planting Sal rows with other suitable species in areas where there is a depression and the land configuration is not fit for Sal sowing / planting.
7. For miscellaneous species, 1 Year old seedlings should be planted. However, one growing season old seedlings of a few fast growing miscellaneous species may be considered for planting.
8. Within the block of Miscellaneous spp., sub blocks, measuring 12 m X 40 m should be planted with one species comprising about 120 individual plants. Miscellaneous species should include Chilaune, Champ, Panisaj, Gokul, Lasune, Lali, Kawla, Sinduri, Lator, Dumur, Bahera, Chalta, Malagiri, Garjan, etc. However, in each plantation area not more than 10 species should be planted.
9. About 10% area should be dedicated for planting trees like Lator, Dumur, Bahera, Chalta, and other endangered species like Malagiri, etc. at the center of each plantation.
10. Species like Champ, Gamar and Bahera to be scattered uniformly over whole area (10 m apart) and should not be planted in block.
11. Few blocks should be planted with rare and endangered species including cane.
12. QPM of rare species, including cane should be raised and supplied by Silviculture Division,

4.3 Acceptance of the Recommendations: Group 3

The technical prescriptions for model A5 (Miscellaneous Plantation in North Bengal) were accepted by the members on the basis of the recommendations of Group 1. PMU and PMC were requested to refine the details of activities and work out the cost per ha by modifying the estimate in the light of accepted technical prescriptions.

The PMU and PMC were also requested to revisit the estimates for maintenance in Year 1, Year 2 and Year 3 on the basis of the accepted prescription of the model.

The modified estimates have been furnished in Chapter 6.

4.4 Acceptance of the Recommendations: Group 4

The technical prescriptions for model A6 (Plantation of Sal and Associates Species in North Bengal) were accepted by the members on the basis of the recommendations of Group 2. PMU and PMC were requested to refine the details of activities and work out the cost per ha by modifying the estimate in the light of accepted technical prescriptions.

The PMU and PMC were also requested to revisit the estimates for maintenance in Year 1, Year 2 and Year 3 on the basis of the accepted prescription of the model.

The modified estimates have been furnished in Chapter 6.

4.5 Acceptance of the Recommendations: Group 5

Fodder Grass Plantation in the Plains

1. In open areas, grass slips should be planted at 1 m x 1 m spacing (10,000 plants/ha) covering a minimum of 1 hectare.
2. Fodder tree seedlings should not be planted as prescribed in the MoD.
3. The grass species should be selected for plantation from the species mentioned in MoD, based on the edaphic and soil condition of the site of plantation. Tall grasses are not advisable for planting because they grow beyond browsing height in two years. For better grassland management, advice from expert institutes and agencies should be taken to determine the suitable management practices including the species choice such as CFGRI-Jhansi, WII etc.
4. In any fodder plantation only upto 20% of the area should be planted with Dhadda, with remaining 80% of other species.
5. Planting of fodder grass should be done preferably near existing water bodies.
6. Controlled fire operations including creation of fire lines should be done to avoid accidental fire that may damage the plantation.
7. There should be provision for fodder plantation maintenance in 4th year also.

Bamboo Underplanting in Mahananda

1. Bamboo underplanting at Mahananda should be done after canopy opening. Prescription of canopy opening should be in concurrence with the approved Management Plan of Mahananda WLS. The possibility of providing funds for canopy opening may be explored under WBFBC Project.

Fodder Tree Plantation after Removal of Maling Bamboo in the Hills

1. As there are diverse opinion about the effects of removal of Maling bamboo, field studies should be done to see the efficacy of the treatment, before undertaking removal of Maling Bamboo.
2. At least 2 year old seedlings of fodder tree species should be planted out at a closer spacing of 2.0 m x 2.0 m (2500 plants/ha). The minimum plot size is 1 ha for one plantation.

The species to be planted in different PAs may be selected from the list below:

Senchal WLS: Champ (*Machilus cathcartai*), Pipli (*Symingtonia populunea*), Buk (*Quercus lamellose*), Phalant (*Quercus lineate*), Korla (*Machilus udulis*), Maya (*Eriobtrya petolata*), Kapasi (*Acer campbelli*),

Singalila NP: Katus (*Castanopsis hystrix*), Champ (*Machilus cathcathai*), Pipli (*Symingtonia populunea*), Oaks like *Quercus lamellose*, *Quercus lineate* etc.

Neora Valley NP: *Quercus* spp., Tenga (*Sorbus cuspidata*), Kapasi (*Acer campbelli*), Kawla (*Machilus odoratissima*), Thekifal (*Actinde collasasa/ strigosa*), Bhalu chinde (*Scheffera impressa*), Katus (*Castanopsis* sp), Siliinge (*Osmanthus suavia*)

Fodder tree plantation in Chapramari WLS (Additional)

Though the MoD does not prescribe any treatment in Chapramari WLS, Fodder Tree Plantation in Chapramari WLS should be taken up under the Project with following species:

Lator (*Artocarpus chaplasha*), Amaloki (*Emblica officinalis*), Bahera (*Terminalia bellerica*), Kumbi (*Careya arborea*), Chalta (*Dillenia indica*), Jogdumur (*Ficus cunia*), Badrase (*Eleaocarpus varunua*), Dudhila (*Ficus nemuralis*), Gayo (*Bridelia rettusa*), Gogun (*Saurauia roxburghii*), Kabara (*Ficus laccor*), Kimbu (*Morus levigata*), Khoksa (*Ficus hispida*), Sindhure (*Mallatus phillipinensis*).

As per the site condition, 8 to 10 species from the above mentioned list should be planted at a spacing 2.5 m X 2.5 m in an intimate mixture. Six to nine months old seedling/cutting should be used for planting.

The technical prescriptions for the Improvement of Wildlife Habitat in Protected Areas and resulting estimates were accepted by the members on the basis of the recommendations of Group 5. PMU and PMC were requested to refine the details of activities and work out the cost per ha by modifying the estimate in the light of accepted technical prescriptions.

The modified estimates have been furnished in Chapter 6.

5. Resulting technical prescriptions

5.1 Technical prescription for Miscellaneous Plantation in North Bengal: A5 Model

Objective: Production of Industrial wood for meeting the requirements of wood based industries like plywood, veneering, saw mills and also to meet the demand of timber for construction. Smallwood, poles and firewood production will also be augmented.

General Description - In North Bengal, plains and hills, on account of grazing, damage due to floods, change of river courses, infestation by weeds, landslides, encroachments, illicit felling, etc., there are sizable extent of blanks and degraded lands though in small pockets. Such areas shall be afforested under this model in the form of one of 3 sub-models as dictated by conditions (foothills, riverine, or hills).

Minimum Target Management Area per JFMC: 10 ha

Maximum Target number of JFMC: 105

Area: 8 Forest Divisions under 3 Districts

Target Area: A5 Miscellaneous Plantation in North Bengal

Soil & Climate: Alluvial plains of Teesta, Torsha, Mahananda. Deep to moderate alluvial deposit of course to fine loamy texture with problems of water logging and Terai soil of the Himalayan foot hills having moderately deep alluvium deposit, faces severe flood hazards.

Species: Not more than any 6 to 10 of the following miscellaneous species *Schima wallichii*, *Michelia champaca*, *Amoora rohituka*, *Amoora wallichii*, *Gmelina arborea*, *Cedrela toona*, *Terminalia tomentosa*, *Terminalia myriocarpa*, *Terminalia myriocarpa*, *Chukrassia tabularis*, *Kaijelia pinnata*, *Duabanga sonneritoides*, *Cinnamomum cecidodaphne* etc. may be planted.

Teak which has been prescribed in the Working Plans should be planted in few sub-blocks by stump cutting or by seedlings prepared through stump cutting in model A5 for Plain areas.

Sites prone to water logging may be planted with *Bischofia javanica*, *Terminalia arjuna*, *Lagerstroemia flos-reginae*. In addition, species like *Barringtonia acutangula* may be considered for swampy areas of Malda.

For Hill areas the selection of species should be made from the representative species of different altitudinal zones. Suitable hill areas should have appropriate species mixes instead of teak and miscellaneous species and should include as principal species *Machilus spp.*, *Michelia spp.*, *Alnus nepalensis*, *Betula alnoides*, *Engelhartia spp.*, *Rhododendron sp.*, Katus (*Castanopsis hystrix*), Hemlock (*Tsuga brunoniana*), Silver fir (*Abies densa*), Pipli (*Symingtonia populunea*) and Oaks like *Quercus lamellosa*, *Quercus lineata* etc.

Plantations in Riverine area will comprise of Khair, Sissoo, Simul and Sirish.

The list of species is illustrative only.

Extent- 1,050 ha of such land has been proposed for afforestation under this model.

Technique- Endemic species as mentioned above are proposed for planting under this model. The planting area has to be cleaned thoroughly. Planting pits of size (0.40 m x 0.30 m)/2 x 0.30 m x 0.30 m will be dug at a spacing of 2m x 2m (2500 plants/ha) in plains and 2.5 m x 2.5 m (1,600 plants / ha) in hills. Soil work has to be completed by early May at the latest. For higher hills 2 year old QPM raised and tended in Central Nursery will be planted. For plains QPM generally has to be one year old however QPM of few species

such as Chikrasi, Jarul etc. may be planted after raising and tending in Central Nursery for one growing season. Teak should be planted in few sub-blocks by stump cutting or by seedlings prepared through stump cutting in model A5 for Plain areas.

Block size should be 20 x 40 m for each species. Each block should be planted with only one species. However, in each plantation area not more than 10 species should be planted.

