West Bengal Forest Department
Government of West Bengal
India

INDIA

THE PREPARATORY SURVEY ON WEST BENGAL INTEGRATED FORESTRY DEVELOPMENT AND BIODIVERSITY CONSERVATION PROJECT

FINAL REPORT

SEPTEMBER 2011

JAPAN INTERNATIONAL COOPERATION AGENCY

ORIENTAL CONSULTANTS CO., LTD.

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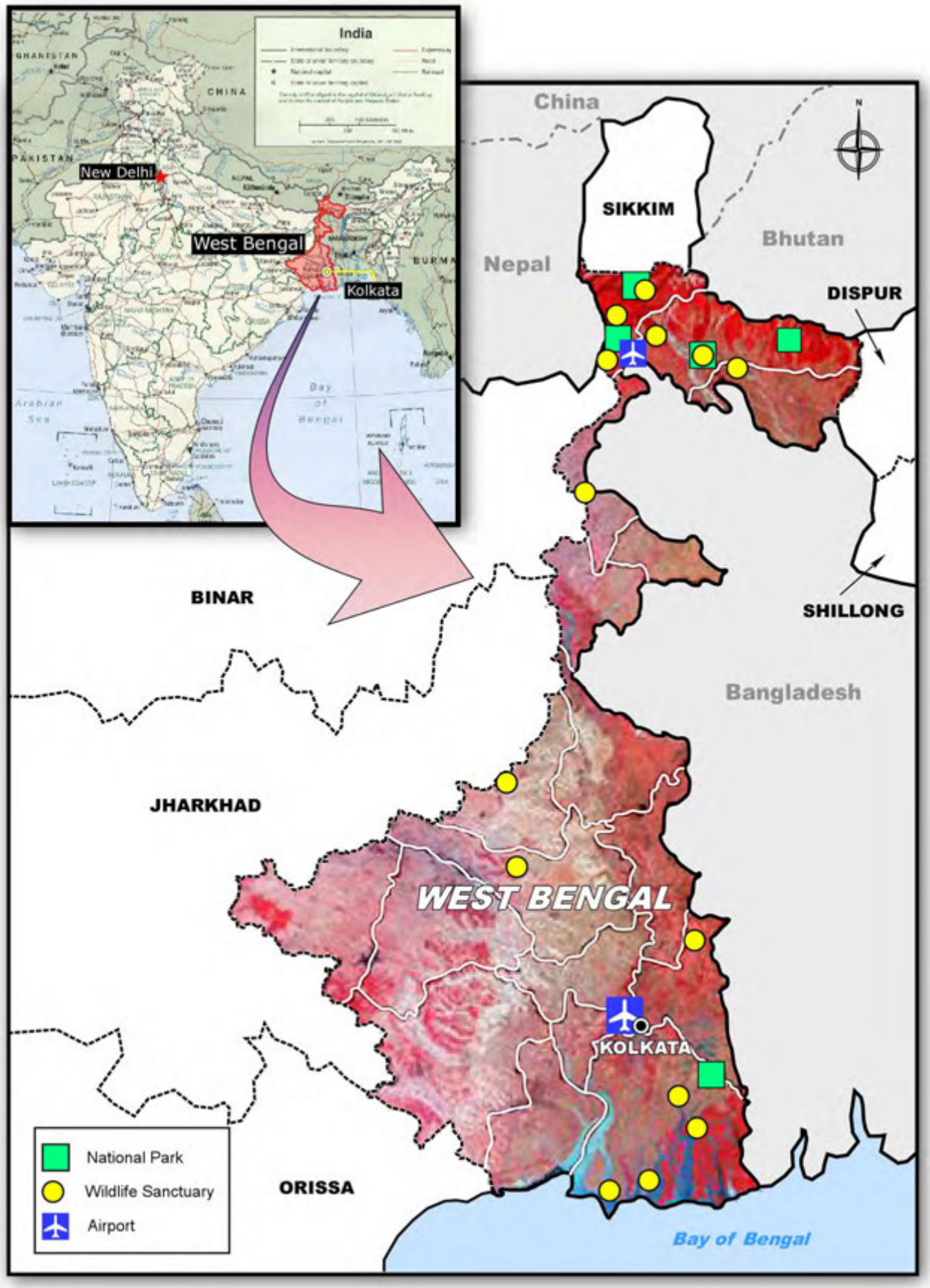
Foreign Currency Exchange Rates Applied in the Survey

Currency	Exchange Rate
Rupee (INR)	INR 1 = USD 45.00
Japanese Yen (JPY)	USD 1 = JPY 83.40
JPY / INR	INR 1 = JPY 1.850

(Monthly Average Rate as of May, 2011)



Map of Survey Area

Abbreviations

APCCF	Additional Principal Chief Conservator of Forests
BDO	Block Development Officer
BPL	Below Poverty Line
BTR	Buxa Tiger Reserve
CBD	Convention on Biological Diversity
CBO	Community Based Organization
CCF	Chief Conservator of Forests
CITES	Convention on International Trade in Endangered Species
COR	Compounding Offence Report
CZA	Central Zoo Authority
DFO	Divisional Forest Officer
DFU	District Facilitation Unit
DLC	District Level Committee
DPR	Detailed Project report
EDC	Eco Development Committee
ER	Elephant Reserve
FAO	Food and Agriculture Organization
FPC	Forest Protection Committee
FSI	Forest Survey of India
FYP	Five Year Plan
GHG	Green House Gas
GIS	Geographic Information System
GOWB	Government of West Bengal
GPS	Global Positioning System
ICFRE	Indian Council of Forestry Research & Education
ICT	Information and Communication Technology
IDA	International Development Association
IFS	Indian Forest Service
IUCN	International Union for Conservation of Nature
JFM	Joint Forest Management
JFMC	Joint Forest Management Committee
JICA	Japan International Cooperation Agency
MDTW	Medium Duty Tube Well
MFP	Minor Forest Produce
MIS	Management Information System
MOEF	Ministry of Environment and Forests
MSC	Multiple Shoot Cutting
NABARD	National Bank for Agriculture and Rural Development
NAP	National Afforestation Program
NFAP	National Forestry Action Program
NGO	Non Government Organization
NP	National Park
NRSA	National Remote Sensing Agency
NTCA	National Tiger Conservation Authority
NTFP	Non Timber Forest Produce

NWFP	Non Wood Forest Products
PA	Protected Area
PCCF	Principal Chief Conservator of Forests
PDA	Personal Digital Assistant
PMU	Project Management Unit
POF	Plantations Outside Forest
POR	Prosecution Offence report
PRA	Participatory Rural Appraisal
PTO	Project Tiger Office
RDF	Rehabilitation of Degraded Forest
REDD	Reducing Emissions from Deforestation and Forest Degradation
RRSC	Regional Remote Sensing Centre
RS	Remote Sensing
SC	Scheduled Cast
SDO	Subdivisional Officer
SDP	State Domestic Product
SFR	India State Forest Report
SHG	Self Help Group
ST	Scheduled Tribe
STR	Sunderban Tiger Reserve
STW	Shallow Tube Well
TPOF	Tree Planting Outside Forest
UNDP	United Nations Development Program
WB	World Bank
WBFD	West Bengal Forest Department
WBFDC	West Bengal Forest Development Corporation Ltd.
WBPRD	West Bengal Panchayat & Rural Development Department
WBREDA	West Bengal Renewable Energy Development Agency
WLI	Wildlife Institute of India
WLS	Wildlife Sanctuary
WRIDD	Water Resources Investigation & Development Department
WSP	Weighted Survival Percentage
ZSI	Zoological Survey of India

Preparatory Survey

On

the West Bengal Integrated Forestry Development and Biodiversity Conservation Project

Draft Final Report

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Chapter 1 Introduction

1.1. Background

The Japan International Cooperation Agency (hereinafter referred to as "JICA") and West Bengal Forest Department, Government of West Bengal (hereinafter referred to as "WBFD") have made several preliminary discussions in order to identify priority projects in the field of forest sector and agreed to-make preparation for West Bengal Integrated Forestry Development And Biodiversity Conservation Project (hereinafter referred to as "The Project") since Government of India had approached the Government of Japan formally in November, 2010 to enlist the project in the Rolling Plan of Japanese ODA loan. Accordingly, JICA dispatched a mission on the Project (hereinafter referred to as the "JICA Mission") to Kolkata, India from 20th to 22nd February, 2011 in order to develop scope and implementing arrangements of a further survey which will review the currently available data including "Detailed Project Report" (DPR) prepared by WBFD and conduct supplementary study to facilitate formation of the Project (hereinafter referred to as the "Preparatory Survey").

Conduct of the Preparatory Survey is subject to the approval by the competent higher authorities of both sides. It should be noted that implementation of the Preparatory Survey does not imply any decision or commitment by JICA to extend its loan, technical cooperation, and grant assistance for the project at this stage.

1.2. Objective of the Survey

The main objective of the Preparatory Survey is to formulate the Project which has already been listed to the Rolling Plan of the Japanese ODA Loan Projects, and officially requested from the Government of India to the Government of Japan dated November 4th, 2010 as a normal track of the FY2010 Japanese ODA Loan. Although the Detailed Project Report (DPR) for the Project has already been prepared by the West Bengal Forest Department, further detailed examination of the DPR such as the basis of the cost estimate and components are required.

1.3. Scope of the Survey and Survey area

1.3.1 Scope of the Survey

The Preparatory Survey will be implemented based on "the Minutes of Meetings on the Mission for the Preparatory Survey on West Bengal Integrated Forestry Development and Biodiversity Conservation Project in the State of West Bengal, India" agreed between the West Bengal Forest Department and the JICA, on 22 February, 2011.

The Preparatory Survey shall cover the following items:

TOR1: Confirm Necessity and Background of the Project

1-1: Issues and Prospects of West Bengal State
- 1-1-1: Review of existing plans, strategies. policies, and acts regarding Forest Sector, Biodiversity Conservation, Poverty Reduction Strategy etc in West Bengal
- 1-1-2: Confirm the situation and challenges of biodiversity conservation in West Bengal
- 1-1-3: Confirm the situation of social forestry and demand and supply of wood
- 1-1-4: Confirm the situation of poverty and livelihood of local people
- 1-1-5: Confirm the management situation of West Bengal Forest Department such as budget, staff, and monitoring method
- 1-1-6: Review of lessons from past projects including World Bank assistance through field survey

1-2: Confirm challenge and necessity of the Project

TOR2: Review of the Project Details

2-1: Confirm the Project scope through field survey
- 2-1-1: Confirm the target area of the Project
- 2-1-2: Confirm the Scope of afforestation in recorded forest area
- 2-1-3: Confirm .the Scope of tree planting outside the recorded forest area
- 2-1-4: Confirm the Scope of socio economic development
- 2-1-5: Confirm the Scope of wildlife management and habitat improvement
- 2-1-6: Confirm the Scope of facilities for forest management and biodiversity conservation
- 2-1-7: Confirm the Scope of survey, training, and research

2-2: Estimation of the Total Project Cost and Eligible JICA Financing Portion (including Annual Fund Requirement, Budget Appropriation)

2-3: Confirm the Implementation Schedule of the Project

2-4: Propose the Procurement and implementation Method

TOR3: Propose the Project Management Structure

3-1: Propose Implementation Structure of the Project

3-2: Propose Appropriate Operation and Maintenance Structure after the Project Completion

TOR4: Confirm social and environmental consideration

4-1: Review of screening form and Draft environmental check list

4-2: Confirm the considerations for Poverty, Gender, Scheduled Tribe etc

4-3: Propose environmental monitoring form

TOR5: Propose coordination with other stakeholders

5-1: Propose Partnership/collaboration with Local Line Departments and Institutions and NGOs etc

TOR6: Examination of the Project Effectiveness

6-1: Propose Operation and Effective Indicators for the Project (Base Year Indicators, Target Year Indicators, Data Availability, Contribution to the Climate Change)

6-2: Review of the Quantitative and Qualitative Impact of the Project and propose indicators

6-3: Calculation of the Economic Internal Rate of Return

1.3.2. Schedule of the Preparatory Survey

Table 1-1 Survey Schedule

Year	2011			
Month	May	Jun	Jul	Aug
Work in Japan	□			□
Work in India	■■■■■■■■■■■■■■■■			
Report	△ ICR		△ DFR	△ FR

ICR: Inception Report, DFR: Draft Final Report, FR: Final Report

1.3.3. Survey Area

The survey area primarily covered three regions namely South-West Bengal, Plains and foothills of North Bengal and the Sunderbans proposed in DPR.

1.4. Counterpart Agency

The WBFD is a counterpart agency to the Survey team and also as a coordinating body with other organisations concerned for the smooth implementation of the Survey.

WBFD shall, at its own expense, provide the Survey team with the following items in cooperation with other organisations concerned:

(1) Security-related information as well as measures to ensure the safety of the survey team;
(2) Information as well as support in obtaining medical service;
(3) Data and information related to the Preparatory Survey;
(4) Counterpart personnel;
(5) Suitable office space with necessary equipment and secretarial services;
(6) Credentials or identification cards;
(7) Entry permits necessary for the survey team members to conduct field surveys;
(8) Support in making transportation arrangements;
(9) Support in obtaining other privileges and benefits if necessary;
(10) Assist the team in custom clearance, exempt from any duties with respect to equipment, instruments, tools and other articles to be brought into and out of India in connection with the implementation of the survey; and

(11) WBFD shall bear claims, if any arises, against the members of the survey team resulting from, occurring in the course of, or otherwise connected with the discharge of their duties in implementation of the Preparatory Survey, except when such claim arise from gross negligence or willful misconduct on the part of the member of the survey team.

Chapter 2 Present Condition of the State of West Bengal

2.1. Location and Physiography

Situated within 21°38' – 27°19' (North) latitudes and 85°50' – 89°50' (East) longitudes the State stretches from the Himalayas in the North down to the Bay of Bengal in the South. Four States (Sikkim, Assam, Bihar and Orissa) and three countries (Bhutan, Nepal and Bangladesh) surround the State – Sikkim on the North, Bhutan on the North-East, Assam and Bangladesh on the East, Nepal and Bihar on the West and Orissa on the South-west. With direct access to the sea and a network of national and international air links, the State's geographic location makes it the gateway to North-East India and adjoining countries. A system of roadways and railways radiate out of and into the State to connect it with all the major centres of activity in the country. The hub of industrial concentration of eastern India, West Bengal also commands an extensive agricultural and industrial hinterland, reaching far beyond its frontiers. The total geographic area of the State is 88752 sq. km. i.e. 2.7% of the total geographic area of India.

The physiography of West Bengal can be divided into two major regions:

a) Himalyan Region

b) Gangetic Plains

2.1.1. Himalyan Region

This is sub-divided further into two parts 1) Darjeeling Himalyas and 2) Sub-Himalyan

2.1.1.1. Darjeeling Himalyas

This zone consists of Darjeeling district (except the Siliguri Sub-Division). The hills are comparatively of recent origin, generally steep sided and prone to land slides. Soils are brown, loamy in nature, rich in nutrients, organically rich and acidic in reaction. Since most of the rivers originate here, these areas are flood prone.

2.1.1.2. Sub-Himalyan

This zone comprises of the plains districts of Jalpaiguri and Cooch Behar and Siliguri Sub-Division of Darjeeling district. Soils are mostly sandy, highly acidic, heavily leached and poor in base and plant nutrients.

2.1.2. Gangetic Plains

The Indo-Gangetic Plains consists of the Lower Ganga Plain in West Bengal. 14 districts of West Bengal are contained in this physiographic region. This region is further divided into four micro physiographic zones. These are:

Gangetic plains forms a part of Indo-Gangetic plains and this region has 14 districts of West Bengal. The region is further subdivided into four micro-physiographic zones. These are:

- Barind tract comprising of Coochbehar, Malda, Uttar Dinajpur and Dakhsin Dinajpur
- Moribund Delta comprising of Nadia and Murshidabad districts
- Proper delta consisting of the districts of Bardhaman, Kolkata, Hoogly, Haora, South and North 24-Parganas
- Rarh having a spread over East and West Medinipur districts, Bankura, Birbhum and Purulia

2.2. State Administration

The State Administration is headed by the Governor and the Council of Ministers is headed by the Chief Minister who is the chief functionary of the State. He is supported by his Cabinet Ministers and Ministers of State in running the administration. An officer of the rank of Secretary/Principal Secretary/ Additional Chief Secretary heads a department. The Chief Secretary of the State supervises the administration of all the Government Departments. Most of the Departments have one or more Directorates to carry out the policies and work plans.

West Bengal is now divided into nineteen districts under three divisions. Districts are administered by District Magistrates, and divisions are administered by Divisional Commissioners. Kolkata, the capital of the state, constitutes the Kolkata district. Other districts are further divided into administrative units such as subdivisions and blocks, administered by SDO and BDO, respectively. The Panchayati Raj has a three-tier structure in the state. The atomic unit is called a Gram Panchayat, which is the Panchayat organisation for a collection of villages. The block-level organisations are called Panchayat Samiti, and the district-level organisations are named Zilla Parishad.

The figure below illustrates the administrative structure and also shows the levels of the Forest Department both in the general Administrative Structure and the structure of Panchayati Raj institutions.

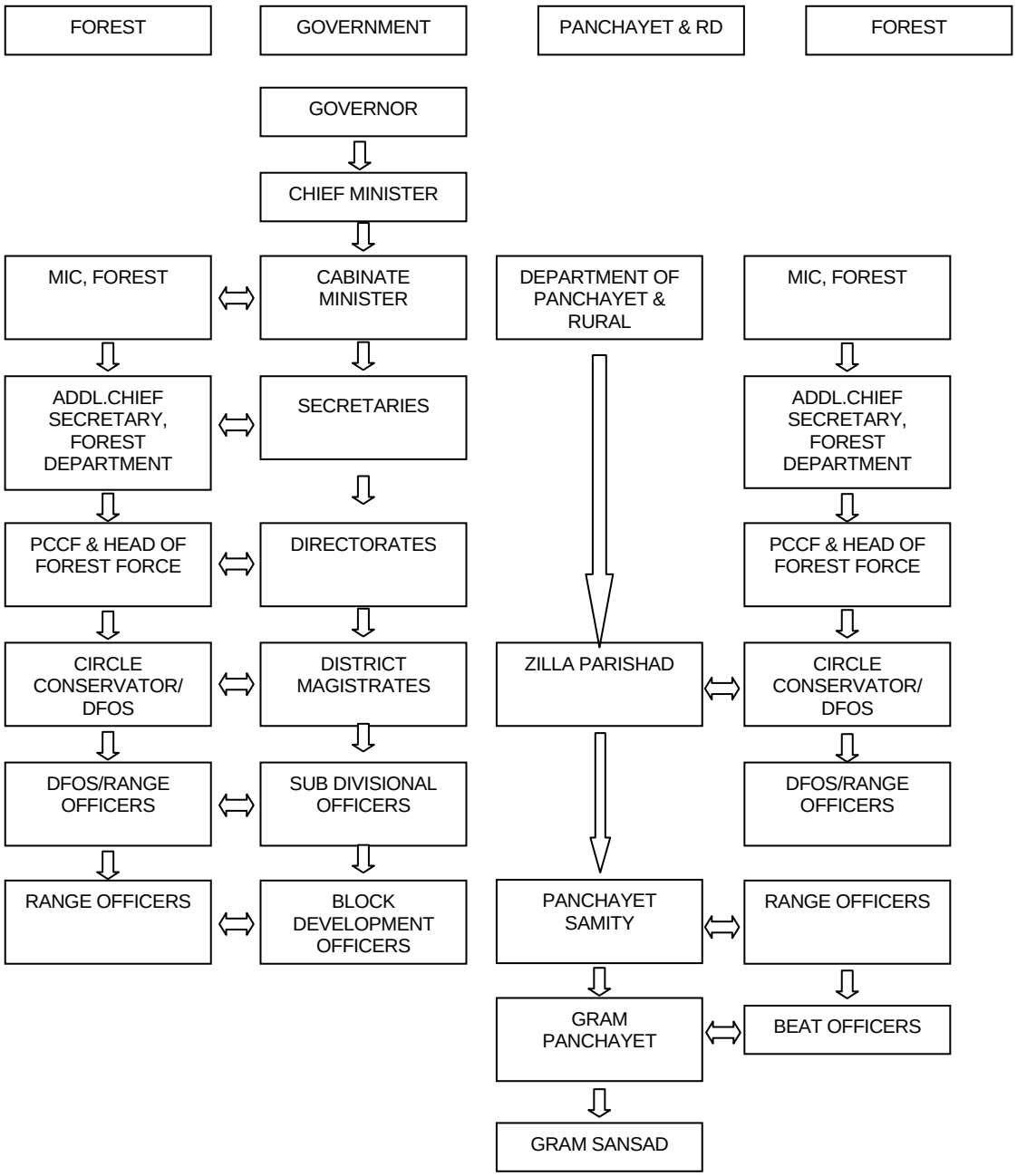


Figure 2-1 Administrative Structure

2.3. Socio-Economic Condition

2.3.1. Demography

West Bengal is the fourth most populous state in India, and ranks first in terms of population density. West Bengal is predominantly an agriculture driven state, however, there has been a rich tradition of industrial set-ups since the start of the industrial age in India. The state is actively engaging investments in industrial sectors to ensure resurgence in of a glorified past as a leader in industrialisation in India. The people of the state are

generally identified by a strong sense of culture and cognisance. West Bengal has earned the distinction of being one of the "food basket" states of India.

Decennial census is the principle source of demographic data in India as well as in the State. The demographic scenario of the State must have undergone several major changes during this decade that could be measured only after the census results for 2011 are declared. Features of the demographic are mentioned below

- The estimated population of West Bengal as on 1st October, 2009 was 8.78 crore .It is expected to have reached 8.87 crore on 1st October, 2010.
- Population density being 903 per sq. km. in 2001. This was 767 per sq. km in 1991.
- In 1981-1991, the decennial growth of population was 24.73 per cent which got reduced to 17.77 per cent in 1991-2001. This was even below the national level decennial growth of 21.56 per cent, according to Census 2001
- Percentage of urban population in West Bengal was 27.97.
- Proportion of scheduled caste population in the State was 23.02 per cent and that of scheduled tribe was 5.50 per cent.
- Percentage of male and female population was 51.72 and 48.28 respectively in 2001

Sex Ratio (no. of females per 1000 males) of the State stood at 934 in 2001 as against 933 at national level. It has also been observed from census results that Sex Ratio in West Bengal had been steadily increasing during last five decades after Independence whereas at national level it registered a decreasing trend during this period.

Literacy rate in West Bengal was 68.64 per cent in 2001 as against 64.82 per cent at national level. 77.02 per cent of male residents and 59.61 per cent of female residents of the State were literate according to Census 2001. The literacy rate was 59.04 per cent among scheduled castes and 43.40 per cent among scheduled tribes in West Bengal.

The number of main workers in West Bengal was 230.24 lakh. The number of marginal workers was 64.58 lakh whereas this figure for non-workers stood at 506.95 lakh in 2001

When the political boundaries in South Asia were redrawn in the middle of 19th century, many refugees surrounding India moved especially to West Bengal till 1971 where has fertile to produce more aliment for a large number of people, it is caused essential background to keep the high density. According to Census 1991, the growth rate of population is moderate and maintain the population, so that the density ratio is still now higher than average in India. Besides the urbanisation has been promoted in West Bengal, the immigration of scheduled cast which would like to leave tight situation of the backward class in the rural area, has been increased and moved from rural area to urban area. The Table below describes decadal growth rate, sex ratio and density of population.

Table 2-1 Population, Decadal Growth Rate, Sex Ratio and Density

India and State/ Union territory*/District	Population 2001			Decadal growth rate		Sex ratio		Density	
	Persons	Males	Females	1981-1991	1991-2001	1991	2001	1991	2001
West Bengal	**80,221,171**	**41,487,694**	**38,733,477**	**24.73**	**17.84**	**917**	**934**	**767**	**904**
Darjeeling	1,605,900	826,334	779,566	26.91	23.54	914	943	413	510
Jalpaiguri	3,403,204	1,753,278	1,649,926	26.44	21.52	927	941	450	547
Koch Bihar	2,478,280	1,271,715	1,206,565	22.55	14.15	935	949	641	732
Uttar Dinajpur	2,441,824	1,260,747	1,181,077	34.00	28.72	921	937	604	778
Dakshin Dinajpur	1,502,647	770,443	732,204	24.39	22.11	944	950	555	677
Maldah	3,290,160	1,689,409	1,600,751	29.78	24.77	938	948	706	881
Murshidabad	5,863,717	3,004,385	2,859,332	28.20	23.70	943	952	890	1,101
Birbhum	3,012,546	1,545,765	1,466,781	21.94	17.88	946	949	562	663
Barddhaman	6,919,698	3,602,675	3,317,023	25.13	14.36	899	921	861	985
Nadia	4,603,756	2,365,054	2,238,702	29.95	19.51	936	947	981	1,172
North 24- Parganas	8,930,295	4,635,262	4,295,033	31.69	22.64	907	927	1,779	2,181
Hugli	5,040,047	2,588,322	2,451,725	22.43	15.72	917	947	1,383	1,601
Bankura	3,191,822	1,634,561	1,557,261	18.12	13.79	951	953	408	464
Puruliya	2,535,233	1,298,079	1,237,154	20.00	13.96	947	953	355	405
Medinipur	9,638,473	4,929,000	4,709,473	23.57	15.68	944	955	592	685
Haora	4,274,010	2,242,395	2,031,615	25.71	14.60	881	906	2,542	2,913
Kolkata	4,580,544	2,506,029	2,074,515	6.61	4.11	799	828	23,783	24,760
South 24-Parganas	6,909,015	3,564,241	3,344,774	30.24	20.89	929	938	574	694

Source: Census India, 2001

Table 2-2 Literacy Rate in West Bengal by District

District	Literacy Rate					
	Persons		Males		females	
	1991	2001	1991	2001	1991	2001
West Bengal	57.7	68.64	67.81	77.02	46.56	59.61
Cooch Behar	45.78	66.3	57.35	75.93	33.31	56.12
Jalpaiguri	45.09	62.85	56	72.83	33.2	52.21
Darjeeling	57.95	71.79	67.07	80.05	47.84	62.94
Uttar Dinajpur	34.58	47.89	45.24	58.48	22.85	36.51
Dakshin Dinajpur	46.4	63.59	56.75	72.43	35.33	54.28
Malda	35.62	50.28	45.61	58.8	24.92	41.25
Murshidabad	38.28	54.35	46.42	60.91	29.57	47.63
Nadia	52.53	66.14	60.05	72.31	44.42	59.58
24 Parganas(N)	66.81	78.07	74.72	83.92	57.99	71.72
24 parganas(S)	55.1	69.45	68.45	79.19	40.57	59.01
Kolkata	77.61	80.86	81.94	83.79	72.09	77.3
Howrah	67.62	77.61	76.11	83.22	57.83	70.11
Hooghly	66.78	75.11	75.77	82.59	56.9	67.21
Purba Midnapore	74	80.2	85.7	89.1	61.5	70.7
Paschim Midnapore	65.4	70.4	77.5	81.3	52.5	59.1
Bankura	52.04	63.44	66.75	76.76	36.55	49.43
Purulia	43.29	55.57	62.17	73.72	23.24	66.5
Burdwan	61.88	70.18	71.12	78.63	51.46	60.95
Birbhum	48.56	61.48	59.26	70.89	37.17	51.55

Source: Census India, 2001

Table 2-3 Data on scheduled caste and scheduled tribe population

Name of State / District	Scheduled Caste Population-2001			Scheduled Tribe Population-2001		
	Person	Male	Female	Person	Male	Female
INDIA	166635700	86088760	80546940	84326240	42640829	41685411
WEST BENGAL	18452555	9469659	8982896	4406794	2223924	2182870
Darjiling	258881	132858	126023	204167	102287	101880
Jalpaiguri	1248577	642828	605749	641688	324250	317438
Koch Bihar	1242374	636446	605928	14246	7425	6821
Uttar Dinajpur	676582	348693	327889	124865	63123	61742
Dakshin Dinajpur	432660	222063	210597	242317	122442	119875
Maldah	554165	284726	269439	227047	113537	113510
Murshidabad	703786	360734	343052	75953	38518	37435
Birbhum	889894	456719	433175	203127	101831	101296
Barddhaman	1860754	954951	905803	441832	221773	220059
Nadia	1365985	700622	665363	113891	57475	56416
North 24 Parganas	1840397	949294	891103	198936	101488	97448
Hugli	1188881	601232	587649	212062	105453	106609
Bankura	997408	506868	490540	330783	166732	164051
Puruliya	463956	237724	226232	463452	235097	228355
Medinipur	1576337	801964	774373	798684	403962	394722
Haora	658707	335761	322946	19168	9959	9209
Kolkata	274835	150866	123969	9810	5471	4339
South 24 Parganas	2218376	1145310	1073066	84766	43101	41665

This clearly reflects that there is concentration of tribes in the forested districts of West Bengal.

2.3.2. Employment Situation in West Bengal

From late 2007, the entire world including the developed countries was suffering from serious employment crisis as an impact of economic recession. Millions of people working in manufacturing and service sectors were losing their jobs. Furthermore, the process of recovery was slow as the contemporary pattern of growth of world economy had been virtually a jobless growth and the growth of GDP did not necessarily imply an equivalent growth of employment. This was a period of severe job loss in our country also. According to a survey conducted by the Labor Bureau of India the estimated job loss during October 2008 to January 2009 due to economic slowdown in India was 5.89 lakhs in sectors like mining, textiles, metals, automobiles, gems & jewelers, transport, construction and information technology. As an effect of recession, the average wage received by the workers has also registered a declining trend.

In this perspective the employment scenario in West Bengal needs to be judged. The target of the economic policy followed by the State Government was to create more and more scope of employment to ensure an employment intensive pattern of growth. The Agriculture and Allied Sector provides employment for 62.7 percent of rural usual workers in West Bengal and there was a consistent effort from the State Government to consolidate

the growth in agriculture as well as to increase agricultural employment by ensuring multiple cropping. The cropping intensity sharply increased to 184 percent in 2008- 09. It is indeed understandable that the pressure on agricultural land is increasing day-by-day and in the present era an urgent need to accommodate the surplus rural labor to other sectors emerged. The State Government has taken serious initiatives for industrialisation, and for last few years considerable advancement has taken place in large-scale industrial sector. It is true that most of these modern industries are capital and technology intensive and therefore the scope of direct employment is limited, but these industries have the potential for creating downstream and ancillary units in small and medium sectors too. There are immense potential for expansion of large & medium size Food Processing Industries in West Bengal due to its diversified agro climate and huge production of fruits & vegetables. The State Government has intensified special efforts to establish more and more agro based Industries that would invigorate agriculture sector and increase employment in trade and transport sectors as well. Investments in Iron & Steel Industries and Chemical Industries registered a considerable growth during recent years and generated a large scope of direct and indirect employment. On the other hand there has been a spectacular growth in Software Technology Services in West Bengal in recent period that provides a large potential of employment generation.