Species like Champ, Gamar and Bahera should be scattered uniformly over whole area (10 m apart) and should not be planted in block.

Khair, Sissoo, Simul, Sirish combine should be planted under model A5 in riverine areas in Plains.

The creation cost provides for 4 tending operations. Subsequently, 3 tending operations will be done in 1st year maintenance. 2nd and 3rd year has provisions for two tendings.

Few blocks should be planted with rare and endangered species including cane. QPM of rare species, including cane should be raised and supplied by Silviculture Division.

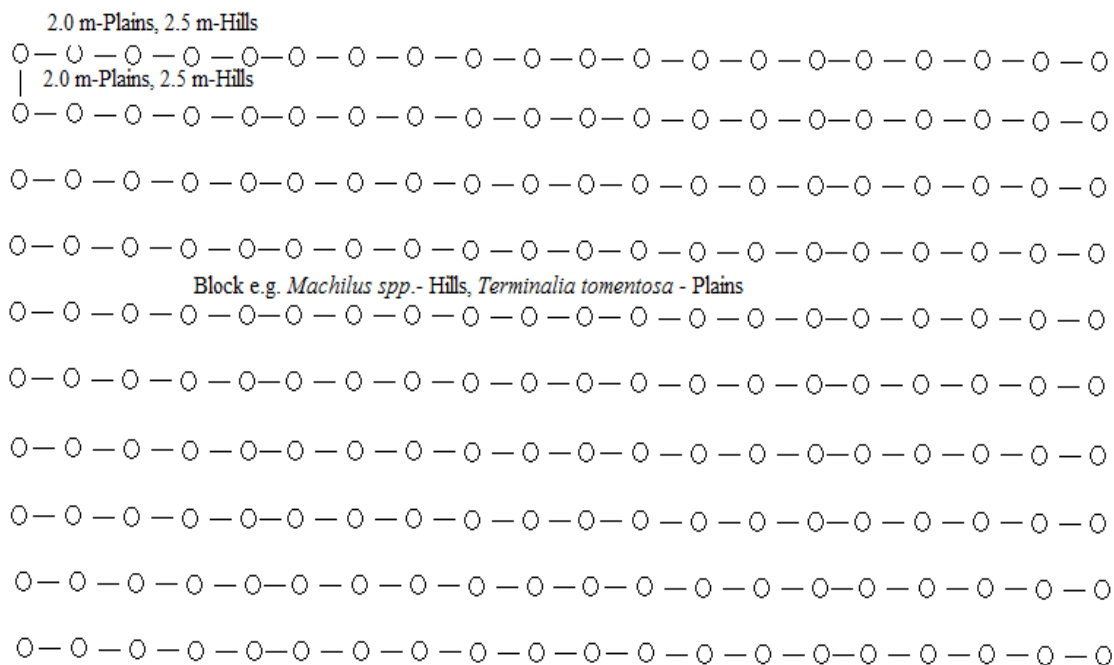


Figure - A5 Miscellaneous Plantation in North Bengal

Management: Silvicultural operations and final felling will be done as per Working Plan prescription. Revenue will be shared as per the extant rules.

Survival Rate (target) - The survival rate for this model may be fixed as follows –

1st year: 85% 3rd year: 80% 5th year: 75%

5.2: Technical prescription for Plantation of Sal and Associates Species in North Bengal : Model A6

Objective: Production of quality construction timber by using endemic species like Sal (*Shorea robusta*) mainly and other associates like Pakasaj (*Terminalia crenulata*), Panisaj (*Terminalia myriocarpa*) etc. and

mixed hard wood timber for plywood / saw mills and veneering industries. This will also augment production of small timber, poles, posts and firewood.

General Description-In North Bengal, plains and foothills, on account of grazing, damage due to floods, change of river courses, infestation by weeds, encroachment, illicit felling, etc, there are sizable extent of blanks and degraded lands though in small pockets. Such areas shall be afforested under this model

Minimum Target Management Area per JFMC: 10 ha

Maximum Target number of JFMC/EDCS: 54

Area: 7 Forest Divisions covered by 2 Districts

Soil & Climate: Alluvial plains of Teesta, Torsha, Mahananda. Deep to moderate alluvial deposit of course to fine loamy texture with problems of water logging and Terai soil of the Himalayan foot hills having moderately deep alluvium deposit, faces severe flood hazards.

Species: Sal and its associate species such as *Schima wallichii*, *Chukrassia tabularis*, *Cedrela toona*, *Gmelina arborea*, *Amoora rohituka*, *Amoora wallichii*, *Terminalia myriocarpa*, *Terminalia crenulata*, etc. The list of species is illustrative only.

Plantation areas under this model will be available mostly near the Forest Village JFMC/EDCS and benefit will go to the members. This will ensure protection and maintenance of the plantation and also will be in consonance with the Working Plan prescription.

Extent: 540 ha of such land are proposed for afforestation under this model.

Technique: Endemic species as specified above are proposed for planting in this model. The planting area has to be cleaned thoroughly. Planting pits of size (0.40 m x 0.30 m)/2 x 0.30 m x 0.30 m will be dug at a spacing of 2 m x 2 m (2,500 plants / ha). Soil work has to be completed by early May at the latest. 1 year QPM of miscellaneous species raised and tended in Central Nursery, will be planted in pits. However QPM of few species such as Chikrasi, Jarul etc. may be planted after raising and tending in Central Nursery for one growing season.

Plantation under A6 model should have 50% Sal and 50% Miscellaneous species, with 6 lines of Sal alternating with 6 lines of Miscellaneous species.

The spacing should be 2 m X 2 m for Miscellaneous species.

Sal should be sown in lines 2 m apart. Each line should have 3 rows 15 cms apart, and the sowing of each row should be done with different lots of Sal seeds.

Failure in Sal sown lines should be replanted in 1st year / 2nd year with Sal seedlings to be planted at 2 m x 2 m spacing upto an extent of 20% of the Sal area. The age of seedlings used for infilling should be in conformity with the year in which it is to be infilled, i.e., 1st year with 1-year old seedlings, 2nd year with 2-year old seedlings.

Deviation may be made for planting Sal rows with other suitable species in areas where there is a depression and the land configuration is not fit for Sal sowing / planting.

For miscellaneous species, 1 year old seedlings should be planted. However, one growing season old seedlings of a few fast growing miscellaneous species may be considered for planting.

Within the block of Miscellaneous spp., sub blocks, measuring 12 m X 40 m should be planted with one species comprising about 120 individual plants. Miscellaneous species should include Chilaune, Champ,

Panisaj, Gokul, Lasune, Lali, Kawla, Sinduri, Lator, Dumur, Bahera, Chalta, Malagiri, Garjan, etc. However, in each plantation area not more than 10 species should be planted.

About 10% area should be dedicated for planting trees like Lator, Dumur, Bahera, Chalta, and other endangered species like Malagiri, etc. at the center of each plantation.

Species like Champ, Gamar and Bahera to be scattered uniformly over whole area (10 m apart) and should not be planted in block.

Few blocks should be planted with rare and endangered species including cane. QPM of rare species, including cane should be raised and supplied by Silviculture Division,

The creation cost provides for 4 tending operations. Subsequently 3 tending operations will be done in 1st year maintenance. 2nd and 3rd year has provisions for two tendings. In the 5th year provision for mechanical thinning and climber cutting should be done.

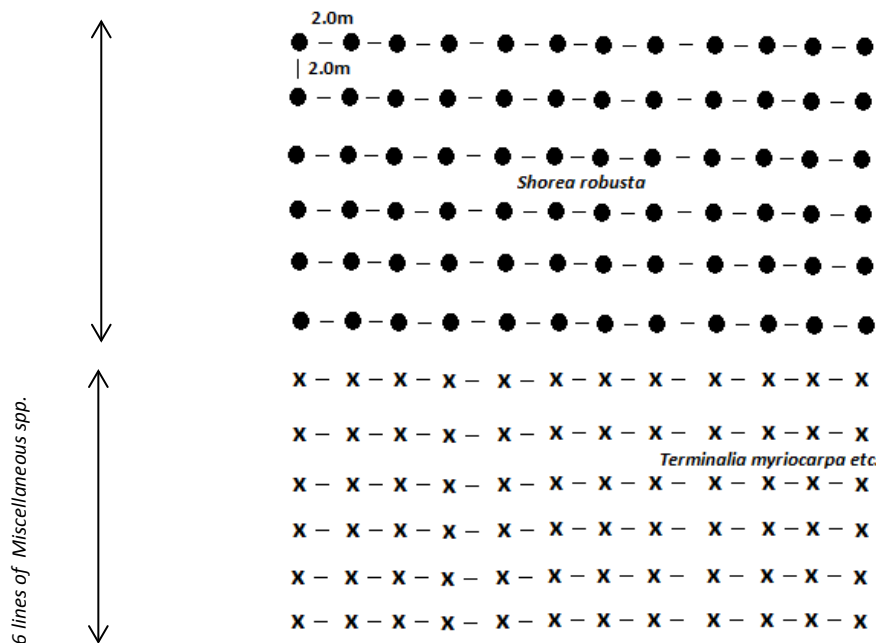


Figure - A6 Plantation of Sal and Associates Species in North Bengal

Management: Sal plants in sown lines should be maintained at a spacing of 1 m x 2 m in the 3rd year. Mechanical thinning will be carried out at 5th year. 1st silvicultural thinning will be done at 15th year and the 2nd one at 30th year. Rotation may be fixed at 60 years or as may be prescribed under Working Plan.