Already, as revealed from NSS, West Bengal has the largest number of small manufacturing units in the country and the number of persons employed therein is also larger than any other State The dynamism in the basic sectors like agriculture and industry stimulates the growth in service sectors also and scope of employment increases. To utilise such scope of employment generation in small-scale industrial sector and service sector, the State Government has intensified self-employment projects. The growth of self-help groups in this State is also extremely encouraging; most of these groups are formed by women. The State Government, through three tier panchayats, has taken comprehensive initiatives in strengthening these groups.

Employment-unemployment statistics published by the National Sample Survey Organisation is the most widely used data in this field. Comparing the last two large sample survey on employment and unemployment conducted by NSSO in their 55th (1999-00) and 61st (2004-05) round the pattern of movement of employment can be deciphered. The compound annual rate of growth of employment and labor force are shown in the table below

Table 2-4 Sector wise Average Compound Annual Growth Rate of Employment (PS+SS) between 2000 and 2005

Sector	Rural	Urban	Total
Primary Sector	3.01	3.35	3.03
Secondary Sector	1.76	4.17	2.77
Tertiary Sector	6.07	3.22	4.44
Total	3.33	3.55	3.34

Source: Based on NSS Report

It is clear that per capita income in Kolkata district located capital of state and the surrounding district with more urban area and population is substantially highest than other District in West Bengal State, and Northern Area of West Bengal such as Darjeeling, Jalpaiguri which has more enterprise tea garden with job opportunity to local people located high position of per capita income, south west and south east area such as remote districts are low position of per capita income. This phenomenon indicates that the accessibility has more influence of income than other factor and poverty also appear such kind of area.

Table 2-5 Per Capita Income by District of West Bengal

District	Monthly per capita income (INR)	Ranking
Darjeeling	1,544.10	2
Jalpaiguri	1,395.76	4
Koch Behar	1,154.61	13
Uttar Dinajpur	931.91	18
Dakshin Dinajpur	1229.93	12
Malda	1,231.43	10
Murshidabad	1,116.03	15
Birbhum	1,065.98	17
Bardhaman	1,461.50	3
Nadia	1,350.96	6
North 24 Parganas	1,230.69	11
Hugli	1,356.64	5
Bankura	1,311.80	7
Purulia	1,087.06	16
Medinipur	1,293.83	9
Haora	1,299.29	8
Kolkata	2,774.96	1
South 24 Parganas	1,135.85	14

Source: West Bengal Human Development Report 2004, the table was elaborated using the data from Chaudhuri et al (2003) SAE study using Central Sample data of NSS 55th Round 1999-2000.

2.3.3. Poverty

Defining poverty requires a way of distinguishing the poor from the non-poor. The usual method is to classify an individual as poor, if he or she does not meet a set of consumption norms. The poverty lines used are generally based on the cost of a fixed bundle of goods deemed necessary for subsistence mostly on nutritional grounds.

In the state of West Bengal BPL Survey was done by WBPRD in the year 2005. This depicts that there are 13393530 numbers of total households out of which 4569262 households have been bracketed in BPL.

Table 2-6 People Living Below Poverty Line

Name of the District	No. of Families	No. of BPL Families (Total Score<=33)	Percentage of BPL Families (%)	No. of Houseless Families	No. of Families living in Kuchha House	No. of Families migrating for Casual Labors	No of marginal Farmers	No of Small Farmers	No of Agricultural Labor	No. of Women Headed Families
Coochbehar	597,817	309,736	51.81	36,418	319,334	137,692	206,569	49,154	353,878	21,453
Jalpaiguri	673,090	239,236	35.54	49,364	254,048	59,922	137,525	40,572	340,724	24,403
Darjeeling	234,590	57,243	24.40	16,754	60,169	26,951	57,616	13,614	92,817	9,670
Uttar Dinajpur	490,360	196,303	40.03	20,079	254,600	71,214	131,821	48,265	256,847	10,335
Dakshin Dinajpur	364,948	115,625	31.68	17,137	17,743	43,241	112,720	42,887	178,651	6,905
Malda	662,235	259,401	39.17	29,087	254,070	114,197	178,102	57,310	353,425	17,281
Murshidabad	1,157,135	461,192	39.86	40,833	483,181	234,154	253,734	90,048	631,867	32,084
Nadia	862,478	321,064	37.23	33,462	360,420	142,604	184,838	55,406	465,362	19,496
North 24 Parganas	1,048,420	307,026	29.28	41,650	464,916	150,168	297,415	62,563	537,794	25,046
South 24 Parganas	1,237,969	422,726	34.15	46,962	625,931	258,236	399,478	77,259	625,222	50,233
Howrah	530,499	79,000	14.89	15,083	110,089	53,906	119,862	18,931	202,013	10,097
Hooghly	816,925	177,703	21.75	32,342	245,066	108,762	222,898	65,351	340,762	24,196
Purba Medinipur	847,579	270,996	31.97	29,968	444,065	184,376	452,205	56,518	399,830	82,312
Paschim Medinipur	1,004,065	365,339	36.39	44,580	531,052	20,088	510,160	124,153	423,447	35,680
Purulia	501,789	164,838	32.85	17,396	218,704	69,027	220,486	87,246	205,882	8,284
Bankura	597,569	172,492	28.87	19,038	275,620	85,051	215,136	85,332	252,676	14,272
Birbhum	653,926	276,809	42.33	35,265	375,103	151,741	158,479	72,268	356,864	23,486
Burdwan	1,112,136	372,533	33.50	52,325	430,918	184,363	227,934	105,030	562,279	26,465
Total :	13,393,530	4,569,262	34.12	577,743	5,725,029	2,095,693	4,086,978	1,151,907	6,580,340	441,698
		Poverty Ratio of West Bengal*	27.02%							
		Poverty Ratio in Urban Area of West Bengal*	31.85%							
		Poverty in India*	26.10%							

Source) BPL Survey done by WBPRD in the year 2005 and Migration of casual labors, Rural Household Survey: Summary Report
* Year 2001 data, West Bengal Human Development Report 2004

Table 2-7 Highlights of the forested districts having concentration of BPL families

District	Number of families	No. of BPL Families (Total Score<=33)
Jalpaiguri	673090	239236
Darjeeling	234590	57243
Paschim Medinipur	1004065	365339
Purulia	501789	164838
Bankura	597569	172492
South 24-Parganas	1237969	422726

According to Study on Impact of Joint Forest Management on the Livelihood of the people in south west Bengal carried out by on 2004 at Purulia, West Midnapore and Bankura Districts, the FPC members collected forest product such as firewood, sal leaves, sabai grass, due to the improvement in FPC forest condition, and average total annual income per household in FPCs (including from share of the final harvest, employment, collection, and use and sale of NTFPs) comes to INR 5,090 corresponded with 11.19% of the total average household income. For the poorest the proportion is much higher: 32%. The more poverty rely on more benefit from forests and reduce the consumption expenditure from forests, in other words they earn a living from the non forest product and depend on the forest resource.

Table 2-8 Percentage and Income from forest of different wealth ranks in FPC villages

	Rich	Medium Rich	Poor	Landless Poor
Sal Leaf (%)	53.13	33.94	32.87	31.33
Fuel wood (%)	8.18	19.23	24.62	39.67
Sabai (%)	26.64	33.40	30.28	15.58
Timber share (%)	4.13	3.37	3.11	2.16
Employment (%)	7.27	10.04	9.10	11.23
Annual Income from forest per household	1,169	6,116	5,727	5,441
Proportion of total family income, from forests	0.88%	14.90%	26.82%	32.10%

The above study targeted 10 FPCs, and the below tables show the profile of FPCs, including Household and FPC members, Accessibility.

Table 2-9 Household, FPC members and Accessibility of Target FPCs

District	FPC Name	No. Household	No. FPC Member	Accessibility (km)			
				Block Headquarters	Primary School	Primary Health Centre	Market/ Township
Purlia	Chakedabad	29	29	4	In the village	45	4
	Dandahit	184	86	NA	In the village	In the village	NA
	Dudhpania	18	18	3	0.5	3	3
Bankura	Raotara	233	227	4	In the village	4	4
	Taldangra	128	98	0.5	0.5	0.5	0.2
	Katula	93	93	3	NA	16	16
West Midnapore	Gohalbera	80	80	10	In the village	NA	NA
	Keisa	56	54	1.5	5	5	5
	Siala	110	110	1	1	5	5
	Keundi-Jamboni	816	416	8	In the village	NA	5
Purulia	Saharjuri*	110	110	5	In the village	In the village	15

Note: NA: Not available to get the information.
* Not establish FPC.
Source: Study on Impact of Joint Forest Management on the Livelihood of the people in south west Bengal carried out by on 2004

Most of the house holds are primary cultivators occupied 64 % of all households and depend on the land and forest for their livelihood. The landless-poor households subsist on wage labor and on the natural resource available near the village, it draw that the feature show in Agricultural Labor and NTFP collection in the below table.

Table 2-10 Occupation of households

Occupation / FPC Name	Primary Occupation				Secondary Occupation							
	Own Agriculture	Profession/ Business	Agricultural Labor	NTFP collection	NTFP Collection	Non Agri Lab. (Non FPC)	Agricultural Labor	Animal Husbandry	Profession/ Business	Forestry	Shar Agriculture	FPC Labor
Chakedabad	100					33				78		
Dandahit	100						20	15	46		19	
Dudhpania	100				80				20			
Raotara	91	9			46	34	20					
Taldangra	47	53				40	60					
Katula	59		41		70			30				
Gohalbera	92		18		56	25		10				
Keisa	88		12			75		15	10			
Siala	86			14				46	20		34	
Keundi-Jamboni	76	24					56			1		44
Average (%)	64.00	6.56	5.42	1.07	19.22	15.79	11.90	8.85	7.32	6.03	4.04	3.36

Note: Average was calculated based on total number of households (1311) in 10 FPCs and 1 village
Source: Study on Impact of Joint Forest Management on the Livelihood of the people in south west Bengal carried out by on 2004

2.3.4. Economy

The state domestic product (SDP) at constant (1999-00) prices for the agriculture sector was Rs. 40862.44 crore in 2007-08 and this declined by 1.9 per cent and stood at Rs. 40085.53 crore in 2008-09. But during 2009-10 it was expected to revive and move up by 4.29 per cent. The state domestic product from agriculture sector of this state was forecast to rise to become Rs.41806.09 crore in 2009-10. In this year forestry and fishery sectors were likely to grow by 7.89 per cent and 5.36 per cent respectively.

The foundation of the rural economy has been laid upon this balanced growth of agriculture and has created conducive environment for its industrial development. During 2009, the number of new industrial project proposals was 206 involving an investment of around Rs. 44390 crore. 121 industrial projects have been implemented in the State during 2009 where amount of investment catalyzed to the tune of Rs.7050.48 crore. These new projects comprise the expansion of big units like MCCPTA, Haldia Petro Chemicals Ltd., IOC Haldia Refinery and the like. Additional employment generated in the big mother units may not be of significant extent but the downstream units are expected to generate substantial employment opportunities in future.

2.4. Natural Condition

West Bengal is a biologically diverse state – the landmass hosting four bio-geographic zones, Central Himalayas, Chhotonagpur Plains of Deccan Peninsula, Lower Gangetic plains and the Eastern Coast. It has six agro-climatic zones and also hosts the unique Sunderbans. Naturally the floristic and faunal diversity is high and connected with there are certain unique livelihood practices that have flourished in the State. According to Champion and Seth's classification 10 major forest types occur in the State. The bulk of forest areas represent three major types Northern Tropical Dry Deciduous Forests(4527 sq km), Littoral Swamp Forests(4263 sq.km) and North Indian Moist Deciduous forests(1757 sq km.)

The State is drained by three major basins namely the Ganges, the Brahmaputra and the Subarnarekha. These three rivers drain 46.30%, 39.17% and 2.74% of the total quantum of surface water.

2.4.1. Climate

The State of West Bengal generally experiences Tropical Monsoon type of climate. Climatic features, however, vary in different regions. Under the new system of climatic classification 5 zones have been recognised. These are:

(1) Humid on the northern mountain slope and Humid coastal area
(2) Super humid Terai and the southern Mountain slope,

(3) Semi-humid north and south,
(4) Sub-humid east and west
(5) Humid coastal area

This new system is based on mean annual rainfall; mean annual range of temperature, evapo-transpiration and mean annual humidity.

Rainfall and air temperatures (maximum and minimum) in different agro-climatic zones during three well defined periods namely pre-monsoon, monsoon and post-monsoon are reflected in the table below:

Table 2-11 Rainfall and Air temperature in different agroclimate zones

Sl No.	Agro-climatic zone/section		Rainfall (mm)	Air temperature	
				Max	Min
1	Northern Hill Zone	March to May	398.5	17.0	10.5
		June to Oct.	2637.5	19.5	14.3
		Nov. to Feb.	68.5	12.0	4.8
2	Terai Teesta Alluvial zone	March to May	376.6	32.3	20.5
		June to Oct.	2134.0	31.3	24.5
		Nov. to Feb.	42.6	26.0	12.8
3	Gangetic Alluvial Zone	March to May	233.8	35.0	23.4
		June to Oct.	1206.0	32.2	25.6
		Nov. to Feb.	67.8	27.4	15.6
4	Vindhyan Alluvial Zone	March to May	137.23	35.3	23.2
		June to Oct.	1206.12	32.0	25.2
		Nov. to Feb.	66.68	27.0	15.1
5	Coastal Saline Zone	March to May	195.0	34.0	24.8
		June to Oct.	1475.2	32.0	26.0
		Nov. to Feb.	82.2	28.2	16.0

The average monthly precipitation in the Districts of West Bengal is shown in the below table.

Table 2-12 Average Monthly Precipitation in the Districts of West Bengal (mm)

Districts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Darjeeling	18.7	24.5	36.6	109.7	237.9	585.0	805.0	588.9	493.5	148.3	22.5	14	3084.6
Jalpaiguri	14.5	23.1	33.6	124.6	361.1	692.1	928.0	616.0	528.8	155.7	19.2	11.6	3508.3
toCoochbehar	9.8	15.0	28.3	123.8	321.0	580.3	792.9	535.8	488.7	127.1	11.0	7.9	3041.6
Uttar-Dinajpur	10.9	10.8	16.6	59.8	183.8	346.5	515.6	408.4	364.3	106.0	10.9	8.3	2041.9
Dakshin Dinajpur	10.4	7.1	13.8	59.4	192.6	288.9	400.1	312.8	347.6	103.9	9.9	8.6	1755.1
Malda	10.9	10.8	11.0	39.1	117.5	229.4	353.1	302.4	296.6	91.8	12.3	10.3	1485.2
Murshidabad	8.8	20.0	22.2	46.2	110.9	236.5	309.3	258.2	236.9	102.1	17.1	9.9	1378.1
Nadia	8.5	28.8	31.7	59.9	138.5	245.9	308.5	269.8	228.7	88.4	18.6	16.6	1443.9
Birbhum	9.7	23.2	23.3	40.7	88.7	234.2	324.5	295.7	258.2	105.4	17.5	9.4	1430.5
Bankura	10.9	25.8	28.6	41.4	90.0	241.4	299.8	296.3	235.4	82.3	18.9	15.1	1385.9
Purulia	12.1	20.0	22.2	30.6	59.0	252.9	298.5	290.9	233.8	70.0	19.3	12.6	1321.9
Burdwan	9.0	24.4	28.3	47.8	108.9	229.3	289.2	279.4	221.3	82.6	15.7	12.4	1348.3
Hooghly	11.3	31.5	33.6	61.6	117.6	248.3	313.9	300.0	236.0	94.2	19.1	9.1	1476.2
Purba Medinipur	11.3	27.8	39.8	47.6	127.6	280.3	315.6	367.1	303.3	132.5	40.7	7.9	1701.5
Paschim Medinipur	13.5	24.7	34.8	60.1	110.3	258.5	319.6	334.5	263.5	92.6	18.5	7.9	1538.5
Howrah	12.3	28.5	34.0	54.7	109.5	249.8	315.6	338.2	263.3	93.2	24.5	11.3	1534.9
Kolkata	15.3	19.5	29.5	49.2	102.3	269.7	329.2	321.3	295.0	142.8	17.1	7.2	1598.1
Uttar 24 - Parganas	8.6	36.4	40.9	65.3	144.3	287.8	333.7	303.6	265.8	95.3	28.1	13.9	1623.7
Dakshin 24- Parganas	10.8	24.4	31.2	52.8	122.7	309.7	386.9	409.3	340.2	135.0	42.4	10.9	1876.3

Note: All values are recorded in June 2006.
Source: Weather and climate of West Bengal (accessed on August 24, 2011)
http://www.wbgov.com/BanglarMukh/Download?FilePath=/alfresco/d/d/workspace/SpacesStore/1111a108-a276-4849-9719-38629b02144f/Chap-Wcw_17.PDF

2.4.2. Geology

Unconsolidated sedimentary deposits of the Quaternary period cover 73,858 sq km of the total area of the state. The rest of the area is covered by hard rocks ranging in age from the Precambrian to the Tertiary periods, which are decidedly older than the sedimentary formations.

The terrain formed of hard rocks can be broadly divided into two distinct regions.

(i) Extra peninsular mountain-terrain of the Darjeeling Himalayas in the north, and
(ii) Peninsular tract comprising a rolling topography in the south west covering parts of Puruliya, Bankura, Paschim Medinipur, Birbhum and Bardhaman districts

The Pre-Cambrians are represented by the Darjeeling Gneiss, Lingtse Gneiss and Daling group of rocks in the districts of Darjeeling and Jalpaiguri. Apart from the Precambrian formations, there exist some sedimentary rocks of the Gondwana period and also of Siwalik formations of the late Tertiary period.

The Terai region of the northern part of Jalpaiguri and Darjeeling districts has a belt of alluvial detritus. This Siwalik group of rocks has representation of coarse, hard, sandstone, siltstone, slate and conglomerate. The rocks follow the fringes along the foothills and have a thrust contact with rocks of Gondowana super-group towards the north.

The Pre-Cambrians in the Peninsular West Bengal are mostly exposed in Puruliya district and also along the western margins of Bankura, Paschim Medinipur and Birbhum districts. There are also extensive exposures of Gondwana rock formations in the districts of Barddhaman, Puruliya, Bankura and Birbhum.

The Gondwana rocks show extensive development in the Bardhaman district and extend into adjoining parts of Bankura and Puruliya districts and also occur as small basins in Birbhum district The Rajmahal basic flows and the associated inter-trappeans of Triassic and Cretaceous age are developed only in the district of Birbhum.

Rocks belonging to Tertiaries, represented by pebbly grit, ferruginous sandstone, red shale, rare mottled clays and gravels are reported from several places in the peninsular extension into West Bengal. These beds occur in a number of small plateau-like formations in the districts of Bardhaman, Bankura, Birbhum and Medinipur districts.

The Quaternary terrain of Peninsular West Bengal may be divided into the following geographical domains:

The area extending from Ganga flood plain in the north to Bay of Bengal in the south, and bounded by the Bhagirathi River in the west up to Indo – Bangladesh border in the east, including parts of Murshidabad, Nadia, 24-Parganas districts.

The high plains of Hughli, Bankura, Medinipur, Bardhaman and Birbhum districts adjoining the peninsular mass sloping towards the course of the Bhagirathi-Hughli river system.

The high plains to the east of the Mahananda River in Dinajpur and Malda districts sloping towards the Ganga-Padma river course.

2.4.3. Soil

The features of soils can be best described in terms of climate and vegetation supported by it. On such considerations the soils of West Bengal can be classified into six agro-ecological sub-regions. These are:

- Warm Humid
- Warm to Hot Humid
- Hot Humid
- Hot Moist Sub-Humid
- Moist Sub-Humid
- Hot Dry Sub-Humid.

Table 2-13 Distribution of soils in agro-ecological sub-regions

Sub-regions	Extent in mha	% of the area of the state	Distribution in districts
1. Warm Humid	0.26	2.9	Darjeeling
2. Warm to Hot Humid	0.17	1.9	Jalpaiguri
3. Hot Humid	0.85	9.6	Jalpaiguri, Kochbehar, Uttar and Dakshin Dinajpur
4. Hot Moist Sub-Humid	4.39	55.7	Dakshin Dinajpur, Malda, Murshidabad, Nadia, Howrah, Hoogly, 24-Parganas (North), Barddhaman, Bankura, Birbhum and Purba Medinipur
5. Moist Sub-Humid	0.68	7.6	24-Parganas (S), Purba Medinipur
6. Hot dry Sub Humid	1.98	22.3	Purulia, Bankura, Paschim Medinipur, Birbhum

Warm humid agro-ecological sub region covers the mountainous region of Darjeeling District. Soils of this sub-region are heterogeneous in nature. The soils developed on steep hill slopes are shallow, excessively drained with severe erosion hazard potential. The soils of the foothill slopes and valleys are moderately deep, well drained, and loamy in texture with moderate erosion hazards. Soil acidity, high runoff rate and limiting soil depth (on steep hill slopes) are the most important problems of this region.

Warm to hot humid agro-ecological sub-region comprising of foothills of Bhutan Himalayas constitutes the northern fringe of Jalpaiguri district with Terai soils. The soils are partly developed and are mainly formed of young alluvium on alluvial fans of the foothills. These are shallow to moderately deep and at places deep with medium to fine texture. Mostly tea and horticultural plantation are supported by these soils. Severe flood hazards

coupled with abrupt break in gradient and severe runoff poses serious water management problems.

Hot humid agro-ecological sub-region covers the Teesta Plain (Duars) below the Bhutan Himalayas, the districts of Kochbehar, Jalpaiguri (southern part) and Uttar Dinajpur. The soils of this region have developed from the alluvium deposited by the rivers like the Teesta, Mahananda and Jaldhaka. These are moderately deep to deep, coarse to fine loamy in texture. At places these soils are moderately well drained but mostly they are imperfectly and/or poorly drained. The area is intensively cultivated for rice and jute. The major problems are water logging, severe flood hazards etc.

Hot moist sub-humid agro-ecological sub region comprises of the Ganga Plain (an eastward continuation of Indo Gangetic Plain covering the districts of Maldah, Dakshin Dinajpur Murshidabad, Nadia, Haora, Hugli, 24 Parganas (North), Bardhaman (eastern part), Birbhum, Bankura and Purba Medinipur. The soils have been formed from the alluvium deposited by Ganga and its tributaries and sub tributaries viz. Ajoy, Damodar, Kangsabati, Bhagirathi, Haldi, Rupnarayan etc. These soils are greatly variable in their morphological, physical and chemical properties depending upon the geomorphic situations, moisture regime and degree of profile development. The soils are intensively cultivated for rice, wheat, potato and oilseed crops. Frequent inundation of low lying areas result in stagnation of water for certain times of the year. Besides flood hazards also affect the normal dry land crop yields. The soils of this sub-region have high nutrient content and mineral resource with a high potential for a large variety of agricultural and horticultural crops.

Moist sub-humid agro-ecological sub-region encompasses the coastal parts of the districts of 24 Parganas comprising mostly Sunderban areas of 24 Parganas (South) and coastal Medinipur. The alluvium deposited by Matla, Haldi, Rupnarayan Rivers have gradually developed into deep, fine loamy to fine textured soils, by and large salt impregnated due to tidal flow of sea water through creeks and sub-tributaries. These soils are imperfectly to poorly drained with moderate to very high salinity hazards. The soils remain wet and saline for considerable period of the year and are suitable particularly for salt resistant crops.

Hot dry sub-humid agro-ecological sub-region comprising the outlines of Chhotonagpur Plateau includes the district of Puruliya and western parts of Bardhaman, Bankura, Birbhum and Medinipur. The soils have developed on parent materials of sedentary nature. They vary from shallow to deep reddish to yellowish red, loamy to clayey and are imperfectly to well-drained. Relatively less aggregated red and laterite soils are prone to frequent development of surface encrustation. Poor capacity for retention of rainwater leads to severe runoff and soil loss. Soil infertility and limiting soil depth also pose problems.

2.4.4. Land Use

The total recorded under different categories of land use in West Bengal was 8.687 million ha in 2003-2004. Salient features of land use in the State are:

Predominance of the net sown area stood at 63% of the recorded area. This reflects the intensity of land use when compared to the figure of 46% for the entire country.

The share of fallow land, uncultivable land and pastures in West Bengal is very low. This is only 1% of land under different uses in West Bengal whereas for the entire country the figure is high as 17.6%.

Land use in the state is characterised by its intensiveness. A recent report brought out by the Govt. of West Bengal reflects that the challenge for land use planning lies in achieving concurrently the objective of protecting and consolidating agriculture, diversifying agriculture production, enhancing rural development and moving firmly towards industrialisation and infrastructure.

The table below gives the distribution of land allocated to nine categories:

Table 2-14 Land use data of West Bengal (2003-2004)

District	Total area	Forest area	Area under non-agriculture use	Barren and unculturable land	Permanent pasture & other grazing land	Land under misc. trees and groves	Culturable waste land	Fallow land other than current fallow	Current fallow	Net area sown
Darjeeling	325.74	124.58	33.79	4.93	0.91	1.94	1.38	3.80	11.15	143.00
Jalpaiguri	622.70	179.00	76.44	2.41	0.00	5.07	0.78	0.08	21.46	337.46
Cooch Behar	331.38	4.26	56.66	1.10	0.84	8.97	1.41	0.24	1.26	257.00
Uttar Dinajpur	312.47	0.58	30.55	0.22	0.09	3.23	0.13	0.62	4.47	272.58
Dakhsin Dinajpur	221.91	0.93	25.61	0.21	0.01	0.67	0.02	0.09	1.15	193.22
Malda	371.05	1.68	84.06	0.00	0.00	3.01	0.09	0.30	49.65	232.26
Murshidabad	532.50	0.77	120.60	2.03	0.04	2.00	0.82	0.40	1.82	403.82
Birbhum	451.12	15.85	90.81	o.40	0.30	0.75	2.92	2.61	26.03	311.45
Barddhaman	698.74	22.27	182.62	2.38	0.62	3.01	9.84	3.33	8.04	466.63
Nadia	390.66	1.22	74.71	0.20	0.10	2.64	0.58	0.05	3.94	307.22
24-Pgs(N)	386.52	0.00	117.96	0.00	0.00	8.71	0.00	0.00	2.40	257.45
Hoogly	312.22	0.53	80.54	0.97	0.11	2.30	1.62	0.14	0.84	225.17
Bankura	688.10	147.70	142.18	2.37	0.52	0.88	3.71	1.49	41.12	364.13
Purulia	625.48	75.05	84.75	4.31	0.65	0.82	6.36	3.69	110.71	339.14
Purba Medinipur	396.59	0.90	91.70	1.73	0.07	3.91	0.06	0.15	0.78	297.29
Paschim Medinipur	928.58	169.69	146.07	2.44	0.65	6.46	4.19	3.82	29.98	565.28
Howrah	138.68	0.00	43.77	0.75	0.14	0.74	0.14	1.11	4.92	87.11
24-Pgs(S)	953.37	426.30	125.95	0.59	0.00	2.76	0.45	0.21	13.66	383.45
West Bengal	**8687.54**	**1171.31**	**1608.97**	**27.04**	**5.05**	**57.87**	**34.50**	**22.13**	**333.38**	**5463.67**

2.5. Forestry sector of the State

2.5.1. Forest Area Classification

West Bengal has a recorded forest area 11879 sq. km. and legally this area belongs to three forest types namely Reserved Forests, Protected Forest and Unclassed State forests accounting for 59.38%, 31.75% and 8.87% respectively. Reserved forests are distributed primarily in the districts of 24Parganas (South), Jalpaiguri and Darjeeling whereas

protected forests are concentrated in the districts of Bankura, West Midnapore, Purulia and Burdwan.