Survival Rate (target) - The survival rate for this model may be fixed as follows –

1st year: 85%

3rd year: 80%

5th year: 75%

5.3 Improvement of Wildlife Habitat in Protected Areas

5.3.1 Grass and Fodder Tree Plantation in the Plains

The plains of Gorumara NP and Jaldapara WS provide the suitable foraging ground for large herbivores. In

these two protected areas, which are relatively small in size, restoring the open grasslands is critically important to sustain the population of rhinoceros in particular. However, many such areas are shrinking due to the natural succession with the rapid growth of colonising tree species. At the same time, the numbers of the threatened species have been increasing due to the success of conservation effort by the Forest Department for the past decade. Thus, the shortage of open grasslands has become more serious management issue for recent years.

In open areas, grass slips should be planted at 1 m x 1 m spacing (10,000 plants/ha) covering a minimum of 1 hectare. Fodder tree seedlings should not be planted.

The grass species to be planted are: Dhadda, Chepti, Malsa, Madhua, Ekra (*Saccharum* sp.), Nal (*Arundodonax*), Khagra (*Pharagmites karka*), Bhuttaghash (*Coixlachrymajobi*), Banspati (*Setaria* sp.), Purundi (*Alpinia alughas*), etc. The grass species should be selected based on the edaphic and soil condition of the site of plantation. Tall grasses are not advisable for planting because they grow beyond browsing height in two years. For better grassland management, advice from expert institutes and agencies should be taken to determine the suitable management practices including the species choice such as CFGRI-Jhansi, WII etc.

In any fodder plantation only upto 20% of the area should be planted with Dhadda, with remaining 80% of other species. Planting of fodder grass should be done preferably near existing water bodies.

Controlled fire operations including creation of fire lines should be done to avoid accidental fire that may damage the plantation.

There should be provision for fodder plantation maintenance in 4th year also. In addition, old grassland of over seven years old will be revitalised by similar operation only in Jaldapara WS. The plot size of one plantation is 1 ha in minimum.

5.3.2 Bamboo Under-planting in Mahananda

Mahananda Sanctuary is located in a key area for elephant conservation. Herds of elephant stay in the foothills longer than other areas along migration routes before crossing to Nepal and after coming back to West Bengal. During the stay, they raid paddy fields or maize farms, damaging crops and house properties seriously. It was reported by a department officer that bamboo under-planting was so effective that it can keep the herds inside the forests one to two weeks longer than the area without bamboo stands; which reduced the time of elephant spent in the agricultural land.

Bamboo underplanting at Mahananda should be done after canopy opening. Prescription of canopy opening should be in concurrence with the approved Management Plan of Mahananda WLS.

After canopy-opening of plantation areas, bamboo seedlings will be planted at 4 m x 4 m spacing (625 plants/ha) and in some plots, fruit tree seedlings will be planted at 10 m x 10 m spacing (100 plants/ha). The bamboo species planned are all indigenous: Bhalubans (*Dendrocalamus sikkimensis*), Choya bans (*Dendrocalamus hamiltonii*), Mala bans (*Bambusa nutans*), Kalaimakla (*Bambusa vulgaris*) and Muli bans (*Melocanabaccifera*). The plot size of one plantation is 1 ha in minimum.

5.3.3 Fodder Tree Plantation after Removal of Maling Bamboo in the Hills

In the hill areas over 2000 m in altitude, hill forests consist of wet hill forest, wet temperate forest, moist temperate forest and sub-alpine forest; a part of which is included in the biodiversity hotspot of Himalaya. The hill forests, however, have been facing undesirable habitat conversion due to prolific invasive spread of Maling bamboo (*Arundinaria maling*) in degraded forests mainly due to the past illegal logging and frequent forest fires.

To recover the original flora and fauna in the hills, such maling bamboo infested areas will be planted up

with trees consisting mainly of fodder species such as Khaniu (*Ficus cunia*), Gogun (*Ficus nepalensis*), Lepcha kowla (*Machilus edulis*), Buk (*Quercus lamellosa*), Pipli (*Bucklandia populnea*), Kapasi (*Acer campbelli*), etc.

2 year old QPM raised and tended in Central Nursery will be planted.

As there are diverse opinion about the effects of removal of Maling bamboo, field studies should be done to see the efficacy of the treatment, before undertaking removal of Maling Bamboo.

At least 2 year old seedlings of fodder tree species should be planted out at a closer spacing of 2.0 m x 2.0 m (2500 plants/ha). The minimum plot size is 1 ha for one plantation.

The other tree species to be planted in different PAs may be selected from the list below:

Senchal WLS: Champ (*Machilus cathcartai*), Pipli (*Symingtonia populnea*), Buk (*Quercus lamellose*), Phalant (*Quercus lineata*), Kowla (*Machilus edulis*), Maya (*Eriobrya peteolata*), Kapasi (*Acer campbelli*),

Singalila NP: Katus (*Castanopsis hystrix*), Champ (*Machilus cathcartai*), Pipli (*Symingtonia populnea*), Oaks like *Quercus lamellosa*, *Quercus lineata* etc.

Neora Valley NP: *Quercus* spp., Tenga (*Sorbus cuspidata*), Kapasi (*Acer campbelli*), Kawla (*Machilus odoratissima*), Thekifal (*Actinde collasasa/ strigosa*), Bhalu chinde (*Scheffera impressa*), Katus (*Castanopsis* sp), Siliinge (*Osmanthus suavia*)

5.3.4 Fodder tree plantation in Chapramari WLS (Additional)

Fodder Tree Plantation in Chapramari WLS should be taken up under the Project with following species:

Lator (*Artocarpus chaplasha*), Amaloki (*Emblica officinalis*), Bahera (*Terminalia bellerica*), Kumbi (*Careya arborea*), Chalta (*Dillenia indica*), Jogdumur (*Ficus cunia*), Badrase (*Eleaocarpus varunua*), Dudhila (*Ficus nemoralis*), Gayo (*Bridelia retusa*), Gogun (*Saurauia roxburghii*), Kabara (*Ficus laccor*), Kimbu (*Morus levigata*), Khoksa (*Ficus hispida*), Sindhure (*Mallatus phillipinensis*).

As per the site condition, 8 to 10 species from the above mentioned list should be planted at a spacing 2.5 m X 2.5 m in an intimate mixture. Six to nine months old seedling/cutting should be used for planting.

6. Resulting estimates

6.1 Cost Estimates for Miscellaneous Plantation in North Bengal : Model A5-Hills

6.1.1 Estimate for Miscellaneous Plantation North Bengal : Model A5-Hills – Creation

Estimate of A5 Plantation									
Hills									
Category	Sl. No.	Item	Quantity	Unit	Type	Output per manday	Required Mandays	Rate	Amount (Rs.)
Advance	1	Survey and demarcation of the plantation area including GPS Survey by Technical person	1.00	ha	Labour	0.50	2.00	216.00	432.00
Advance	2	Alignment of planting lines and staking the pit positions	1,600.00	nos	Labour	1,000.00	1.50	216.00	324.00
Advance	3	Advance Soil works by digging planting pits of size (0.40+0.30)/2 x 0.30 x0.30 m3 at 2.5.x 2.5 m spacing (1600 nos)	1,600.00	nos	Labour	80.00	20.00	216.00	4,320.00
Advance	4	Cleaning of the pltn site and making inspection path	1.00	ha	Labour	0.05	22.00	216.00	4,752.00
	5	Preplanting cleaning of plantation area	1.00	ha	Labour	0.16	6.00	216.00	1,296.00
Creation	6	Transplanting of potted seedlings in pits, including filling up of planting pits with dug up pulverized soil, carriage of Root Trainers to planting site and collection and recarriage of Root Trainers to local store site	1,600.00	nos	Labour	80.00	20.00	216.00	4,320.00
Creation	7	Carriage of Seedlings from Central Nursery to Planting site including loading and unloading and return of Stand and Root Trainers to Central Nursery	1,600.00	nos	Material			LS	1,200.00
Creation	8	Vacancy infilling	160.00	nos	Labour	40.00	4.00	216.00	864.00
Creation	9	1st mulching, weeding, cleaning and application of fertilizer	1,600.00	nos	Labour	115.00	14.00	216.00	3,024.00
Creation	10	2nd mulching, weeding, cleaning and application of fertilizer	1,600.00	nos	Labour	133.00	12.00	216.00	2,592.00
Creation	11	3rd cleaning, weeding	1,600.00	nos	Labour	160.00	10.00	216.00	2,160.00
Creation	12	Carriage of fertiliser, insecticide etc.	LS		Material			LS	250.00

Creation	13	Cost of fertilizer, insecticides etc.	LS		Material			LS	1,200.00	
Creation	14	Watch & Ward (1 md per 10 ha) for 6 months	LS		Labour		18.00	216.00	3,888.00	
Advance	15	Contingencies - Labour	LS		Labour			LS	122.00	
Advance	16	Contingencies - Material	LS		Material			LS	250.00	
Creation	17	Contingencies - Labour	LS		Labour			LS	106.00	
Creation	18	Contingencies - Material	LS		Material			LS	200.00	
		Total							31,300.00	
							129.50			
		ABSTRACT								
					Labour (No.)	Labour (Amount Rs.)	Material (Amount Rs.)	Total (Rs.)		
		Advance			45.50	9,828.00	0.00	9,828.00		
		Contingency			0.00	122.00	250.00	372.00		
		Total Advance			45.50	9,950.00	250.00	10,200.00		
		Creation			84.00	18,144.00	2,650.00	20,794.00		
		Contingency			0.00	106.00	200.00	306.00		
		Total Creation			84.00	18,250.00	2,850.00	21,100.00		
		Grand Total			129.50	28,200.00	3,100.00	31,300.00		