According to Champion and Seth's classification, the state has eight forest types. The forest types, region-wise distribution and their extent are furnished in the table:

Table 2-15 Distribution of Forest types in Different Regions

Group	Name	Location	Area in sq. km.
1B	Northern Tropical Wet Evergreen Forests	North Bengal Plains up to 150m	167
2B	Northern Subtropical Semi evergreen Forests	North Bengal Plains from151mto 300m	25
3C	North Indian Moist Deciduous Forest	North Bengal Plains up to 150m	1757
4B	Littoral swamp Forests-Mangroves	Estuarine South Bengal	4263
4D	Littoral and Swamp forests- Tropical seasonal Swamps	Maldah and Dakshin Dinajpur districts	20
5B	Northern Tropical Dry Deciduous Forest	South Western Bengal	4527
8B	Northern Subtropical Broad-leaved Wet Hill Forest	North Bengal Hills from 301m to 1650m	800
11B	Northern Montane Wet Temperate Forest	North Bengal Hills from 1651 to 3000m	150
12C	East Himalayan Moist Temperate Forest	North Bengal Hills	150
14C	Sub-Alpine Forest	North Bengal Hills from 3001m 3700m	20

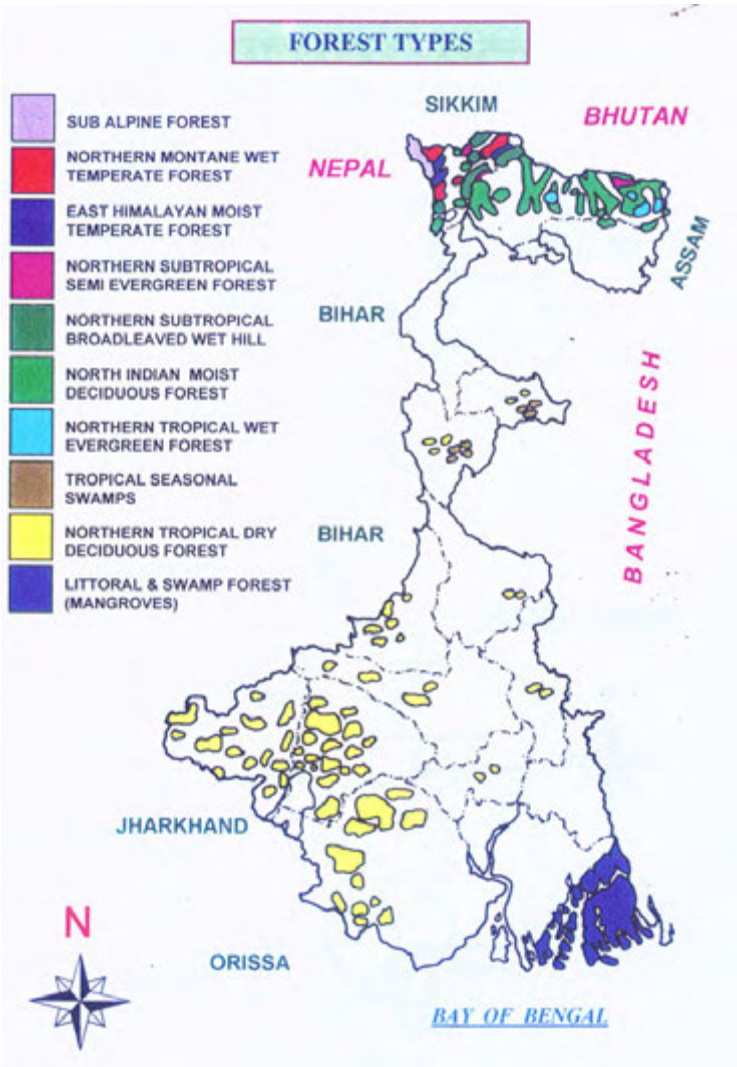


Figure **2-2** The map of forest type

2.5.2. Forest cover

West Bengal is one of the few forest deficient states of India. Forest cover of the State based on the interpretation of satellite data by Forest Survey of India (FSI) is 12994 sq. km. which is 14.64%[1] of the geographical area. In terms of forest canopy density classes, the state has 2987 sq. km of very dense forest, 4644 sq. km. of moderately dense forest and 5363 sq.km of open forest. The forest cover including the forests created outside the recorded forest area is 15.68% [2] of the geographical area as assessed by the GIS Cell of the West Bengal Forest Department in the year 2006 on the basis of Satellite Imagery procured from National Remote Sensing Agency (NRSA).

District wise forest cover in 2007 as assessed by the Forest Survey of India is reproduced in the table below:

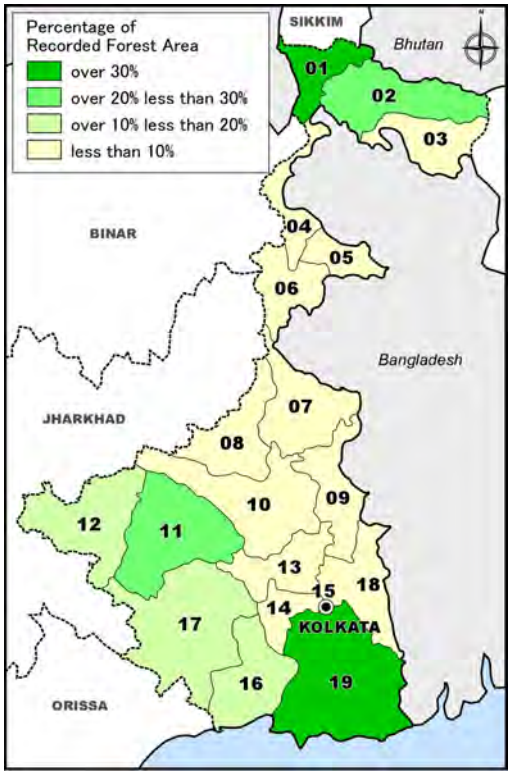


Figure 2-3 Percentage of Recorded Forest Area by District

Table 2-16 Forest cover of different districts

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
District	Geographical Area (km²)	Forest Cover (km²)	Wetland (km²)	Total Forest Cover (km²)	Non-Forest Tree Cover (km²)	Total Tree Cover (km²)	% Forest Cover	% Tree Cover	Very. dense forest	Mod. Dense forest	Open forest	Total	% of GA
				(2)+(3)		(4)+(5)	(4)/(1)	(6)/(1)				9+10+11	(12)/(1)
24 Pgs (S)	9961	2336	1909	4245	722	4967	42.62	49.86	1014	889	501	2404	24.14
24 Pgs (N)	4094	25	10	35	1231	1266	0.85	30.92	20	18	51	89	2.17
W. Midnapore	10375	2204	---	2204	1019	3223	21.24	31.07	n.a.	n.a.	n.a.	n.a.	n.a.
E. Midnapore	3706	13	---	13	825	838	0.35	22.61	n.a.	n.a.	n.a.	n.a.	n.a.
Purulia	6259	1163	---	1163	465	1628	18.58	26.01	43	373	381	797	12.73
Bamlura	6882	2214	---	2214	---	2214	32.17	32.17	214	510	332	1056	15.34
Burdwan	7024	419	---	419	494	913	5.97	13.00	44	135	82	261	3.72
Birbhum	4545	249	---	249	554	803	5.48	17.67	0	42	63	105	2.31
Jalpaiguri	6227	1821	43	1864	1430	3294	29.93	52.90	681	514	1311	2506	40.24
Darjeeling	3149	1407	---	1407	905	2312	44.68	73.42	714	663	912	2289	72.69
Coochbehar	3387	44	---	44	764	808	1.30	23.86	0	15	79	94	2.78
Howrah	1467	0	---	0	618	618	0.00	25.15	0	53	93	146	9.95
Hooghly	3149	3	---	3	789	792	0.10	25.15	0	9	52	61	1.94
N. Dinajpur	3174	18	---	18	473	491	0.57	15.47	n.a.	n.a.	n.a.	n.a.	n.a.
S. Dinajpur	2184	---	---	---	293	293	0.00	13.42	n.a.	n.a.	n.a.	n.a.	n.a.
Malda	3733	20	---	20	855	875	0.54	23.44	0	113	51	164	4.39

[1] India State of Forest Report 2009, FIS: FSI figure is based on interpretation data of Indian Remote Sensing (IRS) P6 LISS-III sensor having a spatial resolution of 23.6m x 23.6m

[2] State Forest Report West Bengal 2009- 2010: Forest cover was estimated by using IRS satellite P6 AWiFS (Advanced Wide Field Sensor) / 2006 for interpretation. This has spatial resolution of 56 m x 56m.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
District	Geographical Area (km^2)	Forest Cover (km^2)	Wetland (km^2)	Total Forest Cover (km^2)	Non-Forest Tree Cover (km^2)	Total Tree Cover (km^2)	% Forest Cover	% Tree Cover	Very. dense forest	Mod. Dense forest	Open forest	Total	% of GA
				(2)+(3)		(4)+(5)	(4)/(1)	(6)/(1)				9+10+11	(12)/(1)
Nadia	3927	13	---	13	1073	1086	0.33	27.56	2	74	53	129	3.28
Murshidabad	5324	8	---	8	852	860	0.15	16.15	0	63	44	107	2.01
Kolkata	185	0	---	0	---	0	---	---	0	0	0	0	0.00
Total	88752	11957	1962	13919	9816	27281	**15.68**	30.74	2987	4644	5363	12994	**14.64**

State Forest Report West Bengal 2009- 2010 and Forest Survey India 2007

The Forest Cover area has increased twice a high over past decade (1999 to 2009) steadily, afforestation activities by JFM approach is one of reasons to increase the forest cover ratio, it can be said that the WBFD has successful result to maintain and increase forest area according to the National Forest Policy. The below table shows the chronological transition of Forest Cover in West Bengal.

Table 2-17 Forest Cover over the past decade

Assessed Year / Type	1999		2001		2003		2005		2009	
	km^2	%	km^2	%	km^2	%	km^2	%	km^2	%
Non-Forest	80292	90.47	77910	87.78	76334	86.01	76271	85.93	75729	85.33
Very Dense Forest	3565	4.02	6346	7.15	2303	2.59	2302	2.59	2987	3.37
Moderately Dense Forest					3742	4.20	3777	4.26	4644	5.23
Open Forest	2672	3.01	4347	4.90	6298	7.10	6334	7.41	5363	6.04
Mangrove	2125	2.39	-	-	-	-	-	-	-	-
Scrub	98	0.11	149	0.17	75	0.10	68	0.08	29	0.03
Total Area (km2)	88752	100	88752	100.00	88752	100.00	88752	100.00	88752	100.00
Forest Cover Area km2)	6237	7.03	10693	12.05	12343	13.91	12413	13.39	12994	14.64

Source: State of Forest Report 1999, 2001, 2003, 2005, and 2009 by Forest Survey of India

Although the Forest Cover Ratio has been increased, the Tree Cover Ratio during 2001 to 2003 has been decrease, and then the ratio has been recovered. The highland which has tea garden plant has more high percentage of tree cover through shade tree. The chorological transaction of tree cover shows below table comparing with forest cover.

Table 2-18 Tree Cover and Forest Cover in West Bengal

Assessed Year / Cover Type	2001		2003		2005		2009	
	km2	%	km2	%	km2	%	km2	%
Tree Cover	3264	3.68	1731	1.95	2458	2.56	2458	2.77
Forest Cover	10693	12.05	12343	13.91	2269	13.99	12994	14.64
Total	13957	15.73	14074	15.86	14682	16.55	15452	17.41

2.5.3. Forest Management System

2.5.3.1. Northern part of West Bengal

Forests of the State are confined to three distinct regions and they are characterised by different agro-climatic parameters resulting in substantial variations in floristic composition. Therefore management practices in these regions evolved along distinctive lines.

With the initiation of forest conservancy in 1864, systematic management of forests could not start because of paucity of staff having appropriate technical knowledge. Best trees were sold on permit system on the basis of a girth limit and these resulted in depletion of the growing stock. First rudimentary working plan was made in 1869 covering the hill forests on the west of the Tista River. This provided for annual clear felling of 40.0 ha and planting of the same on a rotation of 100years. Dr. Schlich's working plan which was in force from 1874-75 prescribed selection felling of sal on a rotation of 40 years and the exploitable girth was fixed at 1.8m. His working scheme for the period 1880-90 prescribed selection felling above 2400m and partial clear fellings below. In 1889-90, the Working Plan division was created and Mr. Mansion took up writing of the Plan for Darjeeling Division. Apart from selection and improvement fellings simple coppice system and coppice with standards system were introduced in some parts of North Bengal. However the system did not prove suitable for high forests and thus had to be abandoned. Mansion's working plan for Darjeeling hills for the period 1892-1902 solved the problem to a great extent by prescribing regeneration in Periodic Block I by taking out half and the remainder to be removed after a definite period on establishment of regenerated seedlings. Experiments on artificial regeneration were started from 1910 and this led to the evolution of the Taungya model. Working Plans for the hills and plains drawn up my Mr. Mansion and Mr. Shebbare were landmarks in the history of forest management of North Bengal.

Forests of these tracts are managed by the provisions of Working Plans prepared for each division. Wildlife areas include in protected area network (sanctuaries, national parks, tiger reserves are managed by wildlife plans approved by the Chief Wildlife Warden. Such Working Plans and Wildlife Management Plans are prepared inconformity of the guidelines of the Ministry of Environment and Forests. No high forest can be converted in terms of the provisions of the National Forest Policy. There are on this date 4 nos of approved Working Plans for Darjeeling, Kalimpong, Kurseong and Jalpaiguri divisions. Draft working Plans of Baikunthapur, Buxa Tiger Reserve (Buffer areas) await approval of the Regional CCF. Sal and miscellaneous plantations are being worked on a rotation of 50 years. Silvicultural thinnings are carried out at 15^{th} and 35^{th} Year.

Protected areas in the districts of Darjeeling and Jalpaiguri are managed as per prescriptions of the Tiger Conservation Plan or Wildlife Management Plans. Buxa Tiger Reserve (Buxa NP & Buxa WLS) has a Tiger Conservation Plan. Gorumara NP and Jaldapara WLS have operative management plans. For other protected areas like Neora Valley NP, Singhalila NP, Mahananda WLS, Senchal WLS and Chapramari WLS such plans are under revision.

2.5.3.2. South-western part of West Bengal

The Junglemahals of south-western part of West Bengal were subjected to the British rule through the East India Company by about 1800. To add to the increasing demands of revenues the zaminders and tenure holders were under compulsion to collect such revenues through clearing the forests and bringing them under the plough. The deforestation proceeded at such a pace that ills of practices were in evidence by the end of the 19th Century. The opening of the Bengal Nagpur Railway with the concurrent rise in price of forest produce added to the tempo of sal forest felling as such forests could be regenerated by coppicing. Zamindars of most parts of Bankura, Birbhum and Midnapore and particularly Purulia held forests under a loose and undefined form of tenure known as the Ghatwali tenure- originally granted in lieu of watch and ward duties of Ghats. Forests of this tract were cut on rotations of 5 to 14 years. For big parties the rotation was longer and for the needy small holders the rotation was smaller. With the enactment of the WB Estates Acquisition Act, 1953, all such forests vested in the state and possession of such forests were taken over by the Forest department by 1956. After take-over fellings were continued under coppice-with-standards system on a rotation of 10 years and arbitrarily increase to 15 years.

Forests of this tract are also being managed through Working Plan prepared under the guidelines issued by the Ministry of Environment and Forests and approved by competent authorities. As on this date 13 Working Plans are active and these cover forest areas of Bankura, Purulia, Midnapore, Burdwan and Birbhum districts. Eucalyptus and miscellaneous plantations are harvested at the age of 12 years. Plantations of Eucalyptus clones have been proposed to be worked on 8 year coppice rotation. Sal forest is managed under the system of coppice with standards and the coppice rotation varies between 10 to 15 years. Mulitple shoot cutting and thinning of coppice shoots are carried out in 3rd. year and 5th year.

2.5.3.3. Sunderbans

Till the middle of the 18th Century, the whole of the Sunderbans up to the vicinity of Kolkata was in a wild and uncultivated state. With the object of reclaiming it, leases were granted by the Collector General. This was done with the idea that extensive forests covering this region could perhaps be converted into revenue yielding tracts. By about 1828, through the introduction of Regulation III, the board asserted the claim of the State on these forests except where proved otherwise. Dr. Brandis in 1862 prepared a memorandum explaining the desirability of conserving forests of Bengal and acting on this report the Govt. stopped granting fresh forest areas for reclamation.

The forests of Sunderbans were worked during 1930-1950 under working plan prepared by Mr. Curtis. Forests were worked under a felling cycle of 40 years but for some species were worked on a rotation of 20 years primarily for production of fuel wood. Exploitable diameter was fixed for some species capable of producing poles and small timber. This Working Plan was in the course a few years was abandoned and Chaudhuri's Working

Scheme put the forests under one working circle and thinning–cum selection system was prescribed on a felling cycle of 20 years. The yield was fixed by area. This scheme worked satisfactorily.

The forests thereafter were worked under the working plan which expired in 2007. The 2nd Preliminary Working Plan Report has been prepared and on approval of this, the next Working Plan for management of forests outside the protected area network will be taken up.

Sunderban NP and Sajnekhali WLS are parts of Sunderbans Tiger Reserve and these are managed by the provisions the Tiger Conservation Plan. Wildlife management plans for Halliday WLS and Lothian Island WLS are under revision.

2.5.4. Impact of Forest Rights Act

"The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006", is a key piece of forest legislation passed in India on December 18, 2006. The law concerns the rights of forest-dwelling communities to land and other resources, denied to them over decades as a result of the continuance of colonial forest laws in India.

In precise the aforesaid Act has been provided rights of tribal/traditional forest dwellers are as follows:

Title rights - i.e. ownership - to land that is being farmed by tribals or forest dwellers as on December 13, 2005, subject to a maximum of 4 hectares; ownership is only for land that is actually being cultivated by the concerned family as on that date, meaning that no new lands are granted;

Use rights - to minor forest produce (also including ownership), to grazing areas, to pastoralist routes, etc.;

Relief and development rights - to rehabilitation in case of illegal eviction or forced displacement and to basic amenities, subject to restrictions for forest protection;

Forest management rights - to protect forests and wildlife

A little over one year after it was passed, the Act was notified into force on December 31, 2007. On January 1, 2008, this was followed by the notification of the Rules framed by the Ministry of Tribal Affairs to supplement the procedural aspects of the Act.

The Act has extended land rights to the forest dwellers and the forest fringe dwellers. There are the numbers of claims made and numbers of claim enquired, pending, rejected and disposed to the claimants. The District Level Committee (DLC), Sub Division Level Committee and the Gram Sansad are the competent authorities to comply with the law.

Claims to such rights have been received in 10 district and the below reflects the details of claims received up to May, 2011. Claims made by Individual and Communities have been shown separately.

Table 2-19 The number of claims for recognition of the forest right

Sr. No	Districts	Individual Claims		Community Claims		Total
		ST	Non-ST	ST	Non-ST	
1	Purulia	21921	11638	19	648	34226
2	Bankura	20107	11767	512	95	32481
3	Jalpaiguri	4553	2346	3010	2032	11941
4	Paschim Medinipur	37377	14929	953	286	53545
5	Burdwan	3456	0	177	0	3633
6	Birbhum	883	0	67	0	950
7	Cooch Behar	183	0	9	0	192
8	Hooghly	8	5	1	0	14
9	Murshidabad	14	0	0	0	14
10	Darjeeling	89	178	15	0	282
Total		**88591**	**40863**	**4763**	**3061**	**137278**

In the 10 districts 28100 individuals' pattas and 108 community pattas have been distributed. The quantum of land distributed to the individuals is approximately 6452 ha and to Communities is 20ha.

Table 2-20 Distribution of pattas/forest rights

Sr. No	Districts	Pattas distributed		Quantum of land involved in case of pattas already distributed (in acres)		Patta ready for distribution	Quantum of land involved in respect of ready cases (in acres)
		Individual	Community	Individual	Community		
1	Purulia	6605	0	3750.60	0	0	0
2	Bankura	6502	0	2528.30	0	826	473.47
3	Jalpaiguri	4895	12	7500.66	18.39	581	1273.35
4	Paschim Medinipur	6581	9	1363.00	2.72	573	198.43
5	Burdwan	2762	53	456.23	9.40	527	93.43
6	Birbhum	505	34	73.81	19.78	0	0
7	Cooch Behar	140	0	176.60	0	0	0
8	Hooghly	8	0	0.65	0	0	0
9	Murshidabad	14	0	1.00	0	0	0
10	Darjeeling	88	0	86.13	0	0	0
Total		**28100**	**108**	**15936.98**	**50.29**	**2507**	**2038.68**

Disposal of claims by the Committees at the levels of Gram Sansad, Sub-division and District stands as follows:

Table 2-21 Number of Disposal of Claims at Gram Sansad, SDLC & DLC Level

Sr. No	Districts	Disposal by Gram Sansad			Disposal by SDLC			Disposal by DLC		
		Recommended	Rejected	Pending	Recommended	Rejected	Pending	Recommended	Rejected	Pending
1	Purulia	11030	22982	214	6819	3854	357	6607	212	0
2	Bankura	10438	13281	7416	9784	0	634	7358	1202	1224
3	Jalpaiguri	6402	0	1884	6227	0	175	5738	411	78
4	Paschim Medinipur	12327	31260	172	6834	5337	156	6543	291	0
5	Burdwan	3342	291	0	3342	0	0	3342	0	0
6	Birbhum	950	0	0	539	378	33	539	0	0
7	Cooch Behar	192	0	0	147	0	45	140	0	7
8	Hooghly	14	0	0	14	0	0	14	0	0
9	Murshidabad	14	0	0	14	0	0	14	0	0
10	Darjeeling	89	0	193	88	1	0	88	0	0
Total		**44798**	**67814**	**9879**	**33808**	**9570**	**1400**	**30383**	**2116**	**1309**

The State Government is sincere in implementation of the provisions of the Act strictly on the basis of provisions of the same. Level of rejections to claims is high and this has created some discontent amongst the claimants. But it must be understood that all claims have been settled after due enquiries on the claims and such enquiries have done within the ambit of guidelines arising out of the provisions of the Act.

2.5.5. Review of JFM Implementation

2.5.5.1. Background and history of JFM in West Bengal

(1) Introduction

The term governance has become a central part of the parlance of development and conservation discourses. The concept of governance is particularly important and relevant for forests because of their economic value and their private and public values. Forest governance is in a state of transition. The elements of this transition include decentralisation/devolution of different forms of participatory management of forests, privatisation and land tenure reform. This transition offers new avenues for sustainable forest management and is particularly important for the rural forest fringe/ forest dwelling Communities.

The system of formal forest management in the States of India including West Bengal had a number of important implications in forest governance. First forest managed was centralised as it was believed that the state had to control the access of people to forests. Second, the state claimed ownership of forests allowing it to manage forests ostensibly in the interest of the nation at large. Thirdly, professional foresters were made responsible for managing the States' forests as it was believed that they had superior knowledge. Fourth, the local people were excluded from forests through reservation /protection and establishment of network of protected areas.

The failure of the custodial arrangement in addressing the problem of the continued degradation of forests and deprivation of the forest fringe communities, the state government had to look for other options. Participatory management of forests through Joint Forest Management system was seen as a viable option for managing natural resources under Indian context. Many obvious problems need to be identified and properly addressed to have the desired results from the new concept of management One of the prime consideration was taking care of the very basic properties of forest based agro-ecosystem i.e. productivity, stability, sustainability and above all equity. One might suggest a number of technical options in order to harness the employment potential and generation of immediate benefits. But the understanding of the relative merits of the technical option and other measures in terms of establishing long term productive base to generate benefits sustainably and the efficacy of the same to offer access to the poorer section of the community become very urgent. Besides, empowerment of the users, reduction of dependence on external agents and increasing the scope of technical interventions, are some

of the other important elements which need consideration for sustainable amelioration of the situation.

The strength of the system to advance the ability and potential of the people for becoming effective partners of Joint Forest Management is significant and the experiences gathered should be enabling to open up further avenues for making a break through in promoting people's efforts to achieve self-reliance, sustainability and equity in making Joint Forest Management a successful venture in resource development both human and natural and restoration of natural resources in forests to a higher stage of productivity in the interest of the communities living in forest and forest fringes and ensuring a stable relationship with such communities based on mutual trust and convenience. Such a venture will necessarily allow a sustainable harvest of industrial materials like timber, poles, pulpwood etc to substantially add to the revenue resources of the States.

(2) Evolution of JFM

Installation of JFM in the state was pioneered by the Forest Department by Dr. A. K. Banerjee through a socio-economic project at Arabari in Midnapore District of West Bengal in early seventies. This project was initiated in 1971-72 with the object to resuscitate 1271 ha of degraded forest by involving villagers through a strategy of providing wage employment by allowing intercropping and creation of plantation on degraded lands and allowing collection of forest produce on collection of token royalty. This demonstrated that with proper motivation and empowerment, the poor forest dependent communities can protect, manage and develop forests effectively.

A socio-economic development scheme was made operational in early eighties in Ramshai in Jalpaiguri district of North Bengal to ensure protection of valuable sal forests of some blocks of forests of North Bengal. About 50 families displaced from their homes by flood had settled unauthorised on revenue department land and were deriving their livelihood by illicit felling from the forests and selling them in the market. Each family was given a patta of 0.4 ha of land which was primarily an old river bed in the neighborhood of forest. Forest Department took up the responsibility of development of these uncultivable lands by tractor plowing, bunding, irrigation by bore tube well; pump sets and agro- forestry. To generate income sericulture and mushroom cultivation were also included under the programme.

In 1987 the GOWB issued the memorandum for usufruct-sharing for the final harvests and this was the first memorandum which recognised the indispensable role of people in the protection of forests. The impact of this government decision was stupendous. FPCs started spreading rapidly covering the degraded forests of South-West Bengal. In 989 a policy resolution was issued by the State Government defining the manner of usufruct-sharing and the duties and responsibilities of the members of the FPC and the FPC as an institution.

National Forest Policy, 1988 which was adopted in the intervening period aimed at combining the objectives of environmental stability and biodiversity conservation for achieving ecological balance and meeting the subsistence needs from forests. This appears

to have caused a spectacular change in the forest management all over the country. This was because 1988 Forest Policy in India, for the first time, recognised the symbiotic relationship between the forest on the one hand, and the tribals (as well as other forest dwelling population) on the other. Thus, emerged a resurgence of grassroots level community initiatives for regenerating degraded forests to deal with the hardships caused by resource scarcities.

The National Forest Policy of 1988 imparted a new orientation to the entire gamut of forest activities envisaging amongst other conservation issues, two major factors pertinent to resource conservation. These are (i) steps to meet requirements of tribal/forest fringe population, ii) steps to create massive people's involvement to minimise pressure on existing forests. Successful implementation of the West Bengal Social Forestry Project in early eighties, opened up avenues for the Forest Officers to interact and build up rapport with the communities, particularly in the forest fringes.

With these developments and advantages and drawing inspiration from the success of Arabari experiment on jointly managing forest, backed up by the revolutionary Resolution of the Government of West Bengal allowing usufructuary benefits@25% of the harvested yield vide no 1118-For/d/6M-76/65 dt.07.03.1987, the West Bengal Forest Department took up the idea of institutionalising the experience. Govt. of India through their circular in 1989 issued directives to all the state governments to involve communities for regeneration/resuscitation of degraded forests. In order to promote people's participation in protection and management of forest the Forest Department, Government of W. Bengal (FD.GOWB.) promulgated the JFM Resolution no. 5962-For D/IS-16/88 dt. 27th.July, 1990, and this was the basis of registering Forest Protection Committees (FPC)s, comprised of willing members of the forest fringe villages, with approval and involvement of Panchayet Raj Institutions. It may not be out of place to mention here that the WB –financed projects on Social Forestry and the West Bengal Forestry Project implemented in the State during the period 1982-1997 had made significant contributions in concretising the concept of JFM and its spread in the forested tracts of the State. JFM in the state is now practiced under the following resolutions which are currently in force:

- Resolution No.5971-For dt 0310.08-This relates to South West Bengal
- Resolution No.5969-For dt 03.10.08- This relates to districts in North Bengal and Central Bengal
- Resolution No.5970-For dt 0310.08 – This relates to Darjeeling Gorkha Hill Council Areas
- Resolution No. 3841-For/d/11M-795 dt. 20.06.96- This relates to EDCs of protected areas

2.5.5.2. Current situation and status of JFM in West Bengal JFM Implementation

(1) Joint Forest Management

JFM as process of managing forests with partner communities has to take cognisance of the following issues for sustenance:

- JFM refers to sharing of products, responsibilities, decision making and authority on forest lands between the Forest Department and local user group. It involves a contract specifying the distribution of authority, responsibilities and benefits between village communities and the FD with respect to lands allocated under the JFM. Precisely JFM gives to the villagers to care for forests through increasing access to control over forest resources on which the programme is founded.

- JFM is also perceived to restore self-respect and dignity of the impoverished forest dwellers which could effectively improve their economic well-being and livelihood.

- Communities participating in JFM are not homogenous. They consist of diverse groups differentiated by caste, class, religion, and ethnicity and within and between each of these groups by gender and age. Imposition of uniform access and controls on all the existing users with levels and types of dependence on forest inherently implies differential distribution of opportunity costs and benefits amongst them. Thus inclusions and exclusion in decision making and articulation of priorities will tend to determine who gains and who loses within and between the communities and as well as households.

- Implementation of JFM concept necessarily demands a change in attitude of the forest fringe dwellers which involves a sharp departure from the traditional behavioral pattern. FPC members need to consciously move away from over-using and excessive exploitation of resources both of NTFP and other major forest produce. Partnering NGOs / CBOs may play a definitive role in this regard. Simultaneously, alternate means of sustenance for them need to be created by developing suitable skills and utilising available resources.

- At the same time Forest Deptt. Officers/Field level staffs have to consciously and sincerely endeavor to treat the FPC members with respect and an attitude of partnership has to be developed between the FPC member and FD personnel. Evidently this is likely to be time consuming process built through bits and pieces in a logical sequence.

- In this context with a view to achieving the objective of the present project meaningfully, implementation may cover the phases as follows:

Phase I: - Conservation and development of Resources

- ***Human Resource –*** By developing capability and confidence, infusing accountability and imbibing spirit of cooperation and service together with creating economic stability of the FPC members.
- ***Natural Resource*** – By physical protection and development of existing resources through afforestation, reforestation and rehabilitation of degraded forest and extension of resources in non-forest areas.

Phase II: - Management of Resources – By developing managerial skill through training and practice, establishing small scale enterprise with local skill and resources, to participate in management decision making and undertake rural development activities ably and sustainably.

(2) Microplan in Implementation

Micro- level planning has been seen as an effective instrument of matching resources in the catchment of a FPC or a cluster of FPCs. Micro-planning predates the State Govt. resolution on JFM in 1989 and it had its origin during the extended period of West Bengal Social Forestry Project. A structured format was prepared and this was tested in a workshop where NGOs and FD officers / Field level Staff participated. Seven plans of microplan consisted of village profile, FPC profile, Resource profile, Need profile Beat fund, Beat microplan and FPC microplan.

The World Bank after the mid-term review insisted on preparation of microplans through participatory rural appraisal. Such structured microplan prepared through PRA for a FPC or a cluster of FPCs may be the starting point in implementation of different work components in the project.

As on March 2010, there are 4271 FPCs in the State in different zones. Out of this 3744 FPCs are operative in South West Bengal, A total of 486779 members are involved in protecting 562527.0ha of forests. Total number of Eco-Development Committees (EDC)s in the State are 115 (96 nos. in North Bengal. 5 in South Bengal and 14 in Sunderbans,) comprising of 23197 members protecting 83264.0 ha of Protected Areas.

The Division wise details of FPCs and EDCs furnished in the tables below:

Table 2-22 Forest Protection Committees in West Bengal

Zone	Division	Total No. of F.P.C	Area Protected (ha.)	No. of Members					
				Male	Female	Total	S.C.	S.T.	Others
Hilly	Darjeeling	73	14376.06	3812	415	4227	139	1006	3082
	Kalimpong	64	26237.86	3583	195	3778	204	876	2698
Duars-Terai	Kurseong	46	13094.61	2043	3065	5108	431	1195	3482
	Jalpaiguri	63	20248.16	11431	638	12069	5255	3399	3415
	Baikunthapur	64	12898.91	5978	129	6107	4475	628	1004
	Cooch Behar	26	4149.39	2078	77	2155	1309	243	603
	Wildlife III	26	6681.71	3738	171	3909	708	1958	1243
	B.T.R. (E)	17	9331.09	3340	103	3443	1548	1334	561
	B.T.R. (W)	32	16603.02	2846	921	3767	769	2244	754
North Bengal Plains	Raigunj	23	1236.56	1637	73	1710	876	430	404
	Malda	11	220.246	830	279	1109	420	528	161
South Bengal	Midnapore	363	45956.45	48038	2801	50839	10131	9186	31522
	Jhargram	474	52179.31	38254	2449	40703	9135	14906	16662
	Kharagpur	254	27437.78	18421	12281	30702	6950	9504	14248
	Rupnarayan	213	26397.78	26331	1343	27674	6419	7814	13441
	Bankura (N)	543	43619.52	45027	8059	53086	19880	8504	24702
	Bankura (S)	614	44097.08	53537	4397	57934	13686	18390	25858
	Panchet	231	28382.67	27424	1590	29014	11040	4712	13262
	Purulia	213	30729.22	20741	867	21608	6012	9944	8652
	Kangsabati (N)	246	17711.22	23639	869	24508	5707	8070	10731
	Kangsabati (S)	305	26114.72	29561	569	30130	10899	4293	14938
	Burdwan	71	23205.46	15312	2634	17946	7488	5037	5421
	Durgapur	23	2391.129	1871	7	1878	523	699	656
	Birbhum	194	10376.39	16608	347	16955	6026	5463	5466
	Howrah	4	479.08	815	319	1134	537	238	359
	Nadia-Msd.	10	869.61	908	44	352	241	254	457
	Purba Medinipur	17	2124.06	4699	1097	5796	1112	50	4632
Estuarine	S.T.R	11	12844	3958	107	4065	3642	254	169
	24- Pgs. (s)	40	42534	12287	12186	24473	13116	517	10840
Total		**4271**	**562527**	**428747**	**58032**	**5E+05**	**148680**	**1E+05**	**219423**

Note) S.C.: Scheduled Cast, S.T.: Scheduled Tribe, F.P.C: Forest Protection Committee

Application of the JFM concept in resuscitating the degraded forests of South West Bengal met with considerable success but the interest generated declined in recent years because of absence of project activities focused on JFM .The whole of West Bengal Forests has been brought under the system through issuance of a series of Govt. Resolutions.

The success of JFM movement in varying degrees in different agro climatic zones of the State may be attributed to:

- Realisation of the rank and file of the Officers and Field Level Officers of the Forest Department that involvement and wellbeing of people, particularly of the forest fringe dwellers are essential for protection and conservation of forests. There is appreciation that custodial system of protection has failed badly.
- Introduction of PRA based microplan and its acceptance and application. There is a lot of scope of improvement on this front.

- Empowerment of people and inclusion of Panchayet Raj Institution (PRI). There is need for gender sensitisation to ensure participation of women. Composition of executive committee of FPCs needs a fresh examination.
- Emphasis on community support activities and income generating activities for economic uplift of the poor amongst forest fringe communities. Such activities need be directed to the poorer amongst FPC/EDC members
- Capacity building measures and awareness development activities for the Forest Department people at different hierarchical levels and forest fringe communities and the forest dwellers
- Support of the Government through issue of resolution related to JFM for forests of different agro-climatic regions. Resolutions currently in force need be examined. 100% of the produce at mechanical thinning in North Bengal plantations and 3rd. year multiple-shoot cutting of sal coppice may be given in favor of FPCs free of cost.

2.5.5.3. Lessons learnt from past projects WB and other Projects

In West Bengal, the following similar projects for Forestry and Biodiversity Conservation have implemented;

- World Bank Social Forestry Project
- West Bengal Forestry Project
- India Ecodevelopment Project

These projects are good sample for formulate the new project on forestry and biodiversity conservation sector,

Project Title: World Bank Social Forestry Project
Period: 1982-1987 extended to 1991
Objectives and achievements: This project intended to create resources in the form of fuel wood, small wood and fodder in non-forest areas to meet the growing need of the communities living in rural areas of West Bengal. Such augmentation of resources in non-forest areas, it was believed, will reduce the pressure of communities on the existing forests and will help conservation of forest and its associated biodiversity. To add to such resources in the forest areas a small provision was kept for rehabilitation of degraded forests. The project at the start had following components; • Creation of village woodlots- 6000.00ha • Creation of strip plantations along canals/roads; 20000.00ha • Farm forestry: 52000.0ha • Rehabilitation of degraded forests: 15000.00ha The project also provided for supply of 10000 of cooking stoves, expansion of WBF School and establishment of FG training centre .With the exception of the village woodlot component, planting targets were increased from 93,000 ha to 210,000 ha as follows: • Strip plantation, from 20,000 ha to 23,000 ha; • Rehabilitation of degraded forests, from 15,000 ha to 70,000 ha, including mainly the sal coppice management; • Farm forestry, from 52,000 ha to 111,100 ha. A number of experiments on agro-forestry were carried out, and the village micro-planning exercises were undertaken to induce people's participation in project planning, A great amount of attention was directed to institutionalise the Village Forest Protection Committee (VFPC) for the protection, management and utilisation of strip plantations and rehabilitated degraded forests.

The project had a physical spread over 16 districts and three agro-climatic zones.
Responsibility of implementation vested primarily with the Divisions of the Social Forestry Wing which was created for this purpose. Complement of staff were also inducted as Forest Extension Workers and Motivators for extension to facilitate acceptance of different models of plantations and their protection.

Lessons learnt:
Through the project, the Bank made significant contributions to the physical, institutional, economic and social development of the forestry sector. The experience suggests a number of lessons learned;

- During implementation more recognition should have been given to the technical aspects of the plantation programme;
- Adequate attention should have been paid to forestry management, planning, and community involvement, coupled with intensive training of village panchayats and VFPCs in plantation management and protection;
- Cost-benefit sharing should have been worked out in advance;
- Plantation components should have been narrowed down to just a few for more effective implementation; and the benefits gained from cash incentives and
- Free seedling distribution should have been weighed more carefully against the costs of such programmes.
- Microplans were prepared in haste and this did not look into fuel wood fodder balances and as a result plantation activities quite often did not include fuel wood –fodder deficit villages
- Survival rate was low at about 53% in initial years and rose substantially to 70% in the closing years. In the component of farm forestry through distribution of seedlings was as low as 46%. Group Farm Forestry which was implemented in rather compact blocks of wasteland leased out to farmers was a great success . Survival rate in such cases varied between 85% and 90%

Project Title: West Bengal Forestry Project

Period: 1992-1997

Project goals and achievements:
The broad goals of the project were to:

- Prevent continuing degradation of the forest lands
- Establish a sustainable protection system
- Enhance productivity and
- Conserve biodiversity

The project exceeded appraisal estimates of the component of prevention of continuing degradation of the forest lands and establishing a sustainable protection system. It rehabilitated large areas of degraded forests, substantially decelerated the onset of degradation in other forest lands, and made a major contribution toward comprehensive and sustainable coverage of forest lands that are potentially suitable for community protection efforts.
* Coverage. Almost 3,300 registered Forest Protection Committees (FPCs) were responsible for helping to protect over 450,000 ha, covering over 90% of all protected and reserve forest lands in the southwest, and over 60% of all forest lands with nearby rural communities in the north and in the mangroves.
* *Area under protection.* FPCs effectively helped to protect an estimated 280,000 ha, a significant increase over the estimated 118,000 ha pre-project situation and 176,000 ha SAR expectations.
On the goal of enhancing productivity the project has increased productivity, but less than appraisal expectations.
* *Future productivity.* The project's most important potential contribution to productivity was the extent to which it had laid a foundation for very significant productivity gains in the future related to the use of improved planting material, improved coppice management techniques.. During the project period, the main contribution to productivity comprised the acceleration in converting wastelands to more productive use under joint forest management (JFM) and farm forestry. The project fully used the 38,000 ha of area that actually required viable rootstock treatments. The plantation treatments (mostly in degraded lands) on about 41,000 ha in the southwest and north exceeded both the SAR and mid-term review (MTR) estimates.
* *Intercropping.* There was also less intercropping than anticipated in many areas intended for intercropping while in other areas, FPCs intercropped only in the first year of plantation.
* *Farm forestry.* Like JFM, farm forestry on 102,769 ha increased land use productivity, with most plantings going on marginal private lands or on public (non-forest) wastelands whose only other use was for periodic grazing.
* *Mangroves.* The mangrove regeneration and afforestation on 20,663 ha (consistent with the reduced MTR estimate that reflected a delayed start-up) did not involve any changes in technical guidelines, but these expected to give productivity gains in mangroves associated with community protection.

* *Planting material.* About *50%* of the plantations were covered by source-identified quality seed, and some 400 ha were covered by improved seedlings produced mainly in 12 pilot modem nurseries.
The project exceeded appraisal expectations on the score of biodiversity conservation.
* *Forest Areas.* The forest protection and regeneration activities have helped to conserve biodiversity throughout the 280,000 ha jointly protected by FPCs, contributing to improved wildlife habitats, and native plant conservation.
* *Mangroves.* The mangrove protection and afforestation also contributed to the biodiversity conservation of globally significant coastal wetlands, the Sunderbans Biosphere Reserve.
* *Ecodevelopment.* The project established a total of 97 registered ecodevelopment committees, who began to play a role in the protection of seven parks and sanctuary areas in the Sunderbans and in the north that cover a total of 356,000 ha.
* *Northern parks.* The limited scale park management support in the North helped important habitats for endangered species such as tigers, rhinos, elephants, and red pandas.
* *Research.* Mid-term adjustments substantially expanded the biodiversity component to include joint protection by ecodevelopment committees and an increase in the number of research studies from 4 to 12.

Lessons learnt:

- Project design and implementation should be results-oriented with a flexible process-oriented approach and an effective monitoring system,
- Project design and implementation should focus on measures to ensure financial, institutional, and incentive framework sustainability,
- Organisational reform is risky and requires careful analysis of power relationships and risks
- Realistic economic analysis requires a careful consideration of the without project scenario
- Forest department officers and staff cutting across rank and file understood the benefits that arose out of installation of forest protection through FPCs. This was possible through change in their attitudinal orientation. But many across the hierarchical levels were still suspect on outcomes.
- Government clearance requirements consultancies, the rigidity in the civil service structure adversely affected the project performance
- Delegation of financial powers to forestry officials and experiential learning by staff about participatory forest protection and improved planting materials contributed to project achievements.
- FPC microplans did focus on distribution of the project budget rather than on a sustainable site-specific forest management.
- Average third year survival rate was around 50% and many of the plantation treatment models in the project design proved unsuitable.
- The construction of HQ office building added advantage of consolidating office locations & project coordination.

Project Title: India Ecodevelopment Project

Period: 1996-2004

Objectives and Achievements
Specific objectives were:

- To improve capacity of PA management to conserve biodiversity and
- To increase opportunities for local participation in PA management activities and decisions; to reduce negative effects of local people on biodiversity, reduce negative impacts of PAs on local people and increase collaboration of local people in conservation efforts;
- To develop more effective and extensive support for ecodevelopment;
- To ensure effective management of this project; and biodiversity projects.

At all sites the project improved the capacity of PA management to conserve biodiversity, and work with local communities to increase collaboration, and benefits from, conservation efforts. The reconstituted Stakeholder committees have started meeting in all parks after a systematic review of membership. Regional planning committees have been constituted at all project sites. Forestry staff, at several sites, worked with EDCs to develop and implement highly innovative solutions which addressed both PA management and livelihood needs.

In project sites of 7 Tiger Reserves 581 EDCs covering about 75,000 HHs (SAR target 806 EDCs covering 71,000 HHs) were operational. Participatory monitoring systems from the field indicated continued improvement with regard to negative impact of people on PAs and vice versa. IUCN instrument, which was administered to all parks, confirms improved Park-People relationships. EDCS have generated substantial funds and have started managing these funds using guidelines developed through a participatory process.

The project led to more effective and extensive support for the ecodevelopment model, including policy changes so that all seven states passed government orders to institutionalise ecodevelopment statewide for PAs.

Despite bottle necks in early phases, (i) funding requests of Parks were promptly attended; (ii) all delayed/pending studies and dissemination activities had been completed; (iii) monitoring tools have been main- streamed across project tiger sites; and (iv) lessons learnt have been widely disseminated by PTO to other parks, NGOs and other stakeholders.
Lessons learnt • The project helped improved relations between park management and local people. There was improved cooperation, collaboration through implementation of ecodevelopment model • Joint training of ecodevelopment committees and forest front-line staff and joint visits to other Pas also contributed to better relationship. • Creation of microplans and community funds linked village development to PA protection • Prioritisation of activities between and within villages based on dependency on forest resources is necessary. The poorest individual may be most dependent on forest resources but may not be able to contribute 25% to access benefits. • EDC as a village-level institution proved effective but long term sustainability would always depend on ownership and benefits derived by the communities. • Ecodevelopment requires dedicated field staff Exclusive staff for ecodevelopment activities allowed more frequent interaction as facilitators with the villagers • Women's SHGs perform more effectively due to small size, cohesiveness and high levels of communication within the group.

Out of the state wide project, the following project in West Bengal has influence of community development with forest sector

- **UNDP Sub-programme in Jaldapara WLS (1997-2002)**

  This had the specific objective of strengthening management planning and raising capabilities in planning eco development capabilities.

- **UNDP programme in Sunderbans Biosphere Reserve (2003-2008)**

  This programme was focused on sustainable livelihood development for conservation of biodiversity in Indian Sunderbans.

- **UNDP Programme on conservation of Medicinal Plants (2006-2011)**

  Under this programme 7 sites State have been created to serve as gene pools. Two of these are in the hills, three in North Bengal, one in Purulia and the other in Sunderbans.

The project execution has definitely added to the confidence of the Department to handle projects in the forestry sector. Capability of officers and staff also has been enhanced both in technical aspects and dealing with people outside the forest. Interaction with some other departments including the PRIs has given the exposure much needed to execute a programme of rural development .UNDP programmes enhanced capabilities of protected area mangers in planning eco-development activities .

Micro plans prepared without proper stakeholder consultation through PRA exercises do not succeed in proper motivation of communities and fail to achieve the desired level of results in community participation of protection of natural resources.

Multiple models of plantations add to the confusion unless backed up by selection through appropriately designed criteria. Farm forestry through free distribution of seedlings and some incentives have resulted in very high rate of casualties.

Gender sensitisation has been poor resulting in very inadequate participation in running institutions of FPC/EDC. Targeting the vulnerable sections of communities was not effective as desired.

The existing system of financial flows during execution of projects has been instrumental in smooth implementation of such schemes. At the same time absence of empowered bodies delayed in some projects in procurement of services.

2.5.6. Review of Plantations Outside Forest (POF) Implementation

2.5.6.1. Background of POF

Rapid depletion of forest resources in India may be attributed mainly to rapid population growth and agriculture expansion, increasing demand for firewood coupled with the excessive demands for fodder for cattle. Free ranging of cattle – a practice by most of the forest fringe communities in the country was also responsible to a large extent for impeding natural regeneration in forests. Forest fire in some parts of the country had also impacted natural regeneration adversely. The National Forest Policy of 1952 envisaged amongst other issues, the need for establishing tree planting programmes that involved local people's participation not only to sustain supply of timber, but also to promote required supply of fuel wood, fodder and small wood for the rural population. National commission on Agriculture (1976) also made comprehensive recommendations on social forestry in non-forest areas of the country to bridge the ever-increasing gap of demand and supply in fuel wood for domestic energy and leaf-fodder for cattle.

WEST BENGAL SOCIAL FORESTRY PROJECT was conceived and executed during the Years 1982- 87 with subsequent extension upto1990-1991. This project had the primary objective of augmentation of tree resources in non-forest areas with the objective to increase supplies of fuel wood, poles, bamboo, small timber, fodder grass, fruits, oilseeds and other minor products for the rural population through establishment of about 93,000 ha of plantations in all the 16 districts and to provide other support including supply of smoke less stoves.

The project at the start had following components;

- Creation of village woodlots- 6000.00 ha
- Creation of strip plantations along canals/roads; 20000.00 ha
- Farm forestry: 52000.0 ha
- Rehabilitation of degraded forests: 15000.00 ha
- With the exception of the village woodlot component, planting targets were increased from 93,000 ha to 210,000 ha as follows:
- Strip plantation, from 20,000 ha to 23,000 ha;
- Rehabilitation of degraded forests, from 15,000 ha to 70,000 ha, including mainly the sal coppice management;

- Farm forestry, from 52,000 ha to 111,100 ha.
- The execution of the project was facilitated by creation of a Social Forestry Wing in the Directorate. This also included induction of a good no of Forest Extension Workers and Motivators.
- Lessons learned from this project execution are:
- During implementation more recognition should have been given to the technical
- aspects of the plantation programme;
- Adequate attention should have been paid to forestry management, planning, and community involvement, coupled with intensive training of village panchayats and VFPCs in plantation management and protection;
- Cost-benefit sharing should have been worked out in advance;
- Plantation components should have been narrowed down to just a few for more effective implementation; and
- Benefits gained from cash incentives and free seedling distribution should have been weighed more carefully against the costs of such programmes.

However people's awareness regarding the importance creation of tree cover in non-forest areas generated through the project helped to control the pace of ecological degradation. Positive relationship fostered by the project between the rural community and forestry personnel has paved the way for introduction and meaningful implementation of the Joint Forest Management system in the State.

WEST BENGAL FORESTRY PROJECT (1992-1997) funded by the World Bank also had a component of farm forestry. This component achieved a target of 102,769 ha enhancing productivity with most plantings going on marginal private lands or on public (non-forest) wastelands whose only other use was for periodic grazing

2.5.6.2. Current situation of POF

The Implementation Structure developed for execution of the Social Forestry Project has been dismantled and most of the Social Forestry Divisions have been converted into Divisions managing small territories. This a step to intensify management of forests and to service JFM, Various models of POF like Farm Forestry, Strip Plantations etc. are being undertaken from by the Territorial Divisions and the remaining Social Forestry Divisions, on a reduced scale though. Such efforts are funded by various operative schemes of the Centre and the State government –like NREGA/RIDF.

Past performance in this sphere has been discussed against the two World Bank Projects of the state.

The State Government through a specific order no.2914- For./D/6m-31/54 defined ways of creating and managing such strip plantations. This also specifies that forest officers shall arrange distribution of the pre-specified percentage of harvested produce In consultation with the Bhumi Sanskar Sthayee Samiti to the selected beneficiaries at a concessional rate or free of cost subject to the recovery of the direct cost for establishing, protecting and

maintaining the plantation less the cost for seedlings and transfer of required funds to the Gram Panchayats for raising future plantations.

Under the present project the component of social forestry will be executed through the existing territorial forest divisions and the Social Forestry Divisions which do not have any territorial responsibility. Stress for selection of such areas will be in districts which have low forest cover. Some of territorial divisions have to be provided with incremental staff like Forest Extension Workers.

2.5.7. GIS and Remote Sensing

Geographical Information System (GIS) has numerous, well developed applications for the spatial sciences, especially forestry, ecology, biology, wildlife management, and geology. The role of GIS in the Forest Department cannot be underplayed for the object in focus as Forests have a spatial as well as time dimension, along with various other qualitative and quantitative attributes. Inputs from Remote Sensing (RS) and Global Positioning System (GPS) enhance the effectiveness of the technique, making it very time efficient for data updating. RS and GIS are integrated system of information gathering and analysis of alternative method for natural resource management. GIS and remote sensing are used to find solutions to environmental problems through improved information effectiveness and efficiency. In itself, the use of GIS to update the forest inventory maps is not much more than automated cartography but it is the analytical power of GIS that sets it apart from cartography.

The recent development in the field of remote sensing and GIS based Natural Resource Management in India is due to the successful launching of a series of remote sensing satellites equipped with advanced sensors.

The history of Remote Sensing Application for this Forest Department began in 1989 when RRSSC, Kharagpur created forest cover map with data from NRSA. Several such maps were made in the following years. Since 1999 satellite images are being used by the in-house GIS Cell of the Forest Department. In recent years Stock Maps and Working Plans have been created for large areas using satellite imagery for several Divisions. Using such satellite imagery not only saves time and cost spent on physical survey but also reduces the forest personnel from the risks in the forests. Moreover it makes the interpretation and mapping much more accurate removing the largely subjective component in conventional mapping. These spatial databases in turn help in asset and resource management, monitoring of plantation and other schemes, planning and advanced decision support system.

GIS is used in mapping the extent forest areas, defining the vegetation type, their territorial limits of ownership, boundaries of plantation, creation of stock Maps, wildlife zones, animal tracks, man-animal conflict zones, resource utilisation centres, scientific forest resource management, tourism management, etc. GIS modeling is used to manage wildlife

populations, timber growth and harvest, and manage environmental quality. Process modeling in GIS is analysis that deals with recognition of problems during the awareness phase.

Even at the global level the need of infusing modern technology in forestry sector has been felt. These systems can play a significant role in improving the quality of life of the people living below the poverty line. The growing concern of international organisations viz. UNDP, The World Bank, JICA, etc. engaged in social service sector clearly reflects this thinking.

The GIS Applications in forestry has come up with excellent results in the decision making in the field level. There are different types of GIS Applications in forestry, such as:

- Change Analysis (control of degradation)
- Control of 'slash & burn' and 'shifting cultivation' in forest areas
- Supervising of afforestation plans
- Monitoring of plantation schemes
- Corridor mapping for animal migration
- Habitat mapping
- Land capability mapping
- Prevention of trespassers in the forests
- Fire alerts
- Timber management (with harvest planning and simulation models)

Timber management focuses on efforts to provide a sustained supply growing stock at different ages of the same for optimal wood production. While today's models are sufficient for defining and developing a spatial management design strategies for wood supply, they lack consideration of the geographic structure of forests and are insufficient for design of wildlife habitat sensitive and operationally, i.e., economically, acceptable management. Remote sensing, in this manner, could aid in determining the effects of forest management activities, such as timber harvesting and best management practices on soil erosion and sedimentation.

2.5.7.1. Current Status of ICT in WBFD

The use of ICT in WBFD is not adequate, and lagging behind even in comparison with the major States of India, leaving aside international levels.

(1) IT Usage

The Forestry Management System, a DOS based application designed in house by the Directorate, has greatly assisted Billing and Account preparation. The accounting module in the application has functionalities for compiling monthly Division accounts including generating Form 14[3], progressive statement, Pay Bill Generation etc. However given that it

[3] A VAT return form set by Directorate of Commercial Taxes, GOWB.

is a non networked system there are several limitations. Other Application Software are standard Automation tools (like Microsoft Office).

At the Wildlife Wing, there are about 13 PCs connected through LAN network. In addition the Wildlife Wing has a dedicated Website and several DFOs have set up their own Web sites, through utilising funds set aside for ICT interventions under different schemes. At the field level in the Division Head Quarter (HQ) there is one PC each in the major sections like Establishment, Accounts, and Correspondence etc. Some Ranges have a single PC each for performing basic functions. The Forestry Management Software is installed on some of the machines primarily for maintaining accounts and generating salary bills. The application has considerably eased the abovementioned processes, but in the absence of any networked system accounts are then submitted further in hard copy to the HQs.

(2) Databases

No systematic data repository is available in West Bengal Forest Department. Some standalone databases are maintained by some units at the HQ such as GIS. Databases are not integrated.

(3) Connectivity

At the HQ a LAN is in place with internet connectivity. At the Division level no LAN, but internet is available for individual machines. At Range and Beat level there is no internet connectivity.

(4) Infrastructure

IT Infrastructure is scarce. The HQ has about 25 work stations with 1 Server and 70 other standalone PCs. In the field there is typically a single PC for some sections at the Division level. By and large at the Range and the Beat level there is no IT infrastructure and all data and information is recorded and dispatched manually, with the exception of a few wild life ranges.

(5) Policy

No distinct IT Policy or roadmap is deployed by the Directorate.

(6) IT Training

At present no formal IT Training has been provided to the Staff using the system at the HQ and in the field. The in-house author of the Forest Management Package has provided basic training on usage and is responsible for troubleshooting any problems that might arise.

(7) Software packages used

- GIS for tiger tracking and death due to train accident
- Forestry Management Software for account & budget preparation
- Stand-alone package for statistical updates

- GIS and Image processing Software at Head Office (Aranya Bhavan and Bikash Bhavan) vide Table 1.
- GPS readings are also used to determine perimeters of all Plantations and some Wildlife related instances

2.5.7.2. Current Status of GIS in WBFD

(1) GIS Cell

Geographical information System was set up in the Office of the Conservator of forests, Working Plan & GIS effectively from July 1999.

Systematic GIS data generation is carried out in the GIS Cell at Aranya Bhavan, Kolkata and some in the Wildlife Cell at Bikash Bhavan, Kolkata. There are also some small GIS/CAD cells doing small related one-off maps. GIS data provides information on:

- State of Forest Resources
- Degradation of land
- Detecting changes in vegetation cover
- Determining the susceptibility to land erosion
- Suitability for timber harvest
- Identification of high risk zones for forest fires and other incidents

The following software is now in use in the GIS Cells:

- ARC/INFO GIS software
- ARC view GIS software
- ERDAS Image Processing Software
- AutoCAD Map (in some)
- Geo media Professional (in some)

Works undertaken by the GIS Cell are:

- Digitization of all district and PS maps of the State
- Digitization of plot-wise detail of Forest areas from Mouza maps
- Procured satellite imagery in digital form from the NRSA Hyderabad for the State, for the years-1997, 2000, 2002 and 2006
- Creating classified forest maps of all districts of the State as in 2005
- Working Plan & GIS Circle developed the first GIS based forest atlas of the State in 2002, showing Divisions, Ranges and Beat level jurisdiction.

At present the Stock maps are yet to be prepared for south west part of the State (viz. Bankura, Purulia, and Eeast & West Medinipur). There is shortage of trained manpower and many areas have not been mapped in detail due to problems of surveying.

(2) Recommended Action for GIS

The Land Record System should be made dynamic and linked with the Stock Maps in order to indicate the coverage and quality of the land. Furthermore changes in all dynamic aspects of the natural resources under the Directorate should be captured/updated and inter-linked, such as Vegetation cover, Wildlife Population, Afforestation (year, locality, composition, quality, etc.). Boundary/ demarcation for forest land not available in many cases:

- Demarcation of actual forest land should be completed
- The back log in Stock map preparation should be cleared
- Land records need to be digitized
- Periodic monitoring of Growing Stock in forests and its reflection in maps is necessary
- Performance of Joint Forest management needs monitoring its reflection in maps
- Dynamic reporting of Wildlife issues in GIS

The GIS application already in existence should be upgraded to the latest technology standards. Proper projection and data standards should be maintained. GIS should further be integrated with the MIS (Management Information System) and access to GIS data should be provided at all levels for better planning. After completion of the base line data the GIS should be an integral part of the web-based data centre on which e-Governance is based.

When integrated into the e-Governance system (web-based integrated forest management system) GIS may consist of the following sub-modules for better functioning:

- Forest Resources (Forest, Parks & Wildlife)
- Working Plan Management System
  (Consisting of plantation management system, research information management system, soil conservation management system, monitoring evaluation management system)
- Joint Forest Management System

A list of actual situation and required number of GIS/RS related hardware and software assessed by WBFD is attached in Annexure 10.

2.5.7.3. Need for GIS Applications in Forest Resource Management

The nature of forestry organisations in terms of their complexity is changing. Some of the key developments in this movement towards greater size and complexity, demanding updated and accurate information, are outlined below (Garg, 2002):

The scope of forestry sector has increased beyond the domain of forest and wildlife management to the areas of soil conservation; rural development, integrated area

development, and landscape improvement have all been brought under the umbrella of forestry organisations. There is growing interdependency of forestry sector with agriculture, water harvesting, and urbanisation, tourism, livestock and infrastructure development. Hence the need to integrate GIS in the Forest Management System and make it available to all concerned (of course with different levels of security) through internet.

2.6. Biodiversity Conservation of the State

2.6.1. Status of Floral/Faunal Diversity

West Bengal State shows comparatively higher diversity of flora and fauna in India. The state has 15% of plant species and 9% of animal species recorded in the country in spite of the small area coverage of only 2.7% for the country. This high diversity reflects the variety of topography from coast, plains, hills to mountains (0-3630 m in altitude), tropical monsoon climate and various vegetation representd by 10 forest types including mangrove, dry/moist deciduous, broad leaved, wet evergreen and sub alpine forests. Particularly for Sunderbans in the southern end and East Himalaya in the northen top, prominent are the species richness and endemism. This unique geographic location, with both coastal and alpine ecosystems, makes West Bengal a state with high biodiversity.

2.6.1.1. Flora

In West Bengal, 7,022 species of flowering and non-flowering plants have been identified, representing about 15.3% of the recorded flora in Indian. Angiosperms comprises of 3580 species, occupying 20.4% of the Indian speies, belonging to more than 1333 genera (about 45%) and 200 families (about 80%). Significant diversity has been recorded in Graminae with 433 species followed by Leguminosae with 324 species (WB Env. Dept., 2002). Due to increasing loss of habitat and impact of human activities, 152 plant species in West Bengal are classified as threatened species by ZSI, which occupies 61.8% of the Indian species.

Table 2-23 Flora in West Bengal for India

Taxa	Species		%
	India	West Bengal	
Bacteria	850	96	11.3
Algae	7,175	865	12.1
Fungi	14,500	860	5.9
Lichens	2,223	600	27.0
Bryophytes	2,500	550	22.0
Pteridophyta	1,200	450	37.5
Gymnosperms	67	21	31.3
Angiosperms	17,527	3580	20.4
Total	**46,042**	**7,022**	**15.3**

(Souce) Status of Biodiversity of West Bengal (ZSI, 2005)
India's Fourth National Report to the Convention on Biological Diversity (MOEF, 2009)

In West Bengal, floral diversity is undoubtedly the most impressive in the Terai, the Duars, Darjeeling Himalayan region and mangrove forests of Sundarbans. The Eastern Himalayan vegetation is characterized by abundance of rhododendrons, orchids, ferns, bryophytes, lichens besides trees like terminalia, oaks, laurel and bamboos. Orchidaceae is the single largest family with as many as 600 species representing more than 50% of total taxa known from India. Asteraceae, Poaceae, Leguminaceae, Rosaceae, Scrophulariaceae, Rubiaceae, Euphorbiaceae, Cyperaceae and Saxifragaceae represent nine (9) dominant families of angiosperms in the area. About 40% of total Himalyan flora is endemic with the majority occurring in the eastern flank. Of Gymnosperms, 15 species occur in the Eastern Himalayas with at least 5 genera being confined only to this region. Of the Pteridophytes (fern and fern allies), 70% of the Indian taxa are concentrated in the Eastern Himalayas. Among Bryophytes (moss), nearly 20% of the Indian species are known from this region. The Eastern Himalayan region is also well known for medicinal and aromatic plants of the genera Aconitum, Asparagus, Berberis, Dioscorea, Ephedra, Gentiana, Inula, Prunus, Rheum, Rosa, Saussurea, etc.