6.1.2 Estimate for Miscellaneous Plantation in North Bengal : Model A5-Hills - Maint. Year 1

Estimate of A5 1st Year Maintenance (for Hill area)									
Category	Sl. No.	Item	Quantity	Unit	Type	Output per manday	Required Mandays	Rate	Amount (Rs.)
Maint. Y1	1	Vacancy infilling	160.00	nos	Labour	80.00	2.00	216.00	432.00
Maint. Y1	2	1st weeding, cleaning, mulching, with application of fertilizer	1,600.00	nos	Labour	100.00	16.00	216.00	3,456.00
Maint. Y1	3	2nd weeding, cleaning	1,600.00	nos	Labour	114.00	14.00	216.00	3,024.00
Maint. Y1	4	3rd weeding, cleaning	1,600.00	nos	Labour	160.00	10.00	216.00	2,160.00
Maint. Y1	5	Cost of fertilizer and insecticide etc. including carriage	LS		Material			LS	600
Maint. Y1	6	Watch & Ward for 12 months	1	Ha	Labour		25	216	5400.00
Maint. Y1	7	Contingency - Labour							28.00
Maint. Y1	8	Contingency - Material							100.00
		Total							15,200.00
							67.00		
ABSTRACT									
				Labour (No.)	Labour (Amount Rs.)	Material (Amount Rs.)	Total (Rs.)		
		Maint. Y1		67.00	14,472.00	600.00	15,072.00		
		Contingency			28.00	100.00	128.00		
				14,500.00	700.00	15,200.00			

6.1.3 Estimate for Miscellaneous Plantation in North Bengal : Model A5-Hills - Maint. Year 2

Estimate of A5 2nd Year Maintenance (for Hill area)									
Category	Sl. No.	Item	Quantity	Unit	Type	Output per manday	Required Mandays	Rate	Amount (Rs.)
Maint. Y2	1	Vacancy infilling	160.00	nos	Labour	80.00	2.00	216.00	432.00
Maint. Y2	2	1st weeding, cleaning, mulching, with application of fertilizer	1,600.00	nos	Labour	114.00	14.00	216.00	3,024.00
Maint. Y2	3	2nd weeding, cleaning	1,600.00	nos	Labour	133.00	12.00	216.00	2,592.00
Maint. Y2	4	Cost of fertilizer and insecticide etc. including carriage	LS		Material			LS	600
Maint. Y2	5	Watch & Ward for 12 months	1	Ha	Labour		25	216	5400.00
Maint. Y2	6	Contingency - Labour							52.00
Maint. Y2	7	Contingency - Material							100.00
		Total							12,200.00
							53.00		
ABSTRACT									
				Labour (No.)	Labour (Amount Rs.)	Material (Amount Rs.)	Total (Rs.)		
		Maint. Y2		53.00	11,448.00	600.00	12,048.00		
		Contingency			52.00	100.00	152.00		
					11,500.00	700.00	12,200.00		

6.1.4 Estimate for Miscellaneous Plantation in North Bengal : Model A5-Hills - Maint. Year 3

Estimate of A5 3rd Year Maintenance (for Hill area)									
Category	Sl. No.	Item	Quantity	Unit	Type	Output per manday	Required Mandays	Rate	Amount (Rs.)
Maint. Y3	1	1st weeding, cleaning	1,600.00	nos	Labour	114.00	14.00	216.00	3,024.00
Maint. Y3	2	2nd weeding, cleaning	1,600.00	nos	Labour	133.00	12.00	216.00	2,592.00
Maint. Y3	3	Contingency - Labour							34.00
Maint. Y3	4	Contingency - Material							50.00
		Total							5,700.00
							26.00		
<u>ABSTRACT</u>									
				Labour (No.)	Labour (Amount Rs.)	Material (Amount Rs.)	Total (Rs.)		
		Maint. Y3		26.00	5,616.00		5,616.00		
		Contingency			34.00	50.00	84.00		
					5650.00	50.00	5,700.00		

6.1.5 Estimate for Miscellaneous Plantation in North Bengal : Model A5-Hills - Maint. Year 4

Estimate of A5 4th Year Maintenance (for Hill area)									
Category	Sl. No.	Item	Quantity	Unit	Type	Output per manday	Required Mandays	Rate	Amount (Rs.)
Maint. Y4	1	1st weeding, cleaning	1,600.00	nos	Labour	114.00	14.00	216.00	3,024.00
Maint. Y4	2	Contingency - Labour							26.00
Maint. Y4	3	Contingency - Material							50.00
		Total							3,100.00
							14.00		
<u>ABSTRACT</u>									
				Labour (No.)	Labour (Amount Rs.)	Material (Amount Rs.)	Total (Rs.)		
		Maint. Y4		14.00	3,024.00		3,024.00		
		Contingency			26.00	50.00	76.00		
					3,050.00	50.00	3,100.00		

6.2 Cost Estimates for Miscellaneous Plantation in North Bengal : Model A5-Plains

6.2.1 Estimate for Miscellaneous Plantation in North Bengal : Model A5-Plains - Creation

Estimate of A5 Plantation									
Plains									
Category	Sl. No.	Item	Quantity	Unit	Type	Output per manday	Required Mandays	Rate	Amount (Rs.)
Advance	1	Survey and demarcation of the plantation area including GPS Survey by Technical person	1.00	ha	Labour	1.00	1.00	216.00	216.00
Advance	2	Alignment of planting lines and staking the pit positions	2,500.00	nos	Labour	1,600.00	1.50	216.00	324.00
Advance	3	Advance Soil works by digging planting pits of size (0.40+0.30)/2 x 0.30 x 0.30 m ³ at 2.0 x 2.0 m spacing (2500 nos)	2,500.00	nos	Labour	125.00	20.00	216.00	4,320.00
Advance	4	Cleaning of the pltn site and making inspection path	1.00	ha	Labour	0.05	20.00	216.00	4,320.00
	5	Preplanting cleaning of plantation area	1.00	ha	Labour	0.16	6.00	216.00	1,296.00
Creation	6	Transplanting of potted seedlings in pits, including filling up of planting pits with dug up pulverized soil, carriage of Root Trainers to planting site and collection and recarriage of Root Trainers to local store site	2,500.00	nos	Labour	125.00	20.00	216.00	4,320.00
Creation	7	Carriage of Seedlings from Central Nursery to Planting site including loading and unloading and return of Stand and Root Trainers to Central Nursery	2,500.00	nos	Material			LS	1,500.00
Creation	8	Vacancy infilling	250.00	nos	Labour	60.00	4.00	216.00	864.00
Creation	9	1st mulching, weeding, cleaning and application of fertilizer	2,500.00	nos	Labour	180.00	14.00	216.00	3,024.00
Creation	10	2nd mulching, weeding, cleaning and application of fertilizer	2,500.00	nos	Labour	215.00	12.00	216.00	2,592.00
Creation	11	3rd cleaning, weeding	2,500.00	nos	Labour	250.00	10.00	216.00	2,160.00
	12	4th cleaning, weeding	2,500.00	nos	Labour	250.00	10.00	216.00	2,160.00
Creation	13	Cutting firelines 3.0 m wide	500.00	rmt	Labour	125.00	4.00	216.00	864.00
Creation	14	Erection of live hedge (ipomea, vitex, thorny spp.) fencing with bamboo/bamboo posts including local carriage of all material	400.00	rmt	Labour	100.00	4.00	216.00	864.00

Creation	15	Material for live fencing including carriage upto site	LS		Material			LS	1,200.00
Creation	16	Carriage of fertiliser, insecticide etc.	LS		Material			LS	250.00
Creation	17	Cost of fertilizer, insecticides etc.	LS		Material			LS	1,500.00
Creation	18	Watch & Ward (1 md per 10 ha) for 6 months	LS		Labour		18.00	216.00	3,888.00
Advance	19	Contingencies - Labour	LS		Labour			LS	120.00
Advance	20	Contingencies - Material	LS		Material			LS	200.00
Creation	21	Contingencies - Labour	LS		Labour			LS	118.00
Creation	22	Contingencies - Material	LS		Material			LS	200.00
		Total							36,300.00
							144.50		
ABSTRACT									
					Labour (No.)	Labour (Amount Rs.)	Material (Amount Rs.)	Total (Rs.)	
		Advance			42.50	9,180.00	0.00	9,180.00	
		Contingency			0.00	120.00	200.00	320.00	
		Total Advance			42.50	9,300.00	200.00	9,500.00	
		Creation			102.00	22,032.00	4,450.00	26,482.00	
		Contingency			0.00	118.00	200.00	318.00	
		Total Creation			102.00	22,150.00	4,650.00	26,800.00	
		Grand Total			144.50	31,450.00	4,850.00	36,300.00	

6.2.2 Estimate for Miscellaneous Plantation in North Bengal : Model A5-Plains - Maint. Year 1

Estimate of A5 1st Year Maintenance (for Plains area)									
Category	Sl. No.	Item	Quantity	Unit	Type	Output per manday	Required Mandays	Rate	Amount (Rs.)
Maint. Y1	1	Vacancy infilling	250	nos	Labour	125	2	216	432
Maint. Y1	2	1st weeding, cleaning, mulching, with application of fertilizer	2500	nos	Labour	155	16	216	3456
Maint. Y1	3	2nd weeding, cleaning, mulching	2500	nos	Labour	180	14	216	3024
Maint. Y1	4	3rd weeding, cleaning	2500	nos	Labour	250	10	216	2160
Maint. Y1	5	Cutting of firelines 3.0 m wide	500	rmt	Labour	125	4	216	864
Maint. Y1	6	Material for repair of live fencing including carriage upto site	LS		Material			LS	100
Maint. Y1	7	Watch & Ward for 12 months	1	Ha	Labour		25	216	5400
Maint. Y1	8	Cost of fertilizer and insecticide etc. including carriage	LS		Material			LS	600
Maint. Y1	9	Contingency - Labour							14
Maint. Y1	10	Contingency - Material							150
		Total							16200
							71		