Table 2-24 Species Abundance of Some Plant Genera in West Bengal for India

% of Indian species found in West Bengal	Genera
Over 50%	*Cyperus, Ficus, Fimbristylis, Acacia, Cassia*
40 – 50%	*Rhododendron, Indigofera, Rubus*
30 – 40%	*Polygonum, Begonia, Solanum, Eriocaulon, Glochidion*
10 – 30%	*Habenaria, Dioscorea, Primula, Crotalaria, Impatiens*

(Souce) West Bengal State Biodiversity Strategy and ActionPlan (WB Env.Dept., 2002)

2.6.1.2. Fauna

The faunal diversity of West Bengal is highly variable in different groups of taxa in relation to the recorded species from India. A total of 10,009 faunal species have been found in West Bengal, which represents 9.1% of the species of the country. The higgher percentages over 20% are revealed for Protozoa, Rotifera, Annelida and vertebrate fauna: particularly for birds and mammals (52.7% and 47.4% respectively). The faunal diversity appears to be highest in the Darjeeling Himalayan region and more than 50% of the species recorded in India could be located in Darjeeling District, particularly for Insects and other invertebrate spcies.

Table 2-25 Fauna in West Bengal for India

No.	Taxa	Number of Species		%
		India	West Bengal	
1	Protozoa	2577	970	37.6
2	Porifera	500	16	3.2
3	Rotifera	330	146	44.2
4	Annelida	840	187	22.3
5	Mollusca	5072	277	5.5
6	Crustacea	2934	236	8.0
7	Arachnida	5818	276	4.7
8	Insecta	61151	5458*	8.9

9	Pisces	2546	555	21.8
10	Amphibia	240	50	20.8
11	Reptilia	460	148	32.2
12	Aves	1232	649	52.7
13	Mammalia	397	188	47.4
14	**All Fauna**	**91307**	**10009**	**9.1**

(Note) * Species number only found in Darjiling District.

(Souce) Faunal Resouces of India (ZSI, 2007), National Biodiversity Action Plan (MOEF, 2008)

Among the total 659 species of threatened plants and animals in India, 257 species are recorded in West Bengal, occupying 39.0%. The ratio is quite high particularly for fishes (77.5%) and reptiles (56.0%). Endangered species of mammals classified by the ZSI are: snow leopard (*Panthera uncia*), clouded leopard (*Neofelis nebulosa*), marble cat (*Pardofelis marmorata*), Indian rhinoceros (*Rhinoceros unicornis*), wild buffalo (*Bubalus bubalis*), goral (*Naemorhaedus goral*), tahr (*Hemitragus jemlahicus*) and pigmy hog (*Sus salvinus*). West Bengal also has at least 39 species of Indian endemic species and among them, 16 species are exclusively endemic to the state, of which 6 species are for amphibians.

Table 2-26 Threatend and Endemic Species in West Bengal for India

No.	Group	No. of Threatened Species			No. of Endemic Species	
		India*	West Bengal**	% of WB	India	West Bengal**
1	Plant	246	152	61.8	12981	17 (7)
3	Mollusc	2	2	100.0	-	-
2	Other Inverts	109	6	5.5	-	-
4	Fish	40	31	77.5	-	5 (1)
5	Amphibian	65	1	1.5	153	9 (6)
6	Reptile	25	14	56.0	-	4 (1)
7	Bird	76	25	32.9	50	2 (0)
8	Mammal	96	26	27.1	43	2 (1)
	Total	**659**	**257**	**39.0**	**13227**	**39 (16)**

(Note) * Only IUCN categories for Critically Endangered, Endangered and Vulnerable.
** Including Endangered and Vulnerable determined by ZSI.
*** Figures are not complehensive ones; those without brackets are Indian endemic and those in brackets are exclusively endemic to West Bengal.

(Souce) Status of Biodiversity of West Bengal (ZSI, 2005)
India's Fourth National Report to the Convention on Biological Diversity (MOEF, 2009)
Wildlife in a Changing World (IUCN, 2009)

(1) Mammal

West Bengal has 188 species of mammals belonging to 111 genera, 33 families and 12 orders. Among them, 127 species use forest areas as their preferred habitats and six species are confined to rivers and seas. The districts of Darjeeling and Jalpaiguri have 111 and 71 species respectively in their limits of about 2,900 km^2. Only 22 species are common in most of the districts, which shows thtat other districts than the two do not have many mammalian species. Sixty-seven species are monotypic, which may indicate vulnerability of some species that are not reproducing and receiving adequate protection.

During the course of last 100 years, a number of important species extincted in Sundarban Tiger Reserve: Javan rhinoceros (*Rhinoceros sondaicus*), wild buffalo (*Bubalus bubalis*), swamp deer (*Cervus duvaucelli*) and barking deer (*Muntiacus muntjak*). In Buxa Tiger Reserve, marble cat (*Pardofelis marmorata*), golden cat *(Catopuma temmincki*) and wild buffalo (*Bubalus bubalis*) are not sighted in recent years. Snow leopard (*Uncia uncial*) and pygmy hog (*Sus salvanius*) were found in Bholka forests and nearby areas but no recent sighting. Sumatran rhinoceros (*Didermocerus sumatrensis*) was also reported along the Sankosh River in the past. Swamp deer (*Cervus duvauceli*) are no longer found and Hispid hare (*Caprolagus hispidus*) may have been extinct in the north Bengal.

(2) Bird

Avian fauna consists of 649 species in West Bengal among 1,232 species recorded in India. There were 350 species found in Jalpaiguri District alone (Shebbeare et al., 1918). The state attracts a large number of birds due to: 1) special biogeographical situation; 2) long altitudinal range; 3) geographical situation being on migratory routes; and 4) large aquatic sites with rich food resources.

Of the aquatic birds, pelicans, spoonbills and storks become rare. Lessor adjutant stork (*Leptoptilos javanicus*) and greaer adjutant stork (*Leptoptilos dubius*) have disappeared from wide areas. While pink-headed duck (*Rhodonessa caryophyllacea*) has become extinct in West Bengal and the rest of India, the sighting of black-necked crane (*Grus nigricollis*) in Buxa Tiger Reserve in recent years is a significant addition. Many of the ground dwelling birds, especially pheasants in the higher reaches of the Himalayas, become increasingly rare largely due to habitat disturbances. Bengal florican (*Houbaropsis bengalensis*), once wide spread in grasslands of the Himalyan Terai, was last seen in Jaldapara Wildlife Sanctuary in 1991. Mountain quail (*Ophrysia superaliosa*) is locally extinct from the hills. Most of the eagles, bazards, falcons, hawks and owls are now threatened or vulnerable largely due to non-biodegradable pesticide contamination. Of the pigeon group, snow pigeon (*Columba leuconota*) and purple wood pigeon (*Columba punicea*) are noted to be scarce.

(3) Reptile

ZSI listed 95 species of snakes from West Bengal (60 species from Darjeeling District alone), 39 species of lizards, 19 species of tortoises and turtles. Two crododile species, gharial (*Gavialis gangeticus*) and mugger (*Crocodilus palustris*), are uncommon now.

(4) Amphibian

ZSI identified 39 species (13 genera) of amphibians from West Bengal. Among them, 30 species were recorded in Darjeeling District alone. There is no information available about the numerical status of various species. The district of

(5) Fish

West Bengal has the richest diversity of fishes than any other states in India with a total number of 555 species, representing 21.8% of the Indian species. ZIS listed 172 species of fish from Rajmahal to Kolkata. In the districts of Darjeeling and Jalpaiguri, 127 species of fishes were recorded (Shaw and Shebbeare, 1927). According to ZSI, fishes are distributed in various habitats: 64 species for riverine, 39 species for hill stream, 4 species for exotic, 40 species for freshwater and marshy, 12 species for freshwater-cum-estuarine and 13 species for terrestrial water.

2.6.2. Status of Larger Mammlas for Conservation Concerns

Enumeration data in the last four decades in respect of larger mammals for conservation concerns in West Bengal are shown below:

Table 2-27 Population Trend of Lager Mammals

Year	Rhino	Elephant	Gaur	Tiger	Leopard
1969	87	-	-	-	-
1974	27	-	-	-	-
1978	27	150	-	-	-
1979	-	-	-	296	-
1984	-	-	-	344	82
1986	22	152	-	-	-
1989	39	175	240	361	108
1992	-	-	-	-	-
1993	45	186	425	335	107
1996	56	-	-	-	-
1997	58	230-250	550	361	-
1998	-	230-250	530-560	-	-
1999	74	327	-	365	-
2000	73	327			
2002	96	328	1180-1284	349	331
2004	121	-	-	344*	300-330
2005	-	396-446	-	-	-
2006	135	-	-	-	-
2007	-	325-375	-	-	-
2008	156	-	-	-	-
2009	160	-	2000	-	-
2010	177	647		85+*	

(Note) * Sunderbans (274) + Bux (27) = 301 in 2004, Sunderbans (70) + Buxa (15) = 85 in 2010. This remarkable decline came out probably due to the application of diffenct methodology for estimation.

(Source) Wildlife Wing Annual Reprot 2009-2010 (WBFD, 2010), Wildlife Wing Data Bank 2010 (WBFD), Wild Bengal (http://www.wildbengal.com/)

1) Rhinoceros

Indian rhinioceors (*Rhinoceros unicornis*) falls into vulnerable sepcies in the IUCN category (2011). Three old homes have been lost due to poaching and habitat disturbance in Buxa, Patlakhawa and Chapramari WS. However, the population of rhino has gone up

more than 6 times from early 1970's at Jaldapara WS and Garumara NP in the north Bengal becase of intensive protection of the animals: total 177 in 2010, consisting of 142 in Jaldapara WS and 35 in Gorumara NP.

However, the population growth in the limited protected areas has reduced available habitat and food per individual and induced intra-specific fights, aiming aggression at sub-adult males in particular. Some of these animals have in recent years moved out of their old habitat and traveled along Torsa, Neora, Chel and Teesta River; two are now living in tall grasslands on Teesta River bed and one reportedly staying in Mahananda WS. Two animals reached evern Bangladesh.

2) Elephant

Indian elephant (*Elephas maximus indicus*) is a subspecies of Asian elephant and categorized as endangered species by IUCN (2011). Elephant is very intelligent animal with about 60 year longevity, having very storng social bonds. They live in family groups headed by an adult female. Adult and sub-adult males make groups or stay in solitary, occasionally joining the family gourps. The dispersal area of elephants appears larger in the wet season than in the dry season: mean density per km^2 was 0.16 in the wet season while 0.36 in the dry season in Eastern Duars ER (Sukumar, 2003). They remember and follow the traditional migration routes basically but also learn adjusting the routes to avoid unfavorable obstructions or extending the range if suitable habitats exist.

In West Bengal, the population of elephant has increased steadly from late 1980's, reaching 647 in 2010: 529 in the north and 118 in the south. The northern population move seasonally between the Assam border in the east and the Nepal border in the west, covering the area of about 1200 km^2. A half of them, however, remain in Jaldapara WS and Buxa TR remaining mostly through a year. The population size is much less than its potential size, although they have a moderately healthy sex ratio (Sukumar, 2003). One major feature of the north population is the presence of a relatively large number of bulls (adult males).

The southern region had not had wild elephants for about last 100 years. Only few animals earlier used to arrive from Bihar (now Jharkhand) State in the west to Midnapur District during winter months and roam about in the hilly forests covering about 80 km^2 in the tri-junction of Midnapur, Bankura and Purulia Districts. During September 1987, a herd of about 30 elephants moved east-wards, crossing Kangsabati River at Lalgarh in Midnapur District and going back in December. Every year thereafter the herds visit the new ground and widen their foraging ground. In December 1992, a herd of 40 elephants came within 50 km of Kolkata. Nowadays they move in seven to eight groups further south-west to the border of Orissa State, covering the area of about 1500 km^2.

3) Tiger

Bengal tiger (*Panthera tigris tigris*) is a subspecies of tiger and categorized as endangered species by IUCN (2011). The population of tiger appears stable at around 350 from 1980's and 2000'. The latest estimation shows that the total populaitn would be 85 in minimum,

comprising of 70 in Sunderbans and 15 in Buxa; this does not mean the substancial decline of the population but rather caused by applying different methodology for the population estimate.

This animal was earlier seen in all the foothills and plain forests of the northern Bengal. They have disappeared from a region of east Teesta River upto Birpara-Falakata Road since 1990. They are distributed in forests in Apalchand Range, foothills of Kalimpong Division, Jalpaiguri Division and Wildlife II Division. The remnant population have migrated to cooler clime of Neora Valley NP and one solitary animal was recorded in Gorumara NP in 2010.

Sunderbans is known as one of the highest density area for tiger population in the world as well as only the population living in mangrove habitat. They adapt the unique habitat and take more variety of foods including fish and crab. After the Aila cyclone of May 2009, tigers have been frequently sighted in the northern part of mangrove forests. This trend generated a belief that enhanced salinity at estuary face, due to the cyclone and climate change, caused the north-ward mobility of tigers from Sunderban NP located in the south.

2.6.3. Review of Biodiversity Conservation

2.6.3.1. Protected Area System

There are 5 National Parks (NP), 15 Wildlife Sanctuaries (WS), 2 Tiger Reserves (TR) and 2 Elephant Reserves (ER). There are also internationally designated protected aeras: 1 Biosphere Reserve, 1 Natural World Heritage site and 1 Ramsar Wetland site. Apart from ERs, the protected area network covers 4,064 km^2 of forests, comprising of 34% of state forest area and 4.6% of the state geographical area.

Table 2-28 Protected Areas of West Bengal

No.	Protected Area	Area (km^2)	Notification No. & Date	Bio-geographic Zone	District
National Parks					
1.	Singalila N.P.	78.60	9057-For dt. 2.12.92	2C	Darjeeling
2.	Neora Valley N.P.	88.00	9058-For dt. 2.12.92	2C	Darjeeling
3.	Buxa N.P.	117.10	3403-For dt. 5.12.97	7B	Jalpaiguri
4.	Gorumara N.P.	79.45	1-For dt. 1.1.98	7B	Jalpaiguri
5.	Sundarban N.P.	1330.10	2867-For dt. 4.5.84	8B	South-24 Parganas
	Total	**1693.25 km^2**			
Wildlife Sanctuaries					
1.	Jorepokhri Salamander W.L.S.	0.04	1107-For dt. 11.03.85	2C	Darjeeling
2.	Senchal W.L.S.	38.88	2773-For dt. 19.8.98	2C	Darjeeling
3.	Chapramari W.L.S.	9.60	2774-For dt. 19.8.98	7B	Jalpaiguri
4.	Mahananda W.L.S.	158.04	2775-For dt. 19.8.98	7B	Darjeeling
5.	Jaldapara W.L.S.	216.51	2890-For dt. 27.8.98	7B	Jalpaiguri
6.	Raiganj W.L.S.	1.30	1901-For dt. 11.4.85	7B	North Dinajpur

No.	Protected Area	Area (km^2)	Notification No. & Date	Bio-geographic Zone	District
7.	Bethuadahari W.L.S.	0.6686	2772-For dt. 19.8.98	7B	Nadia
8.	Ballavpur W.L.S.	2.021	4655-For dt. 11.7.77	7B	Birbhum
9.	Ramnabagan W.L.S.	0.145	4345-For dt. 30.9.81	7B	Bardhaman
10.	Bibhutibhusan W.L.S.	0.64	2776-For dt. 19.8.98	8B	North-24 Parganas
11.	Chintamoni Kar Bird Sanctuary	0.07	4300-For dt. 21.10.05	8B	South-24 Parganas
12.	Sajnakhali W.L.S.	362.40	5396-For dt. 24.6.76	8B	South-24 Parganas
13.	Halliday Island W.L.S.	5.95	5388-For dt. 24.6.76	8B	South-24 Parganas
14.	Lothian Island W.L.S.	38.00	2771-For dt. 19.8.98	8B	South-24 Parganas
15.	Buxa W.L.S.	267.92	316-For dt. 24.1.86; 7588-For dt. 6.10.90 and 12-For dt. 1.1.91	7B	Jalpaiguri
	Total	**1102.1846 km^2**			
Tiger Reserves					
1.	Buxa Tiger Reserve (including WLS & NP)	Total Area: 760.87 Core Area: 459.1306 Buffer Area: 301.7394	1983 [Vide G0I's Notification No. J-11025/18/B/FRY(PT) Dt. 16.2.1983] 6027-For dt. 18.12.07	7B	Jalpaiguri
2.	Sundarban Tiger Reserve (including WLS & NP)	Total Area: 2585.00 Core Area: 1699.62 Buffer Area: 885.27	Dt. 23.12.1973 615-For/11M-28/07 dt. 17.2.09 6028-For dt. 18.12.07	8 B	South-24 Parganas, North-24 Parganas
	Total	**3345.87 km^2**			
Elephant Reserve					
1.	Eastern Duars Elephant Reserve (including BTR & WLS),	Total Area: 977.51 Core Area: 484.00 Buffer Area: 493.51	3293-For/11B-19/2000 dt. 28.8.2002	7B	Jalpaiguri
2.	Mayurjharna Elephant Reserve	414.00	3040-For.11B-19/2000 dt. 24.10.2002	6B	West Midnapur, Bankura, Purulia
	Total	**1391.51 km^2**			
Biosphere Reserve:					
1.	Sundarban Biosphere Reserve (including STR)	9630.00	1989	8B	South-24 Parganas North-24 Parganas
	Total	**9630.00 km^2**			
Natural World Heritage Site:					
1.	Sundarban N.P.	1330.10	1987	8B	South-24 Parganas
	Total	**1330.10 km^2**			
Ramsar Wetland Site:					
1.	East Calcutta Wetlands	125.00	2002	7B	Kolkota
	Total	**125.00 km^2**			

(Souce) Wildlife Wing Annual Reprot 2009-2010 (WBFD, 2010)

2.6.3.2. Law enforcement

There were only four heads of animals reported being poached in 2009/10. No elephant and gaur had been killed by poachers but one tiger, one rhinoceros and two leopards killed for five years from 2005/06 to 2009/2010. Protection of habitat and control of poaching of wild animals is being given top priority through regular patrolling on foot, elephant back, vehicles and speed boats. The protection measures are further augmented through improvement of communication network, supply of improved weapons to wildlife guards, wildlife squads, intelligence gathering, installation of watchtower at strategic points, etc. inside NPs and WSs as well as in the areas important for wildlife conservation. Since poaching is always associated with the inter-state and/or international smuggling of the wildlife products, a regular coordination between various enforcement agencies is a must to control poaching and illegal trade of wildlife products. The Wildlife Wing is actively liaising with the Wildlife Crime Control Bureau.

2.6.3.3. Habitat Improvement

As a habitat improvement programme, canopy opening in monoculture teak plantations is undertaken, followed by natural or artificial regeneration of grasses and under-planting with bamboo and tree fodder species. Plantation of indigenous grasses is being regularly done to increase the fodder base for herbivores with emphasis on rhinoceros. The fodder tree plantation in Eastern Duars ER is a key towards elephant management, being done widely for improving the fodder base of the elephants inside the forest.

These activities have been carried out in Mahananda WS, Jaldapara WS, Garumara NP and Buxa TR. Annual area coverage of grass plantation is 10 to 50 ha after pollarding the tree crop for overhead opening. Grass species planted are Dhadda, Chepti, Malsa, Madhua, Ekra (*Saccharum* sp), Nal (*Arundo donax*), Khagra (*Pharagmites karka*), Bhutta ghash (*Coix lachrymajobi*), Banspati (*Setaria* sp), Purundi (*Alpinia alughas*), etc. Grass slips raised in nurseries are planted at 1 m x 1 m spacing. Three cleanings are done in Year 1 and Year 2. In Year 4, the old grasses are cut back and control burning done in January. In Year 7, the old grasses are uprooted and the area is replanted with fresh grass slips.

In Mahananda WS, under-planting with bamboo is practiced after canopy opening of old teak and eucalyptus plantations. The bamboo species are Bhalu bans (*Dendrocalamus sikkimensis)*, Mala bans (*Bambusa nutans),* Muli bans (*Melocana baccifera),* Choya bans (*Dendrocalamus hamiltonii)* and Kalai makla *(Bambusa vulgaris).*

In Buxa TR, an innovative exercise is undertaken by encouraging grass growth on riverbeds located at the boundary of the forests to cater cattle from villages and tea gardens with the objective of reducing cattle grazing in the protected areas. Development of water holes and wetlands through soil moisture conservation works has been implemented on priority basis. Regular maintenance of fire lines is given priority to control ground fire.

2.6.3.4. Man-Animal Conflict

Major conflicts between man and animal are related to elephants in the north and south-west Bengal and tigers in Sunderbans. To a lesser extent, gaurs and leopards also cause problems at times in the north Bengal. Smaller mammals like monkeys and langoors pose difficulties to some extent at places especially in the central Bengal. The nature and issues for this subject are described in detail in Section 2.6.4.2.

Direct mitigation measures for the elephant conflict employed by the Forest Department are: erection of electric fences in the north (274 km in total), installation of watch towers on village fields, drive-off by trained elephants, chase and drive-off by experienced staff and labourers, use of lights, crackers and burning torches (*Hulla*), and sedation of problem elephants for capture and translocation. Indirect measures include enrichment of elephant habitat, veterinary care and awareness generation among the affected people.

For the tiger conflict, mitigation measures applied are: installation of nylon net fences along Sunderban TR (54 km in total), provision of trap/transportation cages, tiger guard protection gears and immobilizing equipment/drugs, training personnel, wearing face mask for forest users, and installing solar street lights in villages.

No special measures are adopted for gaur, leopard and primates, except for rescue, transport and treatment of problem animlas, since the nature of the conflicts is sporadic in time and space, being difficult to predict the pattern and handle the problem effectively.

2.6.3.5. Ecodevelopment and Community Participation

(1) Constitution and Status

The National Wildlife Action Plan of 1983, based upon a decision of the Indian Board for Wildlife in 1982, outlined the strategies and actions for wildlife conservation in the country including provision of support for people inside and in the fringe of protected areas to compensate for lost opportunities and reduce human-conservation conflict. The National Forest Policy of 1988 also mentioned about eliciting people's cooperation for conserving the biological diversity of the country. The Government of India started fund support for "ecodevelopment" in the centrally sponsored schemes for wildlife conservaaiton from 1991. West Bengal State issued the first country resolution on ecodevelopment in June 1996 for all NPs and WSs in the state. This detailed the structure and function of the Ecodevelopment Committees (EDC) and alternate livelihood modalities for the members of the committees engaged in conservation and development activities. There are at present 109 EDCs and 118 JFMCs in the state with 65,150 member households helping in protection of wildlife area of 1,755 km^2.

(2) Conferred Benefits, Strengths and Weaknesses

The EDC resolution spells out that forest products of protected areas, such as drift poles and firewoods, some NWFPs and 25% tourism revenue, will be shared with the members. Almost the entire produce from FD plantations on non-forest lands would go to them and

village-based community and individual benefit-oriented activities would be funded by the state. Modality of execution by micro planning and cost sharing are stated as also reciprocal commitment of beneficiaries towards conservation actions. The Executive Committee membership favours villagers 6-11 to 3 (3 for FD and PRI) and the Secretary is an elected villager-member. However, this community-based organization (CBO) is bereft of legal standing and entirely dependant on FD for creation and dissolution; this restricts voluntary action and spontaneity.

On the other hand, the JFMC resolution is much more restrictive. There is no mention of sharing of produce from plantations raised by FD on non-forest lands and also no provision for tourism revenue sharing. There is no mention of support to be provided for compensating lost opportunities and, therefore, no provision for micro planing, cost sharing and/or village fund management modalities. The Executive Committee membership is tilted towards outsiders at 3 to 4 (4 for FD and PRI) and one FD personnel is the Secretary of the committee. All papers are maintained by FD and the creation and dissolution of CBOs is at the pleasure of DFOs.

(3) Effects on Conservation

One of the very positive development has been building bridges and rapport between forest staff and villagers. Suspicion, distrust and confrontation are not evident over wide regions and there is mutual goodwill and fellow feeling. A direct fall-out has been safe restoration of straying wild animals from village to the wild. Habitats are also comparatively well preserved where EDC/JFMC are functioning well. Regular joint patrolling of the committee members with FD staff or participatory monitoring are not often conducted, but there exists a social fencing in many forest/protected area fringe villages to keep forest offenders at bay.

(4) Activities

To generate cooperation from the fringe area people, various schemes aimed both at the community and individual beneficiary have been undertaken with generation of alternative livelihood avenues as well as community development of these fringe areas. Organizing the below-poverty line individuals into Self Help Group (SHG) for positive livelihood generation in these communites has been one of the major successes of FD in the fringe areas. Some of the activities undertaken by the Wildlife Wing are as follows:

- Construction and maintenance of roads, bridges, culverts, jetties, watch towers and drinking water supply.
- Construction of earthen dams and sausage works.
- Construction of schools, community halls, disaster shelters and houses for forest villagers.
- Providing irrigation facilities with tube wells, digging ring wells and diesel pump sets and digging minor irrigation shallows and ponds.

- Rural electrification and solar street lights.
- Allocation of nurseries for providing seedlings to local people and various institutions.
- Establishment of eco-parks, bird watching centres and health camps.
- Vocational training on bag making, tourist guide, weaving, soft toy making, apiculture, improved agriculture practices, improved cattle rearing and vermin composting.
- Alternate livelihoods from piggery, goat rearing, poultry, etc.
- Educative tours of school children for developing awareness.

2.6.3.6. Research and Monitoring

Research has been conducted on various aspects of ecology/biology on different species, habitat requirement and socio-economic conditions of fringe villages. The Wildlife Wing conducts regular census of major wild animlas in several poprotected areas for monitoring purpose. In the mid 1990's, World Bank assisted eihgt research subjects on wildlife (elepant, rhinoceros, gaur, tiger, leopard, avifauna in wetlands, etc.) through Integrated Forestry Project (1991-96). UNDP assisted Sundarban Biosphere Reserve Project (2003-2008) helped producing a socio-economic study of villagers in Sunderbans. There were also series of studies and research conducted by outside researchers or university students mainly in Jaldapara WS, Buxa TR and Sunderban TR.

Most of the management plans for protected areas have a list of proposed research areas or subjects. Total 31 research works were permitted by the Wildlife Wing during 2009/2010. Some of the institutions that the Forest Department has received assistance are: Wildlife Instiute of India (WII), Zoological Society of India (ZSI), Botanical Society of India (BSI), Calcutta University and World Wide Fund for Nature (WWF).

Table 2-29 Examples of Research Conducted in Protected Areas of West Bengal after 2000

Subject	Institute	Area	Year
Estimate of palatable biomass with special reference to rhinoceros	Unv. North Bengal	Jaldapara WS	2003
Biodiversity conservation in North Bengal plains through landscape planning	Envirosearch	Jaldapara WS	2003
Spatio-temporal analysis of land cover and vegetative transition	Uta State Unv.	Jaldapara WS	2006-2007
Nutritive ecology of rhinoceros and role of sympatric ungulates in their spatial co-existence in floodplain grasslands	WII	Jaldapara WS	2000's
Snake survey	Expert	Jaldapara WS	2000's
Fish survey	HNAF	Jaldapara WS	2000's
Flog and toad survey	Expert	Jaldapara WS	2000's
Status and distribution of flying squirre and Chinese pangolin	ZSI	Buxa TR	2000's
Behaviour and ecology of tiger in the Indian Sunderban using GPS radio-collaring	WBFD, WII, NTCA	Suderbans TR	2010-

(Note) WII: Wildlife Institute of India, HNAF: Himalayan Nature & Adventure Foundation, ZSI: Zoological Society of India, NTCA: National Tiger Conservation Authority.
(Source) Jaldapara WS Management Plan 2007/08-2016/17, Tiger Conservation Plan for Buxa TR 2011-, Wildlife Wing Annual Reprot 2009-2010 (WBFD, 2010).

2.6.3.7. Captive Animal Facilities

The Forest Department is faced with the problem of rescue and rehabilitation of wild animals. Contol of straying incidence of tigers in Sundarbans, rescuing of leopards from tea gardens, capture of problem animals from urban areas and returning them to the wild are the routine work of the Wildlife Wing.

To ameliorate man-animal conflict in the urban scenario, the Wildlife Wing maintains a rescue squad at a transit facility for rescued wild animals in Salt Lake. The squad maintains a well-publicised telephone number and responds to any call from the general public in respect of problem/distressed animals in/around the Kolkata metropolis. Other territorial divisions also perform similar functions within their designated jurisdictions. Rescued animals are temporarily housed at rescue centres and generally returned to the wild after proper veterinary treatment, but some of them are handed over to mini-zoos. There are 17 such facilities over the state, including deer parks, recognized by the Central Zoo Authority.

Table 2-30 Numbers of Rescued Animals in West Bengal (2009/10)

No.	Species	Number	No.	Species	Number
1	Turtle	2656	16	Wild Boar	9
2	Tortoise	1891	17	Pangolin	6
3	Bird	641	18	Hog Deer	5
4	Snake	384	19	Mongoose	5
5	Civet	138	20	Tiger	4
6	Monkey	65	21	Leopard Cat	4
7	Langur	56	22	Otter	3
8	Leopard	21	23	Porcupine	2
9	Spotted Deer	20	24	Bison	2
10	Jungle Cat	16	25	Gharial/Crocodile	2
11	Monitor Lizard	11	26	Dolphin	2
12	Fishing Cat	10	27	Red Panda	1
13	Elephant	10	28	Serow	1
14	Fox/Jackal	9	29	Himalayan Black Bear	1
15	Barking Deer	9		**Total**	**5984**

(Souce) Wildlife Wing Annual Reprot 2009-2010 (WBFD, 2010)

2.6.3.8. Conservation Education and Awareness

There are 10 Nature Interpretation Centres established at various NPs, WSs and different towns to facilitate nature education and awareness generation for the general public. Various awareness programmes are conducted through film shows, slide shows, workshops, nature camps with the help of NGOs, panchayats and local educatonal institutions. Publicity materials on various conservation themes in the form of leaflets, booklets, brochures, posters and stickers are distributed during events and programmes

2.6.4. Challenge for Biodiversity Conservation

2.6.4.1. Decrease of Wildlife Habitat

One of the major threats to biodiversity in West Bengal is habitat decrease, having taken place by human intervention and change in land use pattern due to demographic pressure. Large-scale conversion of natural habitats, such as for agricultural lands, road networks, railways, army bases, power lines and human settlements, has caused loss and fragmentation of habiats and corridors for wild animals, decline in several species and change in indigenous flora/fauna. Natural forests had been deteriorated through excessive resource exploitation by increasing forest fringe people and plantation industry/workers. However, there is no significant decrease of forest area or wildlife habitat due to deliberate human activities in the recent decades; because there have been a few cases of large-scale encroachment, deforestation or development for non-forest use.

On the other hand, inside protected areas in the north, suitable wildlife habitat providing quality forage ground for large herbivores, such as rhinoceros, gaur and elephant, has been decreasing due to several natural and artificial causes. Large tracts of woodland have been washed away by intensive river flows and floods in Buxa TR, Jaldapara WS and Mahananda WS. Many river beds are presently extensive riverine forests with colonizing tree species. Old teak plantation does not provide forage ground to herbivores as they grow forming mono-type closed forests. Maling bamboo, which is indigenous species, flourishes in the northern hills and changes the flora, followed by deterioration of species richness of the fauna.

2.6.4.2. Increase of Man-animal Conflict

This is the major issue for wildlife conservaiotn in West Bengal as the human population increases, the wildlife population increases and the suitable wildlife habitat becomes limited. Significant staff time has to be spent to deal with incidents of the conflict, disrupting all the normal activities of local department staff.

Most of the damages for persons, livestock, village huts and crops are made by elephant (93 % in 2009/10), followed by gaur, tiger and leopard. In the past nine years from 2002/03 to 2010/11, the number of persons killed/injured by elephant/tiger increased 3.0 times, livestock killed/injuried 102.2 times, huts damaged 2.6 times and the area of crops damaged 1.2 times (2.2 times from 2003/2004). Accordingly, the amount of ex-gratia paid for compensation increased 6.5 times, although the unit cost for each damage type also increased from time to time. In 2010/11, the total amount of compensation reached Rs. 43.5 million. Persons killed/injured and crops damaged occupy 85% of the total amount for the nine years.

On the other hand, there were 20 heads of animlas killed for retaliatory by people for five years between 2005/06 and 2009/10: eleven elephants, eight leopards and one gaur. These numbers are higher than those killed by poachers during the same period.

Table 2-31 Damage and Compensation for Man-animal Conflict in West Bengal
(2002/03 - 2010/11)

Year	Person killed/ injured		Livestok killed/ injured		Hut damaged		Crop damaged		Total
	No.	Comp. (Rs)	No.	Comp. (Rs)	No.	Comp. (Rs)	Ha	Comp. (Rs)	Comp. (Rs)
2002-03	173	2,298,011	4	1,850	1,787	915,797	4111.4	3,480,408	6,696,066
2003-04	148	1,887,051	0	0	1,547	604,833	2183.2	4,164,466	6,656,350
2004-05	179	1,237,477	60	3,700	2,258	422,965	3089.4	917,405	3,691,164*
2005-06	147	2,740,758	36	36,000	2,850	1,931,851	3764.3	8,220,505	12,929,114
2006-07	258	3,288,381	154	20,600	3,011	1,622,140	3556.0	3,951,829	8,882,949
2007-08	303	5,749,309	75	25,045	4,091	2,571,769	3723.2	7,952,723	16,298,846
2008-09	367	7,769,984	296	117,330	4,259	3,765,192	3358.2	14,313,615	25,966,121
2009-10	457	9,519,518	244	150,400	3,491	4,446,072	3546.2	14,960,553	29,076,543
2010-11	524	12,652,620	409	261,913	4,566	5,698,563	4830.5	24,851,886	43,464,982
Total	2,556	47,143,108	1,278	616,838	27,860	21,979,182	32,162.4	82,813,391	153,662,136
		30.9%		0.4%		14.4%		54.3%	100.0%

(Note) Most of the damages are derived from elephant but also including tiger. The figures include backlog cleared during the year.
* Including compensation of Rs.1,109,618 for unknown damage.
(Source) Wildlife Wing Data Bank 2011 (WBFD)

Table 2-32 Damage and Compensastion for Man-animal Conflict in West Bengal (2009/10)

Damage / Compensation	Elephant	Tiger	Gaur	Leopard	Primates	Total
i) Wild animal death*	9	0	4	4	26	43
ii) Human death	82	7	4	3	0	96
iii) Human injury	278	4	22	13	52	369
iv) Livestock injury	190	14	10	30	2	246
v) Hut damage	3470	0	20	0	0	3490
vi) Crop damage (ha)	3370	0	150	0	0	3520
vii) Ex-gratia paid (Rs. lakh)						
a) Human death/injury	93.15	2.50	4.60	3.80	0.50	104.55
b) Livestock death/injury	1.40	0.02	0.03	0.04	0	1.49
c) Hut damage	44.45	0	0	0	0	44.45
d) Crop damage	140.60	0	9.60	0	0	150.2
Total paid (Rs. lakh)	279.60	2.52	14.23	3.84	0.50	300.69
(%)	93.0	0.8	4.7	1.3	0.2	100.0

(Note) * Only by accident and retaliatory killing.
(Souce) Wildlife Wing Annual Reprot 2009-2010 (WB, 2010)

(1) Elephant

Elephant generates the most serious conflict in both the north and the south-western regions. Lone bulls or their small groups (*maljuria*) linger on in small forest patches and multiply crop damage. The crop depredation occurs mostly from dusk to night fall and more crops are damaged rather than consumed. Not only crops but also village huts are destroyed and livestock and human beings are injured or killed.

In the north, the areas affected are proximity of plain forests of Jalpaiguri District and foothills of Darjeeling District. The range is from Sankosh River (on Assam border) in the

east to Mechi River (on Nepal border) in the west, making the affected area about 1200 km^2 in total. Elephant herds return to Eastern Duars ER during two crop harvest seasons: maize from May to June and paddy from December to January. In addition, elephant-train accident is a unique but serious problem in this region as the railway passes through the elephant range: 13 elephants (plus six gaurs) were dead by the train accidents for five years from 2005/06 to 2009/10.

In the south-western, elephants cause devastation over a large area from the border of Jharkhand in the north to Orissa in the south, making the affected area about 1500 km^2 in spanning six districts in the state: namely Purulia, Bankura, West Midinapur, East Midinapur, Bardhaman and Birbhum. Elephant herds usually come to the region in September to raid paddy crop and depart by the end of March. Fragmented forests comprised of Sal (*Shorea robusta*) coppice and associates provid day time shelter for elephants. Nearby villages provid foods in lush fields of paddy, wheat and potato and water bodies for drinking, bathing and frolicking.

(2) Tiger

Tiger conflicts are related to forests and villages in the proximity of mangrove forests in Sunderbans and the affected area is about 90 km^2. The high degree of commotion among villagers is due to deliberate man killing in the forest and village entry. The victims are fisherman, honey collectors and woodcutters. In some forest fringe villages, tigers enter for unknown reasons and kill livestock before their detection. Crowd frenzy causes injury to both the animals and the human beings. Since 2001, however, there is no record of man killing by tiger in any Sunderban village due to the department effort to tackle with the problem.

(3) Gaur

Gaur (*Bos gaurus*) has proliferated the population upto 2,000 heads in 2009, which is 8.3 times more than that of 20 years ago, due to absence of natural predators and non-occurrence of any bovine epidemic. Gaur causes sporadic problems in villages and tea gardens abutting forests in Jalpaiguri (mostly Alipurduar Subdivision) and Coochbehar Districts. Some animals occasionally stray into crop fields and bamboo groves. Panic reaction of the animals due to the crowd hostility often results in serious injury to the animal and villagers. Chemical sedation of excited gaur is always a problem and physical removal from remote areas causes transportation hazard.

(4) Leopard

Leopard (*Panthera pardus*) do not pose any problem on their own except in few cases of livestock lifting from forest or tea garden fringe villages/settlements and in rare cases of attack on humans. Most of the conflicts arise due to chance that tea leaf pluckers encounter with mother leopards nursing her new siblings in tea bushes. These incidents occur in a tea

garden belt extending from the Teesta River to the Kaljani River but most common around Nagrakata-Birpara-Hashimara sectors in the north.

(5) Primates

Common langoor (*Presbytis entellus*) and Rhesus macaque (*Macaca mullatta*) sometimes cause trouble with people and inflict injuries on children and women in particular. These incidents are common in non-forested range, particularly in Kolkata and other cities in Howrah, Hooghly, Nadia, Birbhum and Bardhaman Districts in the central.

2.6.4.3. Lack of Basic Information on Biodiversity

Conservation of wildlife and forest biodiversity requires a better and deep understanding of flora/fauna, ecoystems and the relevant surrounding aspects. In the state, there is a paucity of information available on ecological and socio-economic issues in respect of the protected areas. Although a series of studies have been conducted for various subjects, there has been no systematic attempt made to identify and categorize need-based information on biological, ecological, socio-economic and cultural aspects. There are also little networking and no mutual support agreements with reseach/scientific institutes; thus, research arrangement is mostly ad hoc and individual study basis. No institutional setup and lack of resouces for research works would be some of the reasons for little achievement in the research field.

2.7. West Bengal State and India

Area of West Bengal is 88,752 km2 and extends from the southern coastal areas up to the north Himalayan mountain region of 3,000 m above sea level. The topography and climate are varied. The annual average rainfall ranges from 900 mm to 5,000 mm. According to preliminary census in 2011, population is 9,135 million and the average population density is 1,029 people / km2. Except Union Territory, West Bengal has one of the highest population densities in India as shown in the table right. The table blow shows other demographic feature of West Bengal.

Table 2-33 Area, Population, Population Density and Population Growth Rate of West Bengal

Year	2001		2011	
	West Bengal (% of India)	India	West Bengal (% of India)	India
Area (sq.km)	88,752 (2.7%)	3,287,240	88,752 (2.7%)	3,287,240
Population (pers.)	80,220,000 (7.8%)	1,028,737,436	91,350,000 (7.5%)	1,210,193,422
Density (pers/sq.km)	904	325	1,029	382
Growth Rate (%)	21.56	21.34	13.93	17.64

Source: Census2001 & Census 2011

Table 2-34 Various Indicators in West Bengal

No.	District	Geographical Area (km^2)	Population (person)	Density (person/km^2)	Urban Population (%)	Rural Population (%)	Scheduled Tribes: ST (%)	Scheduled Castes: SC (%)	Forest area per capita (ha/ person)	Forest cover ** (%)	HDI* (2001)	Poverty rate * (%)
1	Darjeeling	3,149	1,609,172	511	32.34	67.66	12.69	16.09	0.20	38.23	0.65	18.22
2	Jalpaiguri	6,227	3,401,173	546	17.84	82.16	18.87	36.71	0.18	28.75	0.53	40.33
3	Cooch Behar	3,387	2,479,155	732	9.10	90.90	0.57	50.11	0.14	1.68	0.52	24.69
4	Uttar Dinajpur	3,140	2,441,794	778	12.06	87.94	5.11	27.71	0.13	0.32	0.51	26.61
5	Dakshin Dinajpur	2,219	1,503,178	677	13.10	86.90	16.12	28.78	0.15	0.36	0.51	26.52
6	Malda	3,733	3,290,468	881	7.32	92.68	6.90	16.84	0.11	0.54	0.44	33.29
7	Murshidabad	5,324	5,866,569	1,102	12.49	87.51	1.29	12.00	0.09	0.15	0.46	46.55
8	Birbhum	4,545	3,015,422	663	8.57	91.43	6.74	29.51	0.15	3.50	0.47	47.01
9	Nadia	3,927	4,604,827	1,173	21.27	78.73	2.47	29.66	0.09	0.31	0.57	25.62
10	Burdwan	7,024	6,895,514	982	36.94	63.06	6.41	26.98	0.10	3.94	0.64	18.25
11	Bankura	6,882	3,192,695	464	7.37	92.63	10.36	31.24	0.22	21.53	0.52	59.09
12	Purulia	6,259	2,536,516	405	10.07	89.93	14.87	18.29	0.25	14.00	0.45	71.44
13	Hooghly	3,149	5,041,976	1,601	33.47	66.53	4.21	23.58	0.06	0.10	0.63	17.42
14	Howrah	1,467	4,273,099	2,913	50.36	49.64	0.45	15.42	0.03	0.00	0.68	4.46
15	Kolkata	185	4,572,876	24,718	100.00	0.00	0.21	6.01	0.00	0.00	0.78	11.17
16	Purba Medinipur	4,295	4,417,377	1,028	8.29	91.71	0.06	14.47	0.32	12.14	0.62	19.78
17	Paschim Medinipur	9,786	5,193,411	531	11.90	88.10	14.87	18.05				
18	24-Parganas (N)	4,094	8,934,286	2,182	54.30	45.70	2.23	20.60	0.04	1.08	0.66	12.01
19	24-Parganas (S)	9,960	6,906,689	693	15.73	84.27	1.23	32.12	0.15	41.54	0.60	23.97
	West Bengal	88,752	80,176,197	903	27.97	72.03	5.50	23.02		**13.38**	0.61	27.02%
									Poverty rate in Rural Area of West Bengal			31.85%
	All India	3,287,240	1,028,737,436	325	27.80	72.20	8.20	16.20		**20.60**	0.59	26.10

: Top 5 or fifth from the bottom of each indicator
Source : Census 2001
* : Year 2001 data, West Bengal Human Development Report 2004
** : STATE FOREST REPORT 2008-2009, West Bengal Forest Department

Regarding forest, West Bengal is the fourth largest state in India with 11,879 km^2 of forest which is 13.38% of coverage. The figure and table below show the area of each District, National Forest area (Recorded Forest Area), and the proportion of forest in percentage.

Although the state's forest area is relatively small compared to many other states, the absolute number of forest dependent people is very high. Scheduled tribes typically living in forested landscapes comprise 5.5% of the population (4 million).

The number of villages having forest as a recorded land use is 8,571 involving 8 million people and about 0.6 million ha of forest. The number of directly forest dependent people is estimated to be 8.3 million, about 10% of the total population of the state, the majority of the forest dependent people are poor. Much of the rest of the state's rural population depends to a significant extent of forest for their livelihood security, particularly for fuel wood, fodder and non timber forest products such as sal leaves and so on[4].

Next table shows 5 top districts which have recorded forest land. Rural population in those districts is over 80 % except Darjeeling and the percentage of ST/SC and poverty rate also relatively high. These facts may prove forest fringe population is poor and majority is in ST/SC groups.

[4] The Creation of West Bengal's Forest Underclass An Historical Institutional Analysis of Forest Rights Deprivations, IPPG Discussion Papers, Number Fifty One, December 2010

Table 2-35 Important Indicators in Top 5 District of High Forest Land Rate

District	Area (km^2)	Population (person)	Density (pers./ km^2)	Urban Popu-lation (%)	Rural Popu-lation (%)	ST (%)	SC (%)	% of Recorded Forest Area	Rural Poverty Rate* (%)	Urban Poverty Rate* (%)	Ave. Poverty Rate** (%)
Darjeeling	3,149	1,609,172	511	32.34	67.66	12.69	16.09	38.23	19.66	15.21	18.22
Jalpaiguri	6,227	3,401,173	546	17.84	82.16	18.87	36.71	28.75	35.73	61.53	40.33
Bankura	6,882	3,192,695	464	7.37	92.63	10.36	31.24	21.53	59.62	52.38	59.09
Purulia	6,259	2,536,516	405	10.07	89.93	14.87	18.29	14.00	78.72	6.47	71.44
24-Parganas (S)	9,960	6,906,689	693	15.73	84.27	1.23	32.12	41.54	26.86	8.50	23.97
West Bengal	88,752	80,176,197	903	27.97	72.03	5.50	23.02	13.38	31.85	14.86	27.02
All India	3,287,240	1,028,737,436	325	27.80	72.20	8.20	16.20	20.06	23.62	26.10	26.10

: Top 5 or fifth from the bottom of each indicator
Source : Census 2001
* : Year 2001 data, West Bengal Human Development Report 2004
** : STATE FOREST REPORT 2008-2009, West Bengal Forest Department

Several areas in West Bengal State are designated World Natural Heritage sites. Hotspots, the presence of rare and endangered species, make the state a very distinctive.

To summarise the above, it is considered that the position of West Bengal in India is characterised unique and distinctive because of 1) higher rural area poverty rate, 2) lower forest cover, and 3) very high population density, than the national average and 4) the biodiversity is very high.

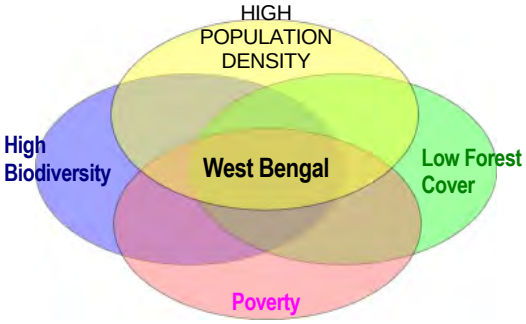


Figure 2-4 Position of West Bengal in India

Chapter 3 Demand and supply of forest products

West Bengal is forest deficient state and it has the highest density of population. The productivity of plantations both in the North in the forested tracts is not optimal because of the sheer human and livestock pressure on such forests. The annual production from forest areas has gone down substantially because of ban on felling of mature natural forests in North Bengal and ban on felling of manmade plantations in the hills beyond 1000m. The execution of West Bengal Social Forestry Project had added a lot of growing stock in non-forest areas of the State .But unfortunately the bulk of production of such plantations in non-forest areas has gone to meet requirements of pulp and paper, sawmilling, and veneering industries.

The information used in the study is secondary, taken from different reports and pervious studies of department namely Annual Reports of 2002, 2003 & 2004, Wood Balance Study 2004, Forest Survey of India 2003 & 2004 etc. Projection made in the study of consumption of wood & wood products for the year 2010 and 2020 are made on basis of several parameters, which are stated as follows.

- Population increase & rate of urbanisation,
- Increase & distribution of wealth.
- The price of fuel-wood & other wood products vis-à-vis other Fuel and products,
- The physical availability of wood for the subsistence sector.

3.1. Demand – Supply Analysis of Fuel-Wood

Fuel-wood is main source of domestic energy in the state of West in the rural areas of West Bengal. The annual consumption of fuel wood used in family excluding institutional sector & cremation in different districts in rural & urban areas is shown in the table below. Out of total annual fuel wood consumption of 22.56 million m^3, the consumption of fuel wood in rural areas is 22.05 million m^3 which is about 97.76 % against only 2.24 % in urban areas which comes to 0.506 million m^3. The consumption of fuel wood in rural areas is indicative of extensive fuel-wood consumption. The table illustrates the consumption patter in different districts of the state:

Table 3-1 Annual consumption of fuel wood (Household sector)

Sl. No.	District	Per Capita Consumption		Total Consumption (in m^3)		
		Rural	Urban	Rural	Urban	West Bengal
1	Darjeeling	0.908	0.125	985201	65109	1050310
2	Jalpaiguri	1.085	0.006	3037302	3623	3040925
3	Coochbehar	0.254	0.444	572205	100124	672329
4	Malda	0.086	0.004	262235	964	263199
5	W. Dinajpur	0.011	0.021	14366	4129	18495
6	Nadia /Murshidabad	0.623	0.043	5455040	73590	5528630

Sl. No.	District	Per Capita Consumption		Total Consumption (in m^3)		
		Rural	Urban	Rural	Urban	West Bengal
7	Bankura	0.2	0.107	591312	25173	616485
8	Midnapore	0.342	0.02	2950611	20219	2970830
9	Burdwan	0.075	0.004	326046	10290	336336
10	Purulia	0.387	0.016	882358	4084	886442
11	Birbhum	0.1	0.118	275406	30477	305883
12	Hooghly	0.22	0.002	737580	3375	740955
13	Howrah	0.015	0.008	31806	17229	49035
14	24-parganas (N)	0.289	0.009	1179431	43643	1223074
15	Kolkata	0	0.001	0	4573	4573
16	24-Pargana (S)	0.749	0.085	4358644	93627	4452271
17	U. Dinajpur	0.184	0.019	395113	5595	400708
West Bengal		**0.325**	**0.061**	**22054656**	**505824**	**22560480**
% Share of Rural and Urban Consumption of Fuel Wood				***97.76***	***2.24***	

Source: - Forest Survey of India 2004
Note: Excluding consumption for cremation purpose

Total Consumption of Fuel Wood = 22.56 million m^3
Total Rural Consumption of Fuel Wood = 22.05 million m^3
Total Urban Consumption of Fuel Wood = 0.506 million m^3

The wood balance study reflects that 86.05 % of the total fuel wood consumed is obtained by collection from non- forest sources and 13.95 % from forest areas. While in urban areas the proportions are 96.12% & 3.88 respectively.

Against the present estimated consumption of 22.56 million m^3 of fuel wood, the supply from the Govt. forests is 0.270 million m^3 , from non-forest areas 2.00 million m^3 , 0.045 million m^3 supply from imported timber and 0.200 million m^3 off cuts from saw mills Thus a total available supply of fuel wood is about 2.515 million m^3. This leaves an estimated deficit of 20.045 million m3 of fuel wood during 2004-2005

These figures when projected to 2010 & 2020, the deficit balances are marginally on the increase, though the supply position is expected to increase at an average rate of 0.0520 million m^3 per year for the first six years up to 2010 and at the rate of 0.055 million m^3 per year for the next ten years beyond 2010.

Table 3-2 Consumption-Supply of Fuel-Wood in West Bengal Wood Balance Estimated

Sl No.	Source	2004 (million m^3)	2010 (million m^3)	2020 (million m^3)
1	Recorded outturn from Government Forests.(2001-02,2002-03,& 2003-2004) (Average of 3 years)*	0.27	0.302	0.355
2	Estimated supply from Private Forests**	2	2.25	2.7
3	Estimated Supply from other sources (Imported timber)***	0.045	0.05	0.06
4	Estimated supply of Saw Mill off-cuts****	0.2	0.224	0.265
	Total Availability of Fuel Wood	**2.515**	**2.826**	**3.380**
	Total Consumption of Fuel Wood	**22.56**	**22.87**	**23.39**
	Balance (-)	**-20.045**	**-20.046**	**-20.012**

Source:- Forest Directorate & WBFDC Ltd*
** *Central Empowered committee constituted by the Supreme Court of India, page no-13.*
*** *Commissioner of Customs (Port) Customs House, Kolkata.*
(Total outturn of imported timber during 2003-04= 4500000 m3/ 1000000 = 0.45 million m3 and 10% wastage of imported timber = 0.045 million m3)
**** *calculated @ 10% wastage of total supply from private Forests*

3.2. Demand Supply Analysis of Wood (Other than Fuel Wood)

During this study, wood used in important industries like Paper mills, Matchwood, Pulpwood, for rural electrification and other local uses such as making furniture, house building, transport, plywood &agricultural implements etc has been investigated. The investigation clearly depicts that the per capita annual consumption of wood is highest for agricultural implements among the four specified ones in the rural areas of the state of West Bengal. On the other hand in urban sector, the per capita annual consumption of wood is primarily for the purpose house and furniture construction. The urban sector consumes the bulk of wood in all cases excepting the purpose of making agricultural implements. The per capita annual consumption of wood for different district and the state as a whole has been brought out in the following table.

Table 3-3 Annual consumption of Wood (other than Fuel Wood)

Sl. No.	District	Per Capita Consumption		Total Consumption		
		Rural	Urban	Rural	Urban	West Bengal
1	Darjeeling	0.022	0.021	23870	10938	34808
2	Jalpaiguri	0.045	0.046	125970	27848	153818
3	Coochbehar	0.031	0.024	69835	5412	75247
4	Malda	0.027	0.026	57977	6773	64750
5	W. Dinajpur	0.034	0.046	14366	9046	23412
6	Nadia /Murshidabad	0.0255	0.016	77754	2891	80645
7	Bankura	0.052	0.033	236413	120274	356687
8	Midnapore	0.034	0.018	100522	4235	104757
9	Burdwan	0.038	0.025	82621	6460	89081
10	Purulia	0.027	0.032	117374	64309	181683
11	Birbhum	0.0385	0.038	87778	5843	93621
12	Hooghly	0.039	0.041	284707	28307	313014
13	Howrah	0.0132	0.009	31513	8435	39948
14	24-parganas (N)	0.007	0.028	8480	60299	68779
15	Kolkata	0.057	0.014	48972	67889	116861
16	24-Pargana (S)	0.0215	0.008	125114	8717	133831
17	U. Dinajpur	0	0.003	0	13718	13718
West Bengal		**0.0286**	**0.0253**	**1493266**	**451394**	**1944660**
% Share of Rural and Urban Consumption of Wood				***76.79***	***23.21***	

Source: - Forest Survey of India 2004

Total Consumption of Wood = 1.944 million m^3
Total Rural Consumption of Wood = 1.493 million m^3
Total Urban Consumption of Wood = 0.451million m^3

Similarly the state is also deficient in wood. This is in spite of the fact that large quantum of timber is imported into the state for consumption in different wood-based industries. Against the present estimated consumption of 1.944 million m3 of wood, the supply from the Government forests is 0.127 million m3, from non-forest areas 0.56 million m3, 0.045 million m3 supply from imported timber and 0.1 million m3 seizure timber. Thus a total available supply of fuel wood is about 1.237 million m3.

These figures when projected to 2010 & 2020, the deficit balances are marginally on the increase, though the supply position is expected to increase at an average rate of 0.0420

million m^3 per year for the first six years up to 2010 and at the rate of 0.0475million m^3 per year for the next ten years beyond 2010.This leaves an estimated deficit of 0.707 million m3 of fuel wood during 2004-2005 and the projection indicates that this may rise to 0.915 million m3 and 1.152 million m^3 in 2010 and 2020

Table 3-4 Consumption-Supply of Wood (other than Fuel-wood) in West Bengal

(Timber, Poles and Pulpwood)

Sl No	Source	2004 (million m^3)	2010 (million m^3)	2020 (million m^3)
1	Recorded outturn From Government Forests (2001-02,2002-03 & 2003-04)*	0.127	0.142	0.167
2	Estimated supply from Private Forests**	0.56	0.63	0.74
3	Estimated supply from other sources (Imported Timber)***	0.45	0.5	0.6
4	Estimated supply from seized timber****	0.1	0.012	0.015
Total Availability Wood		**1.237**	**1.284**	**1.522**
Total Consumption of Wood		**1.944**	**2.199**	**2.674**
Balance (-)		**0.707**	**0.915**	**1.152**

Source:-

* *Outturn of timber and firewood (Average =379937/3 =126646 m3 /1000000 = 0.1266 million m3 or say= 0.127 million m3)*

** *Central Empowered Committee constituted by Supreme Court of India, Page-13*
(Total outturn of imported timber during 2003-04= 4500000 m3/ 1000000 = 0.45 million m3 and 10% wastage of imported timber = 0.045 million m3)

**** *As per seizure list of last three years.*

Chapter 4 Examination of Alternative Renewable Energy Source

4.1. Conventional Energy scenario in West Bengal

West Bengal, whose power deficit is far lower than the national average, is tapping new avenues such as renewable energy to bridge the gap between demand and supply of electricity. The state currently has close to 4,000 mw of power projects in various stages of development and these are likely to be commissioned in the 12th Five-Year plan, according to Dr. G.D. Gautama, Principal Secretary, Department of Power & Non-Conventional Energy Sources, West Bengal.

In West Bengal, the thermal-hydel mix is very adverse, it is 97:3, while in the region it is 74:26 which is much better but we are taking steps to correct this.
In the case of rural electrification, around 99.6 per cent of the villages are already electrified. In the area of households, the success rate is not high; it is close to 51 per cent.

Besides poor power penetration, rural consumers in West Bengal have been complaining for years about unstable supply - frequent outages and poor voltage. About 70% of the state's rural consumers do not always receive power at 230 volts, but even this is being addressed through better engineering.

Reportedly, Electricity has still not reached most of the villages in around Salboni in Paschim Midnapore. The region is mainly arid with low levels of vegetation since water is a scarce supply. Hand pumps are present but most of them do not function. The villagers live under impoverished economic and social condition.

Electricity is yet to penetrate many villages in Jalpaiguri, Bankura, Murshidabad, North 24 Parganas and even in a comparatively developed district like Burdwan, which boasts about highest rice yield per acre in the country

Affordability of conventional energy sources is also a highlighting factor. A short survey has been accomplished in the rural areas of southern part of West Bengal namely Basanti and Gosaba islands of Sundarban, South 24 Parganas. The study has reported that the countryside of that part of India is extremely deprived. Price of electric commodities and forest artifacts are substantially elevated with respect to the low wage rate of the inhabitants.

Households in rural West Bengal are highly dependent on firewood as their main source of energy. The prevailing view is therefore that, when faced with shortages of firewood in the village commons, such households, and especially the women in them, have to spend more and more time searching for firewood and eventually settle for poorer-quality biomass such as twigs, branches and dry leaves.

Starting in the early 1970s, it was widely held that West Bengal would soon face a severe firewood shortage. Demand for firewood, which together with animal dung and agricultural residue is one of the main cooking fuels used by rural households, was thought to be leading to widespread forest degradation. The degradation, it was believed, would soon be

so severe that households would face a firewood "famine" reinforced this sense of an impending firewood crisis by arguing that compared to relatively richer urban households, it was harder for poor rural households to switch to costly non-biofuels such as kerosene and liquefied petroleum gas. Meanwhile, the rural livestock population remained stagnant, thereby offering little prospect of dung for fuel providing a cheap alternative, and a largely ineffective government program to introduce more energy-efficient cooking stoves was doing little to reduce the demand for firewood These dire predictions conjured up images of households - and in particular women - having to spend endless hours searching for firewood, and eventually settling for poorer quality biomass such as twigs, branches, and dry leaves.