ABSTRACT							
				Labour (No.)	Labour (Amount Rs.)	Material (Amount Rs.)	Total(Rs.)
		Maint. Y1		71.00	15,336.00	700.00	16,036.00
		Contingency			14.00	150.00	164.00
					15,350.00	850.00	16,200.00

6.2.3 Estimate for Miscellaneous Plantation in North Bengal : Model A5-Plains - Maint. Year 2

Estimate of A5 2nd Year Maintenance (for Plains area)									
Category	Sl. No.	Item	Quantity	Unit	Type	Output per manday	Required Mandays	Rate	Amount (Rs.)
Maint. Y2	1	Vacancy infilling	250	nos	Labour	80	2	216	432
Maint. Y2	2	1st weeding, cleaning	2500	nos	Labour	160	16	216	3456
Maint. Y2	3	2nd weeding, cleaning	2500	nos	Labour	200	12	216	2592
Maint. Y2	4	3rd weeding, cleaning	2500	nos	Labour	250	10	216	2160
Maint. Y2	5	Watch & Ward for 12 months	1	Ha	Labour		25	216	5400
Maint. Y2	6	Contingency - Labour							10
Maint. Y2	7	Contingency - Material							50
		Total							14,100
							65		
<u>ABSTRACT</u>									
				Labour (No.)	Labour (Amount Rs.)	Material (Amount Rs.)	Total (Rs.)		
		Maint. Y2		65.00	14,040.00		14,040.00		
		Contingency			10.00	50.00	60.00		
					14,050.00	50.00	14,100.00		

6.2.4 Estimate for Miscellaneous Plantation in North Bengal : Model A5-Plains - Maint. Year 3

Estimate of A5 3rd Year Maintenance (for Plains area)									
Category	Sl. No.	Item	Quantity	Unit	Type	Output per manday	Required Mandays	Rate	Amount (Rs.)
Maint. Y3	1	1st weeding, cleaning	2500	nos	Labour	180	14	216	3024
Maint. Y3	2	2nd weeding, cleaning	2500	nos	Labour	100	12	216	2592
Maint. Y3	3	Contingency - Labour							34
Maint. Y3	4	Contingency - Material							50
		Total							5700
							26		
<u>ABSTRACT</u>									
				Labour (No.)	Labour (Amount Rs.)	Material (Amount Rs.)	Total (Rs.)		
		Maint. Y3		26.00	5,616.00		5,616.00		
		Contingency			34.00	50.00	84.00		
					5,650.00	50.00	5,700.00		

6.2.5 Estimate for Miscellaneous Plantation in North Bengal : Model A5-Plains - Maint. Year 4

Estimate of A5 4th Year Maintenance (for Plains area)									
Category	Sl. No.	Item	Quantity	Unit	Type	Output per manday	Required Mandays	Rate	Amount (Rs.)
Maint. Y4	1	1st weeding, cleaning	2500	nos	Labour	180	14	216	3024
Maint. Y4	2	Contingency - Labour							26
Maint. Y4	3	Contingency - Material							50
		Total							3,100
							14		
<u>ABSTRACT</u>									
				Labour (No.)	Labour (Amount Rs.)	Material (Amount Rs.)	Total (Rs.)		
		Maint. Y4		14.00	3,024.00		3,024.00		
		Contingency			26.00	50.00	76.00		
					3,050.00	50.00	3,100.00		

6.3 Cost Estimates for Sal Plantation North West Bengal : Model A6

6.3.1 Estimate for Plantation of Sal and Associates Species:A6 Model- Creation

Estimate of A6 Plantation									
Category	Sl. No.	Item	Quantity	Unit	Type	Output per manday	Required Mandays	Rate	Amount (Rs.)
Advance	1	Survey and demarcation of the plantation area including GPS Survey by Technical person	1.00	ha	Labour	1.00	1.00	216.00	216.00
Advance	2	Alignment of planting lines (50% area) and staking the pit positions	1250 pit + sal lines	nos	Labour	1250+sal lines	1.50	216.00	324.00
Advance	3	Advance Soil works by digging planting pits of size (0.40+0.30)/2 x 0.30 x0.30 m ³ at 2.0.x 2.0 m spacing (1250 nos. over 50% area for misc. spp. only)	1,250.00	nos	Labour	125.00	10.00	216.00	2,160.00
Advance	4	Cleaning of the pltn site and making inspection path	1.00	ha	Labour	0.05	20.00	216.00	4,320.00
Creation	5	Preparation of Sal lines by hoeing	0.50	ha	Labour	0.05	10.00	216.00	2,160.00
	6	Preplanting cleaning of plantation area	1.00	ha	Labour	0.16	6.00	216.00	1,296.00
Creation	7	Transplanting of potted seedlings in pits, including filling up of planting pits with dug up pulverized soil, carriage of Root Trainers to planting site and collection and recarriage of Root Trainers to local store site	1,250.00	nos	Labour	125.00	10.00	216.00	2,160.00
Creation	8	Carriage of Seedlings from Central Nursery to Planting site including loading and unloading and return of Stand and Root Trainers to Central Nursery	1,250.00	nos	Material			LS	750.00
Creation	9	Vacancy infilling including planting in Sal lines against failure of sowing	500.00	nos	Labour	60.00	8.00	216.00	1,728.00
Creation	10	Sowing Sal seeds in 3 rows in each line (sowing to be done in one row at a time)	0.50	ha	Labour	0.08	6.00	216.00	1,296.00
Creation	11	Supply of Sal seeds including carriage upto the site	100.00	kg	Material			LS	4,000.00
Creation	12	1st weeding and hand cleaning of Sal lines	0.50	ha	Labour	0.05	10.00	216.00	2,160.00
Creation	13	1st mulching, weeding, cleaning for misc. lines and Sal seedlings planted against failure of sowing	0.50	ha	Labour	0.05	10.00	216.00	2,160.00

Creation	14	2nd weeding including hand cleaning of Sal lines and application of fertilizer	0.50	ha	Labour	0.06	8.00	216.00	1,728.00
	15	2nd mulching, weeding, cleaning of misc. lines and Sal seedlings planted against failure of sowing including application of fertilizer	0.50	ha	Labour	0.06	8.00	216.00	1,728.00
Creation	16	3rd weeding including hand cleaning of Sal lines	0.50	ha	Labour	0.07	7.00	216.00	1,512.00
	17	3rd mulching, weeding, cleaning for misc. lines and Sal seedlings planted against failure of sowing	0.50	ha	Labour	0.07	7.00	216.00	1,512.00
	18	4th weeding cleaning for whole plantation area	1.00	ha	Labour	0.10	10.00	216.00	2,160.00
	19	5th weeding cleaning for whole plantation area	1.00	ha	Labour	0.12	8.00	216.00	1,728.00
Creation	20	Cutting firelines 3.0 m wide	400.00	rmt	Labour	125.00	3.00	216.00	648.00
Creation	21	Erection of live hedge (ipomea, vitex, thorny spps.) fencing with bamboo/bamboo posts including local carriage of all material	400.00	rmt	Labour	100.00	4.00	216.00	864.00
Creation	22	Material for live fencing including carriage upto site	LS		Material			LS	1,200.00
Creation	23	Carriage of fertiliser, insecticide etc.	LS		Material			LS	600.00
Creation	24	Cost of fertilizer, oil cakes and insecticides etc. including carriage upto site	LS		Material			LS	3,000.00
Creation	25	Watch & Ward (1 md per 10 ha) for 6 months	LS		Labour		18.00	216.00	3,888.00
Creation	26	Cutting trenches for drainaige as required	LS		Labour		10.00	216.00	2,160.00
Advance	27	Contingencies - Labour	LS		Labour			LS	180.00
Advance	28	Contingencies - Material	LS		Material			LS	100.00
Creation	29	Contingencies - Labour	LS		Labour			LS	112.00
Creation	30	Contingencies - Material	LS		Material			LS	150.00
		Total							48,000.00
							175.50		

ABSTRACT							
				Labour (No.)	Labour (Amount Rs.)	Material (Amount Rs.)	Total (Rs.)
		Advance		32.50	7,020.00	0.00	7,020.00
		Contingency		0.00	180.00	100.00	280.00
		Total Advance		32.50	7,200.00	100.00	7,300.00
		Creation		143.00	30,888.00	9,550.00	40,438.00
		Contingency		0.00	112.00	150.00	262.00
		Total Creation		143.00	31,000.00	9,700.00	40,700.00
		Grand Total		175.50	38,200.00	9,800.00	48,000.00