Twenty years after the first warnings of a crisis, rural households were still found to use firewood as their main cooking fuel. Moreover, households had not been forced to switch to poorer-quality biomass. In fact, the percentage of rural households using logs, a superior type of biomass, was found to have increased over time. Also, fewer households were found to be collecting firewood from the village commons, and more were collecting firewood from trees grown on their own lands.[1]

(Source : 1. Renewable energy scenario and disregarded petition of rural populace of an Indian island: A critical survey and concept of an inexpensive artifact Tamal Ghosh, Saswata Nath, Tanmoy Chakraborty, Pranab K Dan Department of Industrial Engineering & Management, West Bengal University of Technology: International Journal of Energy and Environment (IJEE), Volume 2, Issue 3, 2011

Details provided by Dr. G.D. Gautama, Principal Secretary, Department of Power & Non-Conventional Energy Sources, West Bengal to Sandeep Menezes, Project Monitor Weekly, dated November 30, 2009

India's Firewood Crisis Re – Examined By Urvashi Narain, Resource For The Future, Washington D.C, Shreekant Gupta, Neetu Chopra, and Supriya Singh, Delhi University)

4.2. Renewable Energy Scenario in West Bengal

West Bengal is the first state where a solar project was connected to the grid. This was a 2-mw project that was recently commissioned by our own company, Green Energy Corporation, under the department of power. Out of the 20,000 mw target announced in the Solar Mission recently, the government is looking to bring a large chunk of these projects to West Bengal. But there are issues such as regulatory, project cost and subsidy both from the Centre and state governments. Currently, solar cost is Rs.17.5 per unit but, according to the

[1] Renewable energy scenario and disregarded petition of rural populace of an Indian island: A critical survey and concept of an inexpensive artifact Tamal Ghosh, Saswata Nath, Tanmoy Chakraborty, Pranab K Dan Department of Industrial Engineering & Management, West Bengal University of Technology: International Journal of Energy and Environment (IJEE), Volume 2, Issue 3, 2011
Details provided by Dr. G.D. Gautama, Principal Secretary, Department of Power & Non-Conventional Energy Sources, West Bengal to Sandeep Menezes, Project Monitor Weekly, dated November 30, 2009
India's Firewood Crisis Re – Examined By Urvashi Narain, Resource For The Future, Washington D.C, Shreekant Gupta, Neetu Chopra, and Supriya Singh, Delhi University)

Government of India's draft policy, distributors will get Rs.3.5 per unit while the rest will come as subsidy, which will be paid by the Centre and state governments in the ratio of 80 per cent and 20 per cent. The government has set up, West Bengal Renewable Energy Development Agency, in the year 1993, to promote Renewable Energy technologies and create an environment conducive to their commercialisation through innovative projects. The Agency, popularly known as WBREDA, has its corporate office at Kolkata.

Since inception, WBREDA has implemented a large number of programmes related to Solar Energy, Wind Energy, Mini & Micro Hydel, Bio-energy, etc. Today, West Bengal is one of the leading states in the country in respect of utilisation of Renewable Source of Energy. More than hundred thousand families of West Bengal are now using electricity derived from Sun, Biomass, Wind etc. In the rural areas of West Bengal, 150 thousand families are using Bio-Energy for cooking purpose.

WBREDA helps the State Government, Panchayets, Municipal Bodies, and NGOs on all matters relating to promotion of alternative sources of energy. WBREDA has a group of experts in the field of renewable sources of energy who are responsible for formulation, design and proper implementation of the projects related to renewable sources of energy. WBREDA has a programme to assist other States in respect of formulating project proposals on Village Electrification through Renewable Energy Sources, setting up of Energy Education Park Students from abroad visit projects of WBREDA in connection with their research activities etc.

Today, the State of West Bengal is implementing one of the largest programmes on Renewable Energy in India covering a broad spectrum of energy technologies like Solar Thermal, Solar Photovoltaic, Wind Turbines, Improved Chulhas, Biogas Plants, Biomass Gasifier, Small Hydro and Tidal Power etc. These activities are, mainly, taking place in areas where it is very difficult, cost prohibitive or almost impossible to supply power through conventional grid.

The estimated potential of important Renewable Sources of Energy in West Bengal is furnished below:

Table 4.1 Estimated potential of Renewable Sources of Energy in West Bengal

Sl No.	Sources/Systems	Potential
1	Biogas Plants (Nos.)	0.7 Million
2	Improved Chulhas (Nos)	6.6 Million
3	Biomass Based Power	200 MW
4	Solar Energy	20 MW per sq. K.M.
5	Wind Energy	115 MW
6	Small Hydro Power	250 MW
7	Tidal Power	100 MW
8	Urban & Industrial Wastes	250 MW

In West Bengal, there are experiences of renewable source of energy activities through WBREDA, and now the 5 activities are on the preparation. The detailed experience and preparation of activities are shown in following table.

Table 4.2 Achievements of WBREDA and the Activities on the Pipeline in West Bengal

No.	Activities	Remarks
Achievements		
1	No. of villages electrified through Solar PV	124 Nos.
2	No. of villages electrified through Biomass Based power generation.	6 Nos.
3	No. of villages electrified through Biomass Based power generation.	More than 10,000
4	No. of Solar Street Lights Working	More than 700
5	No. of Biogas Plants installed.	1.10 lakhs.
6	No. of Improved Chulhas installed.	2.70 lakhs.
7	Small Hydel Power Plants under installation.	3 MW
8	Small Hydel Power Plants (Renovation).	4.8 MW
On the Preparation		
1	Tidal Power Plants	3 MW
2	Biomass Based Power Plants	1 MW
3	Wind Power Generation	2 MW
4	Small Hydel Power Generation	12 MW
5	Solar PV Power Generation	400 MW

***Source**: Materials of Website For Power Sector In West Bengal: WBREDA*

The Beneficiaries receive Renewable Energy Systems by grant.

a) For remote areas where the Govt. of India has identified that, it is difficult to extend conventional electricity grid; users avail grant / subsidy in the tune of 90% of system cost. Such areas are few; so far 350 nos. of mouzas in Darjeeling, Jalpaiguri, Cooch Behar, Bankura, Purulia, Paschim Medinipur, 24 Parganas (North & South) districts. Total no of uses, approximately 50,000 nos. of families mainly, they are getting electricity from Solar Photovoltaic (SPV) Systems.

b) Subsidy in the tune of 30% of system cost has been provided for users; all over the state for Solar PV systems [for light, fan, TV] and for Biogas Systems [National Biogas and Manure Programme or NBMP]. Here system use for rural areas [for solar PV] is 95% and for urban areas is 5%. For Biogas, it is 100% for rural areas.

c) Power Plant Based Rural Electrification programme:- All these power plants [Solar PV, Biomass Gassifier, Wind, Micro Hydel] are located in rural areas and consumers are rural.

d) Solar PV Power Plant in Urban Areas:- Three nos. plants have been installed in urban areas at institutions:-

    i) Gurudas College, Kolkata
    ii) Sir Nripendranath High School, Kolkata
    iii) Heritage Engineering College, Kolkata

e) Solar PV Street Lighting Systems

    i) In rural areas:- 8251
    ii) In urban areas:- 600

Table 4.3 Micro Hydel Power Generation System in other states of India include

Micro Hydel Power Generation System at	KW
Thulappaly (Western Kerala)	20
Pathanpara (Kannur District in Kerala)	5
Jubbal (Himachal Pradesh)	50
Anini Power House (Arunachal Pradesh)	2 x 50
Sonipat (Haryana)	5
Bhailonath (Madhya Pradesh) installed by IIT, New Delhi	8

(Source: 1 Community based Rural Micro Hydro Projects in India

2. Micro Hydro Wheel Turbo Pump For Canal Based Irrigation & Generation of Electricity in Indo – Gangetic Plains

3. Small Hydro Power Development in the Himalayan Region. A Brief History and a Few Case References by P.D Nair)

4.3. Action Plan of the State:

In order to reduce emission by about 20% in the power sector in the state of West Bengal by the year 2020-21 and 30% by the year 2030-31 the state need to produce 2,000 MW of renewable power by the year 2020-21 and 3,000 MW of renewable power by the year 2030-31. Alternatively, the state can buy a portion of renewable power from other states to reduce its emission intensity. Realistically and considering the technological break through in the Solar Energy sector in next 5 – 6 years time, it may not be difficult for the state to produce 2,000 MW of renewable power by the year 2020-21 and additional 3,000 MW of renewable power by the year 2030-31. However, the Solar Power which is the main renewable energy source of the state has to be harnessed at large scale. The renewable power potential of the state has been indicated in the first part of this report. It is clear from the table that renewable power potential of the state without considering Solar Energy is only 1250 MW. Assuming 80% of such power potential could be achieved and also assuming that 50% of the potential is achievable by the year 2020-21, the Renewable Power installation may touch 500 MW by the year 2020-21 and additional 500 MW by the year 2030-31. This is, however, exclusive of Solar Power where the state has significantly high potential. In order to keep the target of emission reduction the state has to generate 1600 MW Solar Power in the next 10 years and 2400 MW of Solar Power in the next decade.

The grid parity of Solar power is expected to come only in the year 2015. As such, till such time Solar Power Plant will run on subsidy. Under the State Climate Action Plan the state of West Bengal may generate 250 MW of Solar power till 2015 and 750 MW of Solar power beyond 2015 and up to 2020. During next decade the state of West Bengal may plan for 1500 MW of Solar power installation. The State will generate additional 100 MW power from Solar Roof Top by the year 2020 and 300 MW from Solar Roof Top by the year 2030-31. The Solar Water Heating programme will also play a significant role in reducing demand. This works out to be 300 MW_e by the year 2030.

Table below shows the Installation programme of RE technologies in the state up to 2020-21 and 2030-31.

Table 4.4 Planned installation programme of RE technologies

Sl.No.	Source:	2020-21	2030-31
1.	Wind Farm and other Small Wind system.	150 MW	250 MW
2.	Biomass	150 MW	200 MW
3.	Small Hydel	200 MW	100 MW
4.	Waste to Energy	50 MW	100 MW
5.	Roof Top Solar PV	100 MW	200 MW
6.	Solar Farm	1000 MW	1500 MW
7.	Solar Water Heater.	150 MW (Electrical equivalent)	250 MW (Electrical equivalent)
8.	Other Solar Energy programme like Solar Street lights, Replacement of Bill Board, Community lights, etc. and off grid system.	200 MW	400 MW
	Total:-	**2000 MW**	**3000 MW**

***Source**: State Climate Action Plan: New & Renewable Energy, Government of West Bengal*

4.4. Cost – Benefit Performance

Solar Photovoltaic Power Plants

Capital Cost	:	Rs.18,00,00,000 per MW.
Maintenance and Manpower cost	:	Rs.36,00,000/-
Therefore, Total Cost	:	Rs.18,36,00,000/-

The generation in terms of Kilo watt hour (KWh) of the total 19 number of Solar Photovoltaic power plants in West Bengal from the year of their installations to 2011 is

320 sunny days x 6hrs. x 67,988 KWp (Kilowatt peak) x 15% (Plant Load Factor) = 1,95,80,544 KWh

The Levelised cost of generation = Rs.16.72/KWh,

The revenue generation till 2011 = Rs.16.72x1,95,80,544KWh = Rs.32,73,86,696

Hence, the Benefit – Cost ratio = 32,73,86,696/18,36,00,000 = 1.8 : 1

Small Hydel Power (SHP)

Capital Cost	:	Rs.6,50,00,000 per MW
Maintenance and Manpower cost	:	Rs.52,00,000/-
Therefore, Total Cost	:	Rs.7,02,00,000/-

The first SHP in West Bengal was established in 2001 generating 2.2 MW of electricity per year

Therefore, the total generation of electricity from the year of installation till 2011 is

= 365 days x 12 hrs. x 2.2 MW x 1000 x 10 x 85% (Plant Load Factor) = 8,19,06,000 KWh

The Levelised cost of generation = Rs.2.89/KWh

The revenue generation till 2011 = Rs.2.89x8,19,06,000KWh = Rs.23,67,08,340

Hence, the Benefit – Cost ratio = 23,67,08,340/7,02,00,000 = 3.4 :1

Biomass

Capital Cost	:	Rs.4,50,00,000
Fuel, Maintenance and Manpower Cost	:	Rs.1,35,00,000/-
Therefore the Total Cost	:	Rs.5,85,00,000/-

The first Biomass Energy Plant in West Bengal was established in 2003 generating 3 MW of electricity per year

Therefore, the total generation of electricity from the year of installation till 2011 is

= 365 days x 10 hrs. x 3 MW x 1000 x 8 x 20% (Plant Load Factor) = 1,75,20,000 KWh

The Levelised cost of generation = Rs.4.25/KWh

The revenue generation till 2011 = Rs.4.25x1,75,20,000KWh = Rs.7,44,60,000/-

Hence, the Benefit – Cost ratio = 7,44,60,000/5,85,00,000 = 1.27 :1

Wind Energy

Capital Cost	:	Rs.5,50,00,000
Maintenance and Manpower cost	:	Rs.55,00,000/-
Therefore, the Total Cost	:	Rs.6,05,00,000/-

The first Wind Energy Plant in West Bengal was established in 2002 generating 2.2 MW of electricity per year

Therefore, the total generation of electricity from the year of installation till 2011 is

= 180 days x 8 hrs. x 2.2 MW x 1000 x 9 x 10% (Plant Load Factor) = 28,51,200 KWh

The Levelised cost of generation = Rs.3.90 / KWh

The revenue generation till 2011 = Rs.3.90 x 28,51,200 KWh = Rs.1,11,19,680

Hence, the Benefit – Cost ratio = 1,11,19,680/6,05,00,000/- = 0.18 : 1

In the Wind Energy Plant, Benefit is less than Cost because of the following factors:

Period of availability of sufficient wind speed to generate electricity in West Bengal is very small

Conversion efficiency from wind to electricity is also low

(Note: Figures of Capital Cost, Levelised cost of generation etc. obtained from WBREDA)

Average consumption of Renewable Energy by source

In case of **rural electrification**, done through Renewable Energy Sources [Solar PV, Biomass Gasifier, Wind, SHP], the loads as used by rural households are:-

(1) Light: 5,9,11 W Compact Fluorescent Lamps [2-4 nos. in each household]
(2) Fan: 10 W Direct Current Fan
(3) TV: 60 W color TV or now 20 W made in China color TV

Generally working hours for these electrical loads are:- 5/6 hours in the evening, daily

4.5. Case Studies

4.5.1. Smokeless Chulha (Kitchen range)

Smokeless chulha installed by WBREDA in Bondanga village in Birbhum district, in West Bengal, with the help of Technical Back – Up unit, University of Kalyani, is a very simple device having no sophistication, low cost and hundred percent indigenous technology. It is an improved version of the traditional chulha and is thus not alien to the village environment. Usual U shaped chulha with little modification fixed on the floor is connected to the chimney pipe (made out of asbestos and pottery) with a cowl on the top (erected through roof) by a tunnel pipe (made of asbestos and pottery). The smoke generated is carried by tunnel pipe and emitted in the air above man height (10 feet) through the chimney at the roof top. One major advantage with the smokeless chulha is that same fuels used in traditional chulha can be used in it. Heat generated in Smokeless Chulha is very high so it cooks faster compared to traditional chulha and saves fuel. As it saves twigs and leaves for cooking indirectly it saves collection time as well as cooking time. Mostly women and children are engaged in cooking and collecting fuels. Hence, this technology has definite qualitative effect on the female and children in the family. For those households who depend on purchased fuel for them the new technology saves money.

Figure 4.1 Smokeless Chulha

Figure 4.2 Traditional Chulha

Table 4.5 Total Daily Savings In Traditional Fuel Due To Non Traditional Technology

	Season	
	Rainy	Other
Twigs (Kg)	72	30
% of daily twigs consumption	21	11
Leaves (Kg)	24	10
% of daily leaf consumption	25	14

***Source**: State Climate Action Plan: New & Renewable Energy, Government of West Bengal*

The survey was carried out, by the Department of Economics, Jadavpur University, in 107 households in Bondanga, selected through simple random sample method from 535 households (population). Each household reported their savings of firewood due to the use of improved chulha. Based on the reported figures by the households, the average household savings figure was derived. It is observed that 21 % of daily twigs consumption in traditional chulha is saved by installation of smokeless chulha, in rainy season. This 21 % is equivalent to 72 kilograms of twigs. Similarly in other seasons 11 % of daily twigs consumption equivalent to 30 kilograms is saved.

Also, 25 % of daily leaf consumption i.e 24 kilograms of leaves are saved in the rainy season by the usage of smokeless chulha and 14 % of daily leaf consumption equivalent to 10 kilograms of leaves are saved by sing smokeless chulha.

- **Cost Benefit Analysis for Smokeless chulha**

Cost benefit analysis for Smokeless chulha becomes rather difficult in Bondanga village, the major fuel for cooking wood is collected at zero private cost and the qualitative benefit accruing to the users due to savings in collection time can hardly be quantitative. However, a very simple attempt is made by considering the market price of wood saved as benefit life time of 3 years for the components discount rate of 10% and depreciation rate 20%.

The Benefit – Cost Ratio was 1.72. Hence, Cost – Benefit justifies installation of smokeless chulha from a private individual's point of view.

(Source: 1. Solar Lanterns And Other New Technologies In Rural Areas An Evaluation of Performance Market And Entrepreneurial Potential Prepared By: Department of Economics, Jadavpur University, 1995)

4.5.2. Solar Lantern

Solar Lantern technology is an advanced technology which uses solar energy during day time for lighting purpose at night. External getup of a solar lantern resembles the standard hurricane and petromax. It is an electronic device. Dry cell battery, special type of high frequency electronic inverter and special tube lights are the important components of the lantern. It is connected to a solar panel by a cable. The solar cells in the panel charge the battery using the day light. At night the inverter takes the energy from battery to light the lamps.

Figure 4.3 Traditional Chulha

WBREDA has introduced the solar lantern programme at Bondanga village in Birbhum district in West Bengal, to make efficient energy using devices available to tribal poor in order to make them aware of the new device for efficient lighting with a view to improve upon the quality of life.

■ **Cost Benefit Analysis on Solar Lantern**

The cost benefit analysis has been conducted as a means of decision making process. The cost benefit analysis for solar lantern has been derived in terms of the benefits actually and effectively accruing to the user. On the basis of the following assumptions the Benefit cost ratio was calculated for solar lantern based on the following assumptions:

i) Market price (without subsidy) for solar lantern is Rs.4,500/- of which the module price is Rs.1,900/-. With subsidy initial cost is Rs.2,000/- only including the module
ii) Life time for charger module is 20 years
iii) System replacement needed (without module) every fifth year
iv) Maintenance of the module involves no cost. Even if any annual maintenance contract system is introduced, 10% of the lantern cost may be set aside for any minor repair period. Being an electronic device and compact system no major repairing is needed
v) For a private individual savings in kerosene is equivalent to 1.17 litre per week
vi) Average price paid in actual for kerosene by the consumer in Bondanga is the subsidised price
vii) Benefits accrued in terms of economic activities generated and indirectly by way of savings in kerosene lamp and accessories purchase from time to time have been appropriately quantified at market price
viii) Annual inflation rate of 8% of all items have been assumed
ix) For calculating net present value discount rate has been assumed to be 10% equivalent to market rate of interest

The Benefit Cost ratio was 1.67. Hence, Cost – Benefit justifies installation of solar lantern from a private individual's point of view.

The use of Solar Lantern has improved the quality of life of people. Prior to the introduction of Solar Power based supply systems as the night fell in they used to end their daily routine by going to bed. Now with help of Solar Lantern outdoor social activities have increased. Besides outdoor social activities, indoor social activities in the form of family meet in the evening has led to intergenerational exchanges in the court yard.

4.5.3. Biomass Gasifier Power Plant

The gasifier in Gosaba, in South 24 Parganas of West Bengal is one of the largest Biomass Gasifier plant in India for village electrification with a capacity of 500KW.

The gasifier at Gosaba was installed by WBREDA with the help of MNES (Ministry of Non Conventional Energy Sources), Government of India. The plant and machinery was supplied and installed by ANKUR a private sector manufacturer of Baroda. The transmission and distribution network was set up by WBREDA. Gosaba Rural Energy co-operative under the catalytic role of WBREDA has been vested with the responsibility of

administering the Gasifier plant. At the generation level the operation responsibility has been contracted out to ANKUR.

Figure 4.4 Biomass Gasifier Plant

- **Cost Benefit Analysis of the gasifier project**

Project Appraisal through formal cost benefit analysis is important in decision making process. An area's implementation capacity is a critical pre requisite for project success. This would depend on the gasifier project on two things: first the sufficiency of the resource and actual the observable costs and benefits generated by the project. The cost benefit analysis for the gasifier project was calculated in terms of economic benefits accruing to the beneficiaries. The Benefit Cost ratio was calculated on the basis of the following assumptions:

i) The initial project cost of the gasifier plant is Rs.100,000/-
ii) Life time of the plant is 15 years
iii) Operation and maintenance cost is the actual cost needed for the transmission line maintenance, maintenance of the power plant, labor, fuel cost (evaluated at the market price) etc.
iv) The benefits are effectively generated in terms of the savings in electricity bill and increase in business hours of the commercial units. No inflation has been assumed

The Benefit Cost ratio was 1.62. Hence, Cost – Benefit justifies installation of Biomass gasifier project from a private individual's point of view.

Prior to gasifier power to save on kerosene, solar power or diesel power the night time activities were almost non existent. After the introduction gasifier power the household activities in the form of night study, games, socialisation, entertainment through TV watching has changed quality of the village life. Households are aware of the benefits and are ready to go for longer hours of service from gasifier.

(Source: 2. Socio- Economic Evaluation and Sustainability of Gasifier Plant at Gosaba, Sponsored By: WBREDA, Prepared By: Department of Economics, Jadavpur University, 2000)

4.6. Recommendations

1. It is observed from RGGVY (Rajiv Gandhi Grameen Vidyutikaran Yojana) statistics that almost majority of the villages in Bankura district in West Bengal is yet to be electrified. Almost 36% of villages in Medinipur (Purba & Paschim), 30% of villages in Purulia, 10% of villages in Dakshin Dinajpur have not been electrified. Therefore, these are the potential areas where renewable energy sources could be propagated for electrification. However, we should not forget that the locations in other districts of West Bengal which are still un – electrified will also be potential areas for Renewable Sources of Energy.

2. Adequate Solar Radiation is experienced in the districts of Purulia, Bankura, Bardhaman and Birbhum. Hence, locations in these districts could be potential for Solar Photo – Voltaic Plant. Solar Lanterns could be introduced in the un – electrified villages in these districts to improve the quality of life of the people. However, one should keep in mind that that the Solar Power Plant is land demanding. For instance, 1 MW Solar power plant needs 4 acres of land (in case of crystalline silicon) and 8 acres of land (in case of thin film Solar cells). So the necessary arrangements for land in the right proportion should be made before putting up a Solar Photo – Voltaic Plant.

3. Conversely, Biomass Plants do not require land as much as that needed for Solar Plants. However, it needs wooded territories from which input ingredients of the Biomass plant could be derived. It is observed that the forest ranges in Ayodhya Hills in Purulia district would be good locations for Biomass plants. Moreover, Kakrajhor, Balivasa, Belpahari etc. locations in Paschim Medinipur, Chhatna, Saltora, Indpur etc. in Bankura, Baikunthapur Forest Range in Jalpaiguri could be ideal locations for Biomass plants in West Bengal. The number of saw mills in these districts are quite many (Ref: State Forest Report 2008-2009), spread over different locations from where the input ingredients are obtained. Biomass plants could be set up at Bardhaman district also where lot of rice husk is obtained as ingredient to such plants, for instance in Khandagosh Block area where there are certain villages yet to be electrified.

4. Small Hydel Power Plants are also not land demanding. The Khola waterfalls in Kurseong, in Darjeeling district could be used to set up such type of plant. The Turga dam and lake formed by River Bamni, in Ayodhya Hills in Purulia district, the cascading water falls in Susunia Hills formed by River Gandheswari are best locations where a 2 MW, SHP could be put up. National Hydel Power Corporation (NHPC) at Farakka Power Plant has a capacity to set up a 5 MW small hydel power plant.

5. Wind Energy Plants could be rightly located on the seashores, as wind is the source of power generation. In West Bengal we could mainly think of two districts viz. Purba Medinipur and the South 24 Parganas for setting up such types of plants.

Seashores at Purba Medinipur at the outskirts of Digha, Junput etc. and that in Sagardeep, Frazergunge etc. could be good locations for 2 MW Wind Energy Plants.

But, it has also been observed that the number of windy days in West Bengal, for viability of a 2 MW power plant is much less as compared to states like Tamil Nadu, Kerala, Maharashtra, Gujarat etc. and hence the efficiency to run the Wind Energy plant reduces so much that the feasibility of Wind Energy Plant in West Bengal is questionable. Thus, Wind Energy Plants in West Bengal is not recommendable.

6. Different forms of Kitchen Ranges could be used to save fuel and energy by bringing about a reduction in fuel wood consumption. For example, Smokeless Chulha cooks faster than the traditional chulha and saves fuel and money to those households who use them.

   Solar cooker is a device, which uses solar energy for cooking, and thus saving fossil fuels, fuel wood and electrical energy to a large extent. However, it can only supplement the cooking fuel, and not replace it totally. It is a simple cooking unit, ideal for domestic cooking during most of the year except during the monsoon season, cloudy days and winter months.

   Box type solar cookers: The box type solar cookers with a single reflecting mirror are the most popular in India. These cookers have proved immensely popular in rural areas where women spend considerable time for collecting firewood. A family size solar cooker is sufficient for 4 to 5 members and saves about 3 to 4 cylinders of LPG (Liquefied Petroleum Gas) every year. The life of this cooker is up to 15 years. This cooker costs around Rs.1000 after allowing for subsidy. Solar cookers are widely available in the market.

Chapter 5 Project Rationale

5.1. Forest and Biodiversity Conservation in West Bengal

5.1.1. Project Rationale in Forestry Sector

West Bengal is one of the few forest deficient states of India. Forest cover of the State based on the interpretation of satellite data by Forest Survey of India (FSI) is 12994 sq. km. which is 14.64%[1] of the geographical area. In terms of forest canopy density classes, the state has 2987 sq. km of very dense forest, 4644 sq. km. of moderately dense forest and 5363 sq.km of open forest. The forest cover including the forests created outside the recorded forest area is 15.68%[2] of the geographical area as assessed by the GIS Cell of the West Bengal Forest Department in the year 2006 on the basis of Satellite Imagery procured from National Remote Sensing Agency (NRSA).

Forests are primarily concentrated in three geographical regions of the State namely North Bengal (Darjeeling and Jalpiguri), South West Bengal (Bankura, Paschim Medinipur, Purulia, Burdwan) and Sunderbans (24-Parganas South).

FSI report of 2009 has reflected the decadal change in forest cover on the positive side and has clubbed West Bengal in the group of states of India achieving a gain up to 0.5%. Only three states of India like Jharkhand, Meghalaya and Mizoram have achieved a gain of more than 0.5%. Considering the pressure on forests, this is a good sign that efforts put in during last two decades on forest protection side have started paying dividends.

Looking at the status of growing stock in forest and non-forest areas, this state accounts for a total growing stock of 137 million m^3 out of a total growing stock of 6098 million m^3 in the country. This works out to 2.25%. This is reasonable considering that the state has 2.70% of the total geographical area and 1.54 % of the total recorded forest area.

Scientific management of forests started in 1864 in the Darjeeling hills and over the years the entire tract of forests have been brought under Working Plans prepared on the guidelines issued by the Ministry of Environment of Forests. Because of the sheer pressure of population density and livestock in the state, forests had shrunk in different tracts and the growing stock depleted. The demands on forests got more acute because of mushrooming of sawmills and other wood–based industries which generally peaked from the decade of sixties. The period of sixties and seventies of this century saw advent of production forestry and this was intensified through implementation of the recommendations of the National Agriculture Commission (1976). Eighties have been marked by the extension of forest

[1] India State of Forest Report 2009, FIS: FSI figure is based on interpretation data of Indian Remote Sensing (IRS) P6 LISS-III sensor having a spatial resolution of 23.6m x 23.6m

[2] State Forest Report West Bengal 2009- 2010: Forest cover was estimated by using IRS satellite P6 AWiFS (Advanced Wide Field Sensor) / 2006 for interpretation. This has spatial resolution of 56 m x 56m.

practices beyond the frontiers of the recorded forest through the externally aided project of Social Forestry by the World Bank. This project though was intended to reduce pressure on forests through augmentation of supplies from non forest areas failed in its objective as most of the produce was diverted to paper/plywood industries through the operation of market mechanism. West Bengal Forestry Project (WBFP) also funded by the World Bank in addition to its afforestation/reforestation component had a Joint Forest Management (JFM) component to reinforce the results of JFM initiated during the earlier World Bank (WB) project. In fact the 1987 orders of the State Government on sharing of usufructs with the identified beneficiaries of Arbari socio-economic project heralded the phase of intensifying the movement of JFM in different parts and this was spread in the years of the WBFP, Forest Protection Committees of West Bengal were awarded Paul Getty award a coveted one in the field of conservation. Large tracts of degraded Sal coppice forests have been resuscitated through this movement during the years 1992-93 till this date. There is a clear need to carry forward this movement to stabilise the frontiers of forests and add to the existing growing stock in such forests to meet the requirements of fuel wood / small wood of the fringe communities and enhance their livelihood through enhanced NTFP production from the forests. West Bengal has been considered a pioneer in JFM in India. However, further boost in the process is required in order to consolidate the gains achieved for the benefit of the forest and the forest dependent people living in the fringes of forests. The basic rationale behind the proposed project is to strengthen and consolidate JFM in the State with some new interventions to firm up the mutual gains to the people and to the resource base.

5.1.2. Project Rationale in Biodiversity Conservation Sector

Since mid eighties the state has good track record in conservation of wildlife in its protected area network but for the flagship species of tiger. The state has put in about 34% of forest area in its protected area network and in spite of intense pressure of population; it has been possible to religiously guard the frontiers. Most of protected areas are being managed by management plans written up under the guidelines of the MoEF. The state has also developed its own Strategy and Action Plan for Conservation of Biodiversity and its actions are guided by the provisions of this and guidelines enshrined in the National Forest Policy, 1988.