6.3.2 Estimate for Plantation of Sal and Associates Species:A6 Model- Maint. Year 1

Estimate of A6 1st Year Maintenance									
Category	Sl. No.	Item	Quantity	Unit	Type	Output per manday	Required Mandays	Rate	Amount (Rs.)
Maint. Y1	1	Vacancy infilling including planting in Sal lines against failure of sowing	500.00	nos	Labour	80.00	6.00	216.00	1,296.00
Maint. Y1	2	1st weeding, cleaning, hand cleaning and mulching of Sal lines with application of fertilizer	0.50	ha	Labour	0.06	8.00	216.00	1,728.00
Maint. Y1	3	1st mulching, weeding, cleaning and application of fertilizer for misc. lines and Sal seedlings planted against failure of sowing	0.50	ha	Labour	0.06	8.00	216.00	1,728.00
Maint. Y1	4	2nd weeding and hand cleaning of Sal lines	0.50	ha	Labour	0.07	7.00	216.00	1,512.00
Maint. Y1	5	2nd mulching, weeding, cleaning of misc. lines and Sal seedlings planted against failure of sowing	0.50	ha	Labour	0.08	6.00	216.00	1,296.00
Maint. Y1	6	3rd weeding cleaning for whole plantation area	0.50	ha	Labour	0.08	12.00	216.00	2,592.00
Maint. Y1	7	4th weeding cleaning for whole plantation area	1.00	ha	Labour	0.10	10.00	216.00	2,160.00
Maint. Y1	8	Cutting of firelines 3.0 m wide	400.00	rmt	Labour	125.00	3.00	216.00	648.00
Maint. Y1	9	Repair of live hedge (ipomea, vitex, thorny spp.) fencing with bamboo/bamboo posts including local carriage of all material	400.00	rmt	Labour	200.00	2.00	216.00	432.00
Maint. Y1	10	Material for live fencing including carriage upto site	LS		Material			LS	100.00
Maint. Y1	11	Watch & Ward for 12 months	1.00	ha	Labour		25.00	216.00	5,400.00
Maint. Y1	12	Cost of fertilizer and insecticide including carriage	LS		Material			LS	1,000.00
Maint. Y1	13	Contingency - Labour							58.00
Maint. Y1	14	Contingency - Material							50.00
		Total							20,000.00
							87.00		

<u>ABSTRACT</u>							
				Labour (No.)	Labour (Amount Rs.)	Material (Amount Rs.)	Total (Rs.)
		Maint. Y1		87.00	18,792.00	1,100.00	19,892.00
		Contingency			58.00	50.00	108.00
					18,850.00	1,150.00	20,000.00

6.3.3 Estimate for Plantation of Sal and Associates Species:A6 Model- Maint. Year 2

Estimate of A6 2nd Year Maintenance									
Category	Sl. No.	Item	Quantity	Unit	Type	Output per manday	Required Mandays	Rate	Amount (Rs.)
Maint. Y2	1	Vacancy infilling	250.00	nos	Labour	80.00	3.00	216.00	648.00
Maint. Y2	2	1st weeding, cleaning	1.00	ha	Labour	0.06	16.00	216.00	3,456.00
Maint. Y2	3	2nd weeding, cleaning	1.00	ha	Labour	0.08	12.00	216.00	2,592.00
Maint. Y2		3rd weeding, cleaning	1.00	ha	Labour	0.10	10.00	216.00	2,160.00
Maint. Y2	4	Cutting and maintenance of firelines 3.0 m wide	500.00	rmt	Labour	250.00	2.00	216.00	432.00
Maint. Y2	5	Watch & Ward for 12 months	1.00	ha	Labour		25.00	216.00	5,400.00
Maint. Y2	6	Contingency - Labour							62.00
Maint. Y2	7	Contingency - Material							50.00
		Total							14,800.00
							68.00		
<u>ABSTRACT</u>									
				Labour (No.)	Labour (Amount Rs.)	Material (Amount Rs.)	Total (Rs.)		
		Maint. Y2		68.00	14,688.00		14,688.00		
		Contingency			62.00	50.00	112.00		
					14,750.00	50.00	14,800.00		

6.3.4 Estimate for Plantation of Sal and Associates Species:A6 Model- Maint. Year 3

Estimate of A6 3rd Year Maintenance										
Category	Sl. No.	Item	Quantity	Unit	Type	Output per manday	Required Mandays	Rate	Amount (Rs.)	
Maint. Y3	1	1st weeding, cleaning	2500	nos	Labour	180	14	216	3024	
Maint. Y3	2	2nd weeding, cleaning	2500	nos	Labour	100	12	216	2592	
Maint. Y3	3	Contingency - Labour							34.00	
Maint. Y3	4	Contingency - Material							50.00	
		Total							5,700.00	
							26.00			
		<u>ABSTRACT</u>								
				Labour (No.)	Labour (Amount Rs.)	Material (Amount Rs.)	Total (Rs.)			
		Maint. Y3		26.00	5,616.00		5,616.00			
		Contingency			34.00	50.00	84.00			
				5,650.00	50.00	5,700.00				

6.3.5 Estimate for Plantation of Sal and Associates Species:A6 Model- Maint. Year 4

Estimate of A6 4th Year Maintenance										
Category	Sl. No.	Item	Quantity	Unit	Type	Output per manday	Required Mandays	Rate	Amount (Rs.)	
Maint. Y4	1	1st weeding, cleaning	2500	nos	Labour	180	14	216	3024	
Maint. Y4	2	Contingency - Labour							26	
Maint. Y4	3	Contingency - Material							50	
		Total							3,100	
							14			
		ABSTRACT								
				Labour (No.)	Labour (Amount Rs.)	Material (Amount Rs.)	Total (Rs.)			
		Maint. Y4		14.00	3,024.00		3,024.00			
		Contingency			26.00	50.00	76.00			
					3,050.00	50.00	3,100.00			

6.4 Cost Estimates for Afforestation under Biodiversity Conservation.

6.4.1 Estimate of Grass and Fodder Plantation

Estimate of Grass and Fodder Plantation									
Category	Sl. No.	Item			Type		Required Mandays	Rate	Amount (Rs.)
Advance	1	Preparation of mother beds			Labour		6	216.00	1,296.00
Advance	2	Collection of grass seeds / slips & processing			Labour		8	216.00	1,728.00
Advance	3	Shifting of slips to different beds			Labour		5	216.00	1,080.00
Advance	4	Making of sheds for beds (cost of covering with thatch)			Labour		2	216.00	432.00
Advance	5	Material for making temporary sheds			Material			LS	600.00
Advance	6	Weeding / cleaning of beds			Labour		8	216.00	1,728.00
Advance	7	Watering of beds			Labour		9	216.00	1,944.00
Advance	8	Manuring / application of organic pesticide / fungicides			Labour		4	216.00	864.00
Advance	9	Cost of Manure/organic pesticide / fungicides			Material			LS	500.00
Advance	10	Cost of implements like measuring tape, ropes, axe, lime powder, sickle etc.			Material			LS	600.00
Advance	11	Labour for Power fencing (with existing energizer) of Nursery			Labour		2	216.00	432.00
Advance	12	Materials for Power fencing of Nursery			Material			LS	1,500.00
Creation	13	Survey and demarcation of area including alignment of lines			Labour		4	216.00	864.00
Creation	14	Cleaning and control burning of the area			Labour		12	216.00	2,592.00
Creation	15	Collection of grass slips and seedlings from nursery and transportation			Labour		5	216.00	1,080.00
Creation	16	Transportation of grass slips and seedlings from nursery			Material			LS	500.00
Creation	17	Digging of trenches and pits and planting of grass slips and seedlings			Labour		30	216.00	6,480.00
Creation	18	Gap filling and three times weeding cleaning			Labour		50	216.00	10,800.00
Creation	19	Watching the plantation against grazing and applying fertiliser			Labour		16	216.00	3,456.00
Creation	20	Energised fence			Material			LS	20,000.00
Creation	21	Removal of woody weeds and climbers and energised fencing			Labour		30	216.00	6,480.00
Maint Yr 1	22	Cleaning of weeds two times and gap filling			Labour		40	216.00	8,640.00
Maint Yr 1	23	Watching the plantation against grazing and other damage			Labour		10	216.00	2,160.00
Maint Yr 1	24	Supply of misc. items			Material			LS	1,000.00
Maint Yr 2	25	Cleaning of weeds two times and gap filling			Labour		20	216.00	4,320.00

Maint Yr 2	26	Watching the plantation against grazing and other damage			Labour		10	216.00	2,160.00
Maint Yr 2	27	Supply of misc. items			Material			LS	400.00
Advance	28	Contingencies - Labour						LS	46.00
Advance	29	Contingencies - Material						LS	50.00
Creation	30	Contingencies - Labour						LS	48.00
Creation	31	Contingencies - Material						LS	100.00
Maint Yr 1	32	Contingencies - Labour						LS	50.00
Maint Yr 1	33	Contingencies - Material						LS	50.00
Maint Yr 2	34	Contingencies - Labour						LS	20.00
Maint Yr 2	35	Contingencies - Material						LS	100.00
							271.00		84,100.00
ABSTRACT									
					Labour (No.)	Labour (Amount Rs.)	Material (Amount Rs.)	Total (Rs.)	
		Advance			44.00	9,504.00	3,200.00	12,704.00	
		Contingency				46.00	50.00	96.00	
		Total Advance			44.00	9,550.00	3,250.00	12,800.00	
		Creation			147.00	31,752.00	20,500.00	52,252.00	
		Contingency				48.00	100.00	148.00	
		Total Creation			147.00	31,800.00	20,600.00	52,400.00	
		Maint Yr 1			50.00	10,800.00	1,000.00	11,800.00	
		Contingency				50.00	50.00	100.00	
		Total Maint. Yr. 1			50.00	10,850.00	1,050.00	11,900.00	
		Maint Yr 2			30.00	6,480.00	400.00	6,880.00	
		Contingency				20.00	100.00	120.00	
		Total Maint. Yr. 2			30.00	6,500.00	500.00	7,000.00	
		Grand Total			271.00	58,700.00	25,400.00	84,100.00	

6.4.2 Estimate of Bamboo underplanting

Estimate of Bamboo underplanting									
Category	Sl. No.	Item	Quantity	Unit	Type	Output per manday	Required Mandays	Rate	Amount (Rs.)
Advance	1	Preparation of nursery beds			Labour		6	216.00	1,296.00
Advance	2	Collection of bamboo offsets and planting in mother beds			Labour		8	216.00	1,728.00
Advance	3	Cost of of bamboo offsets			Material			LS	2,800.00
Advance	4	Shifting of culms to other beds			Labour		10	216.00	2,160.00
Advance	5	Making of sheds for beds (cost of covering with thatch)			Labour		2	216.00	432.00
Advance	6	Material for making temporary sheds			Material			LS	600.00
Advance	7	Weeding / cleaning of beds			Labour		8	216.00	1,728.00
Advance	8	Watering of beds			Labour		9	216.00	1,944.00
Advance	9	Manuring / application of organic pesticide / fungicides			Labour		4	216.00	864.00
Advance	10	Cost of Manure / organic pesticide / fungicides			Material			LS	1,000.00
Advance	11	Cost of implements like measuring tape, ropes, axe, lime powder, sickle etc.			Material			LS	600.00
Advance	12	Labour for Power fencing (with existing energizer) of Nursery			Labour		2	216.00	432.00
Advance	13	Materials for Power fencing of Nursery			Material			LS	1,500.00
Creation	14	Survey and demarcation of area including alignment of lines			Labour		4	216.00	864.00
Creation	15	Cleaning and control burning of the area			Labour		12	216.00	2,592.00
Creation	16	Collection of bamboo seedling from nursery			Labour		10	216.00	2,160.00
Creation	17	Transportation of bamboo seedling from nursery			Material			LS	2,000.00
Creation	18	Digging of pits, manuring and planting bamboo seedlings			Labour		25	216.00	5,400.00
Creation	19	Gap filling and three times weed cleaning and mulching			Labour		50	216.00	10,800.00
Creation	20	Watching the plantation against grazing and applying fertiliser			Labour		16	216.00	3,456.00

Creation	21	Energised fence			Material			LS	20,000.00
Creation	22	Removal of woody weeds and climbers and energised fencing			Labour		30	216.00	6,480.00
Maint Yr 1	23	Cleaning of weeds two times and gap filling			Labour		40	216.00	8,640.00
Maint Yr 1	24	Watching the plantation against grazing and other damage			Labour		10	216.00	2,160.00
Maint Yr 1	25	Supply of misc. items			Material			LS	1,000.00
Maint Yr 2	26	Cleaning of weeds two times and gap filling			Labour		20	216.00	4,320.00
Maint Yr 2	27	Watching the plantation against and other damage			Labour		10	216.00	2,160.00
Maint Yr 2	28	Supply of misc. items			Material			LS	400.00
Advance	29	Contingencies - Labour						LS	16.00
Advance	30	Contingencies - Material						LS	100.00
Creation	31	Contingencies - Labour						LS	48.00
Creation	32	Contingencies - Material						LS	100.00
Maint Yr 1	33	Contingencies - Labour						LS	50.00
Maint Yr 1	34	Contingencies - Material						LS	50.00
Maint Yr 2	35	Contingencies - Labour						LS	20.00
Maint Yr 2	36	Contingencies - Material						LS	100.00
							276.00		90,000.00

ABSTRACT							
				Labour (No.)	Labour (Amount Rs.)	Material (Amount Rs.)	Total (Rs.)
		Advance		49.00	10,584.00	6,500.00	17,084.00
		Contingency			16.00	100.00	116.00
		Total Advance		49.00	10,600.00	6,600.00	17,200.00
		Creation		147.00	31,752.00	22,000.00	53,752.00
		Contingency			48.00	100.00	148.00
		Total Creation		147.00	31,800.00	22,100.00	53,900.00
		Maint Yr 1		50.00	10,800.00	1,000.00	11,800.00
		Contingency			50.00	50.00	100.00
		Total Maint. Yr. 1		50.00	10,850.00	1,050.00	11,900.00
		Maint Yr 2		30.00	6,480.00	400.00	6,880.00
		Contingency			20.00	100.00	120.00
		Total Maint. Yr. 2		30.00	6,500.00	500.00	7,000.00
		Grand Total		276.00	59,750.00	30,250.00	90,000.00

6.4.3 Estimate of Plantation after removal of Maling bamboo – Creation

Estimate of Plantation after removal of Maling bamboo									
Hills									
Category	Sl. No.	Item	Quantity	Unit	Type	Output per manday	Required Mandays	Rate	Amount (Rs.)
Advance	1	Survey and demarcation of the plantation area including GPS Survey by Technical person	1.00	ha	Labour	0.50	2.00	216.00	432.00
Advance	2	Alignment of planting lines and staking the pit positions	1,600.00	nos	Labour	1,000.00	1.50	216.00	324.00
Advance	3	Advance Soil works by digging planting pits of size (0.40+0.30)/2 x 0.30 x0.30 m3 at 2.5.x 2.5 m spacing (1600 nos)	1,600.00	nos	Labour	80.00	20.00	216.00	4,320.00
Advance	4	Cleaning of the pltn site and making inspection path	1.00	ha	Labour	0.02	50.00	216.00	10,800.00
Creation	5	Preplanting cleaning of plantation area	1.00	ha	Labour	0.10	10.00	216.00	2,160.00
Creation	6	Transplanting of potted seedlings in pits, including filling up of planting pits with dug up pulverized soil, carriage of Root Trainers to planting site and collection and recarriage of Root Trainers to local store site	1,600.00	nos	Labour	80.00	20.00	216.00	4,320.00
Creation	7	Carriage of Seedlings from Central Nursery to Planting site including loading and unloading and return of Stand and Root Trainers to Central Nursery	1,600.00	nos	Material			LS	1,200.00
Creation	8	Vacancy infilling	160.00	nos	Labour	40.00	4.00	216.00	864.00
Creation	9	1st mulching, weeding, cleaning and application of fertilizer	1.00	ha	Labour	0.05	20.00	216.00	4,320.00
Creation	10	2nd mulching, weeding, cleaning and application of fertilizer	1.00	ha	Labour	0.06	16.00	216.00	3,456.00
Creation	11	3rd cleaning, weeding	1.00	ha	Labour	0.07	14.00	216.00	3,024.00
Creation	12	Carriage of fertiliser, insecticide etc.	LS		Material			LS	250.00
Creation	13	Cost of fertilizer, insecticides etc.	LS		Material			LS	1,200.00

Creation	14	Watch & Ward (1 md per 10 ha) for 6 months	LS		Labour		18.00	216.00	3,888.00
Advance	15	Contingencies - Labour	LS		Labour			LS	124.00
Advance	16	Contingencies - Material	LS		Material			LS	100.00
Creation	17	Contingencies - Labour	LS		Labour			LS	118.00
Creation	18	Contingencies - Material	LS		Material			LS	100.00
		Total							41,000.00
							175.50		

ABSTRACT							
				Labour (No.)	Labour (Amount Rs.)	Material (Amount Rs.)	Total (Rs.)
		Advance		73.50	15,876.00	0.00	15,876.00
		Contingency		0.00	124.00	100.00	224.00
		Total Advance		73.50	16,000.00	100.00	16,100.00
		Creation		102.00	22,032.00	2,650.00	24,682.00
		Contingency		0.00	118.00	100.00	218.00
		Total Creation		102.00	22,150.00	2,750.00	24,900.00
		Grand Total		175.50	38,150.00	2,850.00	41,000.00

6.4.4 Estimate of Plantation after removal of Maling bamboo - 1st Year Maintenance (for Hill area)

Estimate of Plantation after removal of Maling bamboo 1st Year Maintenance (for Hill area)									
Category	Sl. No.	Item	Quantity	Unit	Type	Output per manday	Required Mandays	Rate	Amount (Rs.)
Maint. Y1	1	Vacancy infilling	160.00	nos	Labour	80.00	2.00	216.00	432.00
Maint. Y1	2	1st weeding, cleaning, mulching, with application of fertilizer	1.00	ha	Labour	0.04	25.00	216.00	5,400.00
Maint. Y1	3	2nd weeding, cleaning	1.00	ha	Labour	0.06	16.00	216.00	3,456.00
Maint. Y1	4	3rd weeding, cleaning	1.00	ha	Labour	0.07	14.00	216.00	3,024.00
Maint. Y1	5	Cost of fertilizer and insecticide etc. including carriage	LS		Material			LS	600
Maint. Y1	6	Watch & Ward for 12 months	1	Ha	Labour		20	216	4320.00
Maint. Y1	7	Contingency-Labour							68.00
Maint. Y1	8	Contingency-Material							100.00
		Total							17,400.00
							77.00		
ABSTRACT									
				Labour (No.)	Labour (Amount Rs.)	Material (Amount Rs.)	Total (Rs.)		
		Maint. Y1		77.00	16,632.00	600.00	17,232.00		
		Contingency			68.00	100.00	168.00		
					16,700.00	700.00	17,400.00		

6.4.5 Estimate of Plantation after removal of Maling bamboo - 2nd Year Maintenance (for Hill area)

Estimate of Plantation after removal of Maling bamboo 2nd Year Maintenance (for Hill area)									
Category	Sl. No.	Item	Quantity	Unit	Type	Output per manday	Required Mandays	Rate	Amount (Rs.)
Maint. Y2	1	Vacancy infilling	160.00	nos	Labour	80.00	2.00	216.00	432.00
Maint. Y2	2	1st weeding, cleaning, mulching, with application of fertilizer	1.00	ha	Labour	0.05	20.00	216.00	4,320.00
Maint. Y2	3	2nd weeding, cleaning	1.00	ha	Labour	0.07	14.00	216.00	3,024.00
Maint. Y2	4	Cost of fertilizer and insecticide etc. including carriage	LS		Material			LS	600
Maint. Y2	5	Watch & Ward for 12 months	1	Ha	Labour		20	216	4320.00
Maint. Y2	6	Contingency-Labour							54.00
Maint. Y2	7	Contingency-Material							50.00
		Total							12,800.00
							56.00		
ABSTRACT									
				Labour (No.)	Labour (Amount Rs.)	Material (Amount Rs.)	Total (Rs.)		
		Maint. Y2		56.00	12,096.00	600.00	12,696.00		
		Contingency			54.00	50.00	104.00		
					12,150.00	650.00	12,800.00		

6.4.6 Estimate of Plantation after removal of Maling bamboo - 3rd Year Maintenance (for Hill area)

Estimate of Plantation after removal of Maling bamboo 3rd Year Maintenance (for Hill area)									
Category	Sl. No.	Item	Quantity	Unit	Type	Output per manday	Required Mandays	Rate	Amount (Rs.)
Maint. Y3	1	1st weeding, cleaning	1.00	ha	Labour	0.05	20.00	216.00	4,320.00
Maint. Y3	2	2nd weeding, cleaning	1.00	ha	Labour	0.07	14.00	216.00	3,024.00
Maint. Y3	3	Contingency-Labour							6.00
Maint. Y3	4	Contingency-Material							50.00
		Total							7,400.00
							34.00		
<u>ABSTRACT</u>									
				Labour (No.)	Labour (Amount Rs.)	Material (Amount Rs.)	Total (Rs.)		
		Maint. Y3		34.00	7,344.00		7,344.00		
		Contingency			6.00	50.00	56.00		
					7,350.00	50.00	7,400.00		

6.5 Estimate for production of Quality Planting Material

6.5.1 Estimate for production of Quality Planting Material – One Season

Estimate Preparation QPM									
One Season									
150 cc Root Trainers				1 Root Trainer		2,000 Root Trainers		10,000 Root Trainers	
					(cc)		(m3)		(m3)
		Requirement of Compost			50.00		0.10		0.50
		Requirement of Coarse Sand			50.00		0.10		0.50
		Requirement of Burnt Rice husk			50.00		0.10		0.50
For 10,000 Seedlings									
Category	Sl.No.	Item	Quantity	Unit	Type	Output per manday	Required Mandays	Rate	Amount (Rs.)
Creation	1	Supply of Compost	0.50	m3	Material			LS	1,500.00
Creation	2	Preparation of potting mixture (Mixing through hand driven Mixture Machine)	1.50	m3	Labour	0.75	2.00	216.00	432.00
Creation	3	Supply of Coarse Sand including collection and carriage	0.50	m3	Material			LS	300.00
Creation	4	Drying and Seiving Sand	0.50		Labour	1.00	0.50	216.00	108.00
Creation	5	Supply of Burnt Rice Husk including collection and carriage	0.50	m3	Material			LS	300.00
Creation	6	Drying and seiving Burnt Rice husk	0.50	m3	Labour	2.00	0.25	216.00	54.00
Creation	7	Filling of Root Trainers and keeping filled Root Trainers on Stands	10,000.00	no.	Labour	800.00	12.50	216.00	2,700.00
Creation	8	Collection of Quality Seeds including collection and carriage	LS		Material			LS	500.00
Creation	9	Drying, Sorting and Pretreatment of Seeds and Sowing in Hygropits	5.00	kg	Labour	5.00	1.00	216.00	216.00
Creation	10	Pricking out and transplanting of seedlings in Root Trainers	10,000.00	no.	Labour	500.00	20.00	216.00	4,320.00

Creation	11	Supply of insecticides	LS		Material			LS	500.00
Creation	12	Watering for 90 days (January to March) including Watering in Hydropits and Spraying of insecticides	10,000.00	no.	Labour	20,000.00	45.00	216.00	9,720.00
Creation	13	Sorting and Weeding-2 times	20,000.00	no.	Labour	10,000.00	4.00	216.00	864.00
Maint	14	Watering for 120 days (April to July) including Spraying of insecticides	10,000.00	no.	Labour	15,000.00	80.00	216.00	17,280.00
Maint	15	Sorting and Weeding-2 times	20,000.00	no.	Labour	10,000.00	4.00	216.00	864.00
		Contingencies - Advance						LS	100.00
Creation	16	Contingencies - Creation	LS					LS	286.00
Maint	17	Contingencies - Maintenance	LS					LS	56.00
		Total							40,100.00

ABSTRACT

		Labour (No.)	Labour (Rs.)	Material (Rs.)	Total (Rs.)
Advance		0.00	0.00	0.00	0.00
Contingency		0.00	0.00	0.00	0.00
Total Advance		0.00	0.00	0.00	0.00
Creation		85.25	18,414.00	3,100.00	21,514.00
Contingency		0.00		286.00	286.00
Total Creation		85.25	18,414.00	3,386.00	21,800.00
Maintenance		84.00	18,144.00		18,144.00
Contingency		0.00	56.00		56.00
Total Creation		84.00	18,200.00	0.00	18,200.00
Grand Total		169.25	36,614.00	3,386.00	40,000.00

Cost per Seedling Advance	0.00
Cost per Seedling Creation	2.18
Cost per Seedling Maintenance	1.82
Total	4.00

6.5.2 Estimate for production of Quality Planting Material – Two Seasons

Estimate Preparation QPM									
Two Seasons									
300 cc Root Trainers				1 Root Trainer	2,000 Root Trainers	10,000 Root Trainers			
				(cc)		(m3)	(m3)		
		Requirement of Compost		100		0.2	1		
		Requirement of Coarse Sand		100		0.2	1		
		Requirement of Burnt Rice husk		100		0.2	1		
For 10,000 Seedlings									
Category	Sl.No.	Item	Quantity	Unit	Type	Output per manday	Required Mandays	Rate	Amount (Rs.)
Advance	1	Supply of Compost	1.00	m3	Material			LS	3,000.00
Creation	2	Preparation of potting mixture (Mixing through hand driven Mixture Machine)	1.00		Labour	0.75	4.00	216.00	864.00
Creation	3	Supply of Coarse Sand including collection and carriage	1.00		Material			LS	600.00
Creation	4	Drying and Seiving Sand	1.00	m3	Labour	1.00	1.00	216.00	216.00
Creation	5	Supply of Burnt Rice Husk including collection and carriage	1.00	m3	Material			LS	600.00
Creation	6	Drying and seiving Burnt Rice husk	1.00	m3	Labour	2.00	0.50	216.00	108.00
Creation	7	Filling of Root Trainers and keeping filled Root Trainers on Stands	10,000.00	no.	Labour	500.00	20.00	216.00	4,320.00
Creation	8	Collection of Quality Seeds including collection and carriage	LS		Material			LS	2,500.00
Creation	9	Drying, Sorting and Pretreatment of Seeds, Sowing in Hygropits and Dibbling in Root Trainers	20.00	kg	Labour	5.00	4.00	216.00	864.00
Creation	10	Pricking out and transplanting of seedlings in Root Trainers	10,000.00	no.	Labour	500.00	20.00	216.00	4,320.00
Creation	11	Supply of insecticides	LS		Material			LS	500.00
Creation	12	Watering for 30 days (June) including Watering in Hygropits and Spraying of insecticides	10,000.00	no.	Labour	10,000.00	30.00	216.00	6,480.00
Creation	13	Watering for 90 days (July to September) including Watering in Hygropits and Spraying of insecticides	10,000.00	no.	Labour	30,000.00	30.00	216.00	6,480.00

Creation	14	Watering for 90 days (October to December) including Watering in Hygropits and Spraying of insecticides	10,000.00	no.	Labour	20,000.00	45.00	216.00	9,720.00
Creation	15	Watering for 90 days (January to March) including Watering in Hygropits and Spraying of insecticides	10,000.00	no.	Labour	20,000.00	45.00	216.00	9,720.00
Maint	16	Watering for 105 days (April to Mid July) including Watering in Hygropits and Spraying of insecticides	10,000.00	no.	Labour	15,000.00	70.00	216.00	15,120.00
Maint	17	Sorting and Weeding-2 times	20,000.00	no.	Labour	10,000.00	4.00	216.00	864.00
Creation	18	Contingencies - Creation	LS					LS	208.00
Maint	19	Contingencies - Maintenance	LS					LS	16.00
		Total							66,500.00

ABSTRACT					
		Labour (No.)	Labour (Rs.)	Material (Rs.)	Total (Rs.)
Advance		0.00	0.00	3,000.00	3,000.00
Contingency		0.00	0.00	0.00	0.00
Total Advance		0.00	0.00	3,000.00	3,000.00
Creation		199.50	43,092.00	4,200.00	47,292.00
Contingency		0.00		208.00	208.00
Total Creation		199.50	43,092.00	4,408.00	47,500.00
Maintenance		74.00	15,984.00	0.00	15,984.00
Contingency		0.00	16.00	0.00	16.00
Total Creation		74.00	16,000.00	0.00	16,000.00
Grand Total		273.50	59,092.00	7,408.00	66,500.00

Cost per Seedling Advance	0.30
Cost per Seedling Creation	4.75
Cost per Seedling Maintenance	1.60
Total	6.65