State’s management interventions have attributed to the growth of population of large herbivore like One-horned Rhino, Indian Elephant and Gaur. These in many areas have led to higher incidence of man-animal conflict.

EDCs are spread in all the protected areas and the State Government resolution have to a great extent motivated to protect both animal and plant resources of protected areas.

Capabilities of managing protected areas of officers and staff have been enhanced through execution of India Eco-development Project in BTR and UNDP Sub-programmes in Jaldapara WLS and Sunderbans.

5.1.3. Examination of the Project Components

The project components which were originally proposed in the DPR are examined and regrouped to deal with existing problems and by considering the similarity of their nature as well as the simplification of the project components. The components are thus regrouped in 4 categories which are indicated as follows:

- Component 1 : Afforestration and Allied Works
- Component 2 : Biodiversity Conservation
- Component 3 :Community Development
- Component 4 : Institutional Capacity Development

Component 1: Afforestation and Allied Works is the main component of the Project. Forest cover of the country according to India State Forest Report 2009, as per 2007 assessment is 690,899 km2 which is 21.02 % of the geographical area of the country. However, that of West Bengal is 14.64 % which is 6 % below than the national average. Moreover, it is far from the national target of 33% by 2020.

On the other hand, as described in Chapter 3, 20 million m^3 of fuel-wood and 0.915 million m^3 of other than fuel wood are in short supply and a huge demand-supply gap exists in the West Bengal State. Therefore, expansion of forest cover area by afforestation activities is pressing task.

Component 2: Biodiversity Conservation: India is recognised as one of 12 mega-diverse countries in the world, having very rich biodiversity, ranking the country in terms of species number, ninth in higher plants, birds and amphibians, seventh in mammals, fifth in reptiles and first in fishes. Plant species of India occupies 11.3% of the world species and the animal species occupies 7.3% of the world total (MOEF, 2009). At the same time, the number of threatened species is ranked on the ninth in the world with 246 species for plants and 413 species for animals (IUCN, 2009).

The State of West Bengal has also diverse flora and fauna reflecting the variety of topography, climate and ecosystems. This is only the state in India having both coastal and alpine ecosystems, of which significance of conservation values is further recognised internationally. Sunderban National Park in the coast is inscribed as a Natural World Heritage site and the northern-top hills compose of the biodiversity hotspot of Himalaya. Therefore, in spite of its small area occupying only 2.7% of the country, the state has 53% of bird species recorded in the country, 47% of mammals, 32% of reptiles and 21% of

angiosperms with many internationally endangered species like Asian elephant, tiger, fishing cat, pygmy hog, Ganjetic dolphin, Indian vulture and gharial.

Therefore, it can be mentioned that conservation of wildlife and biodiversity in West Bengal shall contribute not only to the country but also to the world. The state has developed the protected area network, composing sites of well-preserved forest ecosystems and high biodiversity, with total area of 4,064 km^2; which occupies 4.5% of the state land and 34% of the state forest lands. This shall justify investment of more resources for the protected areas and their surroundings for biodiversity conservation.

Component 3: Community Development is closely-correlated with Component 1 and 3; it is indispensable component of the Project. Poverty level in rural area of West Bengal is 31.85 % and majority of them are forest fringe population as discussed in Chap 2. This poverty rate is higher than national average of 27.09%. Generally said that mostly poor, are dependent on forests for meeting their subsistence and livelihood needs. Therefore, this poverty combined with high population density in the region leads to increase pressure on forest resource and forest degradation.

These degraded forests consisted of low quality scattered forest lands mostly of Sal coppice, surrounded by densely populated villages with 20-25 million people. These degraded forests were subjected to heavy stress from the local people (and their cattle) that used to enjoy, in the past, various types of concessions, particularly collection of forest produce for meeting their daily subsistence needs of fuel and small timber and uncontrolled grazing rights for their cattle. The owners of these private forests had neither the wherewithal nor the resources to manage these resources properly on a sustainable basis, being always driven by short term survival needs. A rigid imposition of state control involving withdrawal of concessions enjoyed by the villagers from the forest owners resulted in large scale depletion even to the extent of complete decimation of these forests in some cases, encroachment of forest lands which were neither properly demarcated or their status legally settled.

These factors ensued into a relentless battle of attrition often assuming violent shape and the relation between the forest official and the local people turned into one of bitter animosity and mutual distrust. As a result, forest in these regions soon became a zone of conflict between the government and the local people. Accordingly, the forestry perspective during the decades of sixties and seventies have been conditioned by a number of concerns, the most important being denudation of tree cover both inside and outside of forest reserves. Realisation, albeit slowly, came to the forestry administration, planners and policy makers that solution of the problem of unabated erosion of forest resources would hardly be achieved by rigid enforcement of law and order alone, but the same would have to be sought against a much broader perspective involving suitable policy adjustment and priority

reallocation so as to make forestry more meaningful to the rural communities who constituted 70% of the total population of the state.

The problem of deforestation, however, is not only endemic in the state of West Bengal or to the other state of the country but throughout the developing world. Despite some improvement in arresting the forest loss, the fact remains that vast tracts of forests are subjected to serious depletion by the impoverished people and their famished cattle. Ironically, the perpetrators of this damage are themselves victims of such destruction. The reasons were identified as land hunger for a growing population and meeting the requirements of modernisation and industrialisation to meet the rising aspiration of the people. However, this explanation is too simplistic and superficial.

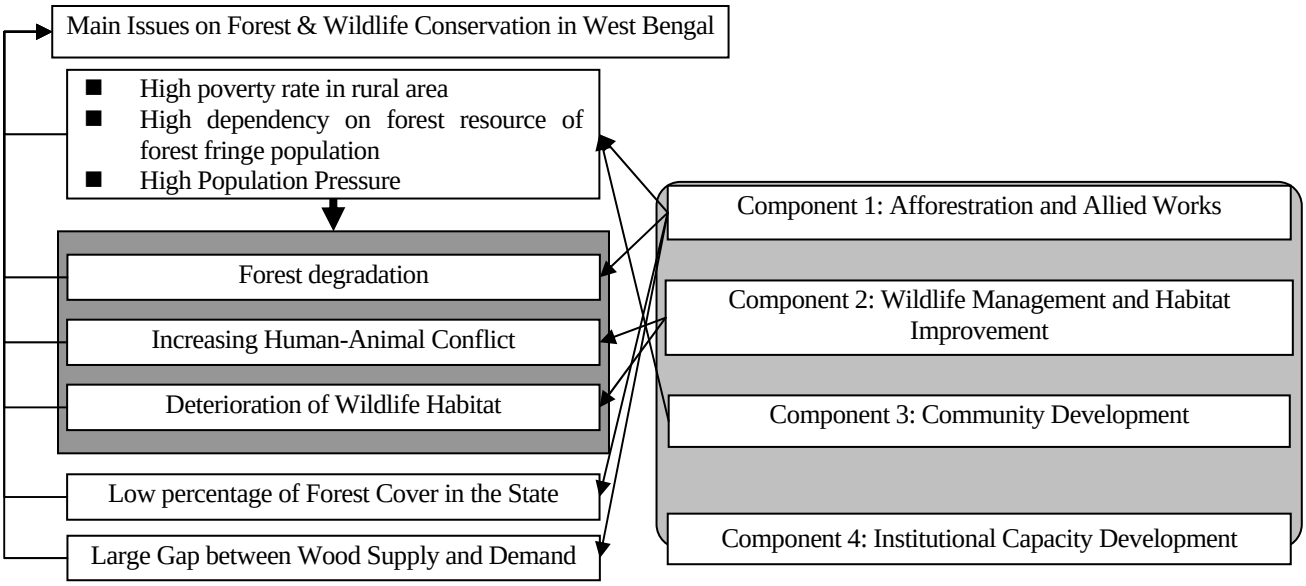
According to past experience and lesson leant in West Bengal, uncontrolled deforestation reflects the societies' inability to redress some of the harsh social injustice afflicting the people, especially the lack of employment, income, entitlement and access to productive resources and all that implies livelihood and livelihood security of indigent forest dependent people generally belonging to the traditionally economically handicapped class. Disastrous consequences of such social injustice in forestry are appearing in the degradation of the resource.

Consensus was reached that destructive pressure on forests can hardly be expected to abate, unless suitable strategies are developed to provide economic benefits to the people who live near the forests and depend on it for their subsistence.

For implementing the project there will be necessity to restructure the organisation at the project management level and field level to efficiently execute the works related to the project. Some amount of relocation of offices and staff to facilitate close supervision and monitoring and additional facilities may have to be created to support the project program efficiently. There will be need for some additional equipment and facility etc. A few vehicles will also be necessary after relocation of some staff for project implementation. Moreover, for all of necessary activities for smooth and effective implementation of the Project mentioned above, it is necessary for central and frontline forest officers and JFMC/EDC members to develop their capacity. Those kinds of activities are grouped as the Component 4 Institutional Capacity Development.

Moreover, since the Project will be the first project financed by JICA for West Bengal Forest Department, it is highly preferable to hire international consultant to support smooth realisation of the Project. Therefore, Consulting Services shall be added.

The relations between existing problems and the constitution of the project component can be summarised as follows.



Source: JICA Survey Team

Figure 5-1 Relations between Components Determined and Problems Identified

5.2. Compliance with Govt. Policies and strategies

- ***National Forest Policy of 1988***

The State does not have a State Forest Policy. All its actions in the Forestry sector are guided by the provisions of the policy.

- ***National Forestry Action Programme***

The National Forestry Action Programme integrates elements from its State Forestry Action Programmes, involves co-ordinated Centre-State strategic Planning for implementing sustainable forest resource conservation, management and development with well-defined inter-sectoral linkages that blend with the national development.

The State's action programme has been integrated into this national programme and therefore, the State follows the guidelines of this action plan in letter and spirit.

As far as forest management is concerned the country is a party to the ***'Principles for a Global Consensus on the Management, Conservation and Sustainable Development of all Types of Forests***' West Bengal being an integral part of India always has these principles in mind while drawing up schemes/ projects in this sector for managing and developing its forest resources.

In the field of conservation of wildlife and biodiversity, the state is guided by the provisions of the ***National Forest Policy, 1988***. Other State policies/ strategies include:

➢ ***National Wildlife Action Plan***

This plan stresses on the following issues:

- Ecological security and in situ conservation
- Peoples' support for wildlife
- Effective management of protected areas
- Conservation of wild and endangered species and their habitat
- Control of poaching and illegal trade in animals and plant species
- Conservation awareness and education

➢ ***State Biodiversity Strategy and Action Plan***

This was prepared under the National Biodiversity Strategy and Action Plan (NBSAPs). This plan is managed under the jurisdiction of the Environment Department of West Bengal and it has identified desirable actions covering different sectors. Action points related to the forestry and biodiversity conservation are;

- Setting of State-level Biodiversity Board
- Stepping up of conservation efforts in representative biodiversity rich areas like Buxa Tiger Reserve like Buxa Tiger reserve like Buxa Tiger Reserve, Neoa Valley National Park, Gorumara National Park and other major forest areas of North Benga.
- Protection of the coastal biodiversity
- Building up of biodiversity data-base for each district
- Commercially attractive and incentive-based conservation of medicinal plants
- Phased conversion of Dhupi and Teak monoculture in Darjeeling Himalayas

5.3. Compliance with International Conventions

Government of India has a fairly large number of International Treaties and Conventions and the country also has contributed to framing of such documents. Conservation of forest and biodiversity related international conventions are;

➢ ***CITES (Convention on International Trade in Endangered Species)***

CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival.

➢ ***United Nations Framework Convention on Climate Change (UNFCCC)***

The United Nations Framework Convention on Climate Change is an international environmental treaty produced at the United Nations Conference on Environment and

Development (UNCED), informally known as the Earth Summit, held in Rio de Janeiro. 154 nations signed the UNFCCC that upon ratification committed signatories' governments to a voluntary "non-binding aim" to reduce atmospheric concentrations of greenhouse gases with the goal of "preventing dangerous anthropogenic interference with Earth's climate system."

- ***World Heritage Convention - Convention Concerning the Protection of the World Cultural and Natural Heritage***

The 1972 Convention concerning the Protection of the World Cultural and Natural Heritage developed from the merging of two separate movements: the first focusing on the preservation of cultural sites, and the other dealing with the conservation of nature. The Convention defines the kind of natural or cultural sites which can be considered for inscription on the World Heritage List.

- ***The Ramsar Convention on wetlands***

The Convention on Wetlands of International Importance, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.

- ***The United Nations Convention to Combat Desertification***

The Convention establishes a framework for national, sub regional and regional programmes to counter the degradation of dry lands, including semi-arid grasslands and deserts.

The State of West Bengal while formulating plans and programmes in the field of conservation/development of forests and biodiversity has always made sure that these do not contain any component in divergence from the guidelines enunciated under these convention/treaties.

5.4. Necessity of JICA Assistance

The State Government has been implementing programs/ schemes in areas of forest and biodiversity conservation within the ambit of national, sate and international guidelines. This state has the experience of executing externally-aided projects in the forest and forest biodiversity sector since early eighties. These are:

- West Bengal Social Forestry Project (1982-1991) (WB)
- West Bengal Forestry Project (1992-1997) (WB)
- India Eco-development Project (1996-2001) (IDA, GEF)
- UNDP Sub-Programme in Jaldapara Wildlife Sanctuary (1997- 2003)

- UNDP project for Sunderbans (2003-2008)
- UNDP-CCF II Project on Promoting Medicinal Plants Conservation(2005-2011)

All these projects have been executed successfully and have produced a batch of competent officers and staff in the organisational infrastructure of the Department of Forest capable of handling such projects. There has been a remarkable change in the attitude of forestry personnel and the fringe communities during execution of such projects.

No project in the external sector has come in the state with a focus on strengthening the movement of JFM covering all forest areas after the West Bengal Forestry Project. It is also a fact that funds for afforestation/reforestation activities will get substantially reduced with the exit of Rural Infrastructure Development Fund (RIDF) schemes by the end of current five year plan.

During past projects micro-planning has been undertaken to develop work plans for JFMCs. Matching resources with needs in catchments of individual JFMC or cluster of JFMCs through development of micro plans on the basis of appropriately designed PRA exercises is the crying need. Empowerment of institutions of JFMCs/EDCs/SHGs in handling community support activities and gender sensitisation is an area where substantial intervention is necessary to have the desired results inclusion of economically disadvantaged communities in the activities provided under different components in general and community support activities in particular will be an added advantage of such micro plans.

Earlier projects did not provide for a baseline survey of resources in the forests or on the socio-economic condition of people of forest fringes or communities included in JFMCs and EDCs. Such baseline survey will help in targeting communities to be brought under the community support services. The baseline survey of forest resources and NTFP content will enhance the quality of control and management and add to possibilities of putting in place a mechanism to add value to NTFP through organised collection, storage and marketing.

In a state with deficient forest resources and a wide gap in areas of wood and fuel wood demand and supply situation, enhancement of productivity can be achieved only by bringing in more areas in recorded forests for intensive production and extending tree lands in non-forest areas. Production of quality planting material including use of improved clones of some species can significantly contribute to this effort.

The project proposed with its components of afforestation and focus on strengthening JFM suits the requirement of funding by JICA.

It can be concluded that necessity of Japanese ODA support is high since it can support fully JFM scheme including realisation of micro-planning where have not been supported enough from any other external funding agencies.

Its validity also is high since the Project qualifies for all of the "Strategic Goals by 2020" set for by JICA –a vision document described as following;

- Address the underlying causes of biodiversity loss by mainstreaming biodiversity across the government and society
- Reduce direct pressure on biodiversity and promote sustainable use
- Improve the status of biodiversity by safeguarding ecosystems, species, and genetic diversity
- Enhance benefits to all from biodiversity and ecosystem services
- Enhance implementation through participatory planning, knowledge management and capacity building

Chapter 6 Scope of the Project

6.1. Title of Project

West Bengal Forest and Biodiversity Conservation Project

6.2. Objectives of the project

Overall goals and objectives of the Project are determined as the following.

6.2.1. Overall Goals

Overall goals of the Project are;

- Regeneration and development of degraded forests and adjoining wasteland.
- Augmentation of the availability of fuel wood, fodder and grasses from the regenerated areas.
- Securing people's participation in planning and regeneration efforts to ensure sustainability and equitable distribution of forest products from the regenerated lands, and to promote the partnership concept in the management and administration of forests and common property resources.
- Improvement of South West Bengal Sal coppice forest through coppice induced regeneration.
- Raising plantation in non-forest areas such as village common land, Government owned blank land etc to develop green cover and to develop alternative source of fuel wood & small timber in village area.
- Employment generation for the disadvantaged sections of society particularly women, scheduled castes/scheduled tribes and landless rural labour, inhabiting the forests and adjoining areas.

6.2.2. Objective of the Project

The project aims at restoration degraded forest lands through 1) afforestation, reforestation and rehabilitation of degraded Sal forests through plantation models designed within the framework of bio physical, social and environmental criteria and 2) biodiversity conservation activities.

Objective of the project is;

To improve forest ecosystem and conserve biodiversity by undertaking afforestation, regeneration and wildlife management activities through Joint Forest Management approach, including institutional capacity development, thereby contributing to environmental conservation and harmonised socio-economic development of West Bengal

This project objective will be archived by obtaining following results;

- Conducting a baseline survey to assess the growing stock and availability of minor forest produce (NTFP) to measure their potential to respond to JFM mechanism. Such survey also will include assessment of performance of JFMCs/EDCs on sample basis in different forested tracts and try to identify reasons which contribute to successful operation of JFMCs/EDCs
- Restoration of degraded forests in different agro-climatic regions through afforestation, reforestation and rehabilitation with people's participation
- Reinforcing biodiversity conservation measures for development of protected areas through habitat improvement, man-animal conflict mitigation in identified areas.
- Securing people's participation in planning and regeneration efforts through development of micro plans for areas allocated to JFMC/EDC on cluster basis. Such development of micro plans will be done through induction NGOs.
- Raising plantations in areas other than conventional recorded forest lands using strips along roads/canals and foreshore lands adjoining embankments of the Sunderbans. Marginal lands belonging to small and marginal farmers and occurring in clusters in villages are also to be included through a sharing mechanism agreed between the Forest Department and such farmers.
- Ensuring equity in sharing of usufructs within the capacity of forest and biodiversity areas within the ambit of existing rules, regulations, guidelines and judicial directives
- All such foregoing objectives will cumulate to the ultimate objective of augmentation of supply of timber, firewood and NTFP thus opening up opportunities for alternate livelihood. Livelihood improvement activities will necessarily add to the potential of opening up of such opportunities
- Production of quality planting material in modern nurseries for use in different models of plantations to ensure faster addition to the existing growing stock.
- Capacity development of forestry professionals and training of stakeholders including JFMC/EDC/SHG members enabling them to participate in spheres of creation of community assets and managing them. Enriching their capability to develop their micro plans.

6.3. Components of the Project

As discussed in previous Chapter, this Project will be implemented by 4 components. Moreover, each component consists of multiple sub-components as shown in the following table. Then, detailed contents of the each component shall be described in the following section.

Table 6-1 Components and Sub-Components of the Project

No	Components	Sub-Components
1	Afforestation and Allied Works	1A Afforestation of Degraded Forest Land in Recorded Forest Area 1B Tree Planting Outside Forest (Social Forestry) 1C Soil & Moisture Conservation in Forestry Treatment Areas 1D Production of Quality Planting Material
2	Biodiversity Conservation	2A Improvement of Wildlife Habitat in Protected Areas 2B Mitigation of Man-animal Conflict 2C Research on Wildlife and Biodiversity

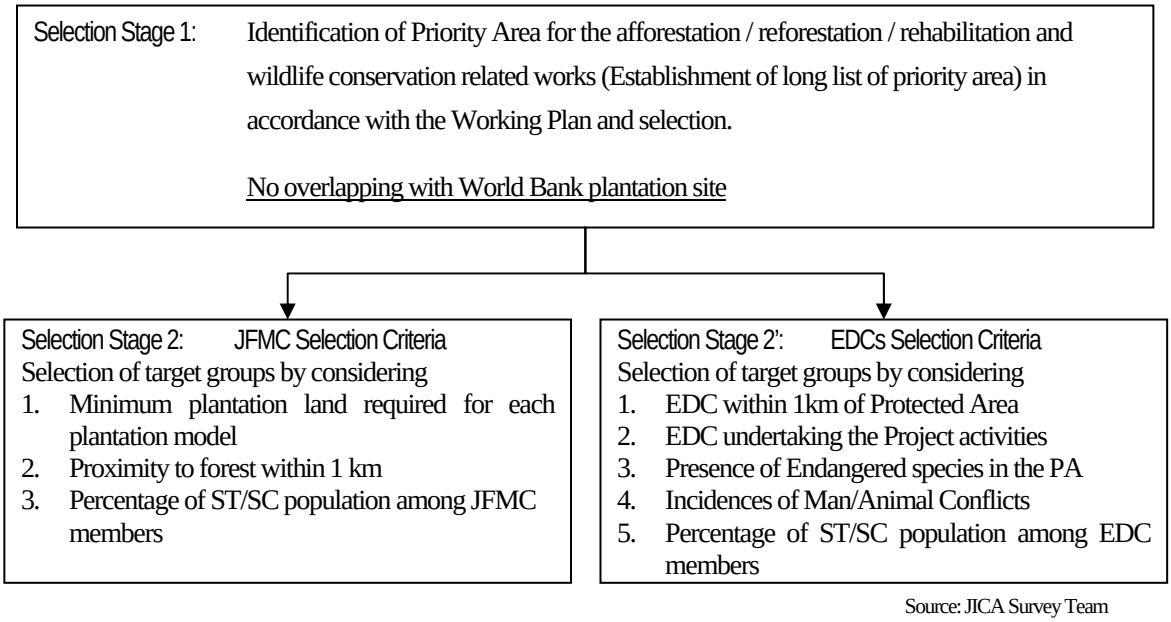
No	Components	Sub-Components
3	Community Development	3A Community Mobilisation 3B Micro Planning 3C Income Generation Activities 3D Community Development Infrastructure
4	Institutional Capacity Development	4A Base line Survey of the State's Forest Resource at the Start of the Project 4B Training & capacity Building of Project Implementing Officials, Field &Office Staffs and Other Stakeholders 4C Infrastructure development for TPOF (Social forestry), training, research, GIS, forest protection etc including Building, Equipment &Vehicle 4D Forestry Research Activities 4E Mid-term Monitoring & Evaluation including periodic biodiversity & community development studies 4F End-term Monitoring and Evaluation

Source: JICA Survey Team

6.4. Project Target Area and Selection of Criteria of Target Area and JFMC

The target area is the whole of the State excluding Kolkata. Kolkata however will have its share in infrastructure development. There is no denying that there will be a concentration of activities in the forested districts like Jalpaiguri and Darjeeling districts of North Bengal, Bankura, Paschim Medinipur, Purulia, Burdwan and Birbhum districts of Central, south-west and South Bengal. It may not be out of place to mention here that these districts have the largest cover of JFMCs and EDCs in the State and has the bulk of protected area network representing a variety of ecosystems. Other districts will be targeted for TPOF (Tree Planting Outside Forest) like strip plantations, block plantations to achieve some addition to the forest cover in these areas.

Target area will be determined through following steps at the preparation stage of the Project;



Source: JICA Survey Team

Figure 6-1 Steps of Target Area Selection

Detail of target area selection is described in 6.7 Component 3: Community Development.

After above-mentioned selection, selected groups shall be examined by social & environmental point of view described separately in the later section.

6.4.1. Selection of Priority Area for the Forestry and Wildlife Conservation Related Works

At first, long list of the priority area (candidate site) for the forestry and wildlife conservation related components which are presented below shall be established by Project Management Unit (PMU) at the preparation stage of the Project.

Table 6-2 List of Component, Sub-Component and Activities which are necessary to determine the target area/group at the preparation stage of the Project

Components	Sub-Components & Activities
1. Afforestation and Allied Works	1A Afforestation of Degraded Forest Land in Recorded Forest Area A1 Planting with High Yielding Eucalyptus Clones in South West Bengal A2 Plantation of Sal & Associate Species in South Bengal A3 Quick growing & small timber spp. plantation in South Bengal A4 Enrichment of Degraded forests of South Bengal A5 Miscellaneous Plantation in North Bengal A6 Sal & associate Plantation in North Bengal 1B TPOF (Social Forestry) in Non Forest Area B1 Strip Plantation B2 Block Plantation
2. Biodiversity Conservation	2A Habitat Management A1 Grass and fodder tree plantation in the plains A2 Bamboo under-planting in Mahananda A3 Fodder tree plantation after removal of maling bamboo in the hills 2B Mitigation of Man-animal Conflict B1 Elephant and gaur conflict in the north and south-west B2 Leopard conflict in the north B3 Tiger conflict in Sunderbans B4 Conflict with smaller animals in the central 2C Research on wildlife and biodiversity

This selection will be made by PMU collaboratively with Conservator of Forest (CF) and Divisional Forest Office (DFO). Degraded forest[1] area or blank area shall be treated as most important priority area. Selection criteria are described later in description of each component. Detailed explanation for each component is described in following section.

6.5. Component 1: Afforestation and Allied Works

This Component 1 "Afforestation and Allied Works" consists of four sub-components and their physical target is set as following;

Table 6-3 Contents and Physical Target of Afforestation and Allied Works Components

No	Component	Sub-Component	Physical Target
1	Afforestation and Allied Works	1A Afforestation of Degraded Forest Land in Recorded Forest Area	18,970 ha
		1B Tree Planting Outside Forest (Social Forestry)	2,800 ha
		1C Soil & Moisture Conservation in Forestry Treatment Areas	-
		1D Production of Quality Planting Material (QPM)	▫ New Modern Nurseries: 20 ▫ Capacity expansion: 20 ▫ 22,940,000 QPM Production

[1] Two sub-classes viz., scrub dominated degraded forest land and agriculture land inside notified forest area are defined as degraded forests.
Scrub dominated: Land, as notified under the Forest Act and those lands with various types of forest cover with less than 20 % of vegetative cover, are classified as degraded forest. These lands are generally confined to the fringe areas of notified forest.
Agricultural land inside notified forest land: This category refers to land that have been notified under the Forest Act, in which agriculture is being practiced, (except for the de-notified forest areas) Source: Ministry of Rural Development Department of Land Resources, Government of India

This is the major component of the Project and about a half of the project cost has been allocated to this component.

Under this component, there are four sub-components namely, 1A) Afforestation of Degraded Forest Land in Recorded Forest Area, 1B) Tree Planting Outside Forest (Social Forestry), 1C) Soil & Moisture Conservation in Forestry Treatment Areas, 1D) Production of Quality Planting Material.

Target area of Component 1A is degraded forest areas (Recorded Forest Area) and one component for non forest areas otherwise sub-component B will contribute non forest area.

Component 1 is directly associated with the Component 3 "Community Development" which will be described in later because the members of JFMC are expected to be directly involved in regeneration and protection and also to derive benefit out of the created assets. Most of the forest areas have now been brought under the protective cover of the respective JFMC/EDC. Therefore, linking execution of different models with respective JFMC will not be difficult as the practice is already in vogue.

But in respect of non-forest areas, it is perhaps necessary to identify beneficiaries, individually or in Groups/Villages at the time of site selection so that respective villagers may be involved in implementation of the project activities. Besides, a benefit sharing mechanism has to be developed with the identified individual, group or village, so that a sense of ownership is created to adequately motivate them to participate in the implementation and management process.

To achieve the above objective it is necessary to ensure that different components chosen for implementation under the project are technically sound, properly managed and are of benign environmental and social consequence. Technical details and management system of each activity is discussed in Chapter 7.

Quality Planting Materials (QPM) will be used for all plantation model except "A4" Enrichment by coppice re-generation and B1 & B2 model that seedlings from field nursery will be used. Component 1D is prepared for production of those QPM as described later.

6.5.1. Component 1A: Afforestation of Degraded Forest Land in Recorded Forest Area

This component will be implemented by following 6 activities.

Table 6-4 Component 1A: Afforestation of Degraded Forest Land in Recorded Forest Area

No.	Activities	Areas	Physical Target (ha)
A1	Planting with High Yielding Eucalyptus Clones	South West	450
A2	Plantation of Sal and Associate in South West Bengal	South West	3,430
A3	Plantation of Quick Growing Small timber, Fuel & Fodder Species	South West	6,000
A4	Enrichment of Degraded Forests of South West Bengal through coppice regeneration	South West	7,500
	(i) Rehabilitation of Degraded Forest (RDF)		*7,500*
	(ii) Multiple Shoot Cutting (MSC)		*7,500*
A5	Miscellaneous Plantation in North Bengal	North Bengal	1,050
A6	Plantation of Sal and Associates Species in North Bengal	North Bengal	540
		Total	**18,970**

Above-mentioned proposed plantation models are designed, taking into account certain parameters such as soil, climate, community preference, working plan prescription etc. Besides as per JICA guidelines, cluster approach and JFMC/EDC proximity need be looked into in the matter of area selection and finally there should be expressed stake of the community, manifested in the form of Micro plan.

Model wise area selection criteria are furnished below.

6.5.1.1. A1: High Yielding Eucalyptus Hybrid Clones Plantation in South West Bengal

Objective: Production of industrial pulpwood.

General Description: These will be mono crop multi-clonal plantations of high yielding Eucalyptus hybrid clones raised in modern nurseries. Red lateritic soil having deep soil depth without Pan is ideal for this type of plantation.

Minimum Target Management Area per JFMC: 10 ha

Maximum Target number of JFMC: 45

Area: This plantation model will be raised in 8 forest division covered by 3 districts.

Table 6-5 Target Area: A1 High Yielding Eucalyptus Hybrid Clones Plantation

Afforestation Model	Area Proposed (ha)	Minimum viable area (ha)	Maximum number of JFMC	District to be covered	Division
A1: Planting with High Yielding Eucalyptus clones in South West Bengal	450	10	45	Paschhim Medinipore	Medninipore Kharagpore Rupnarayan
				Bankura	Panchet Bankra N. Bankra S.
				Burdwan	Burdwan Durgapur

Soil & Climate: Red lateritic soil, deep reddish-yellow loamy to clayey soil low in organic matter and available minerals. Hot dry summer, moderate winter, rainfall-900 to 1500mm spread over

150 to 180 days. Where soil condition is not favourable for any other tree species, eucalyptus shall be selected preferentially for this model.

Species: High yielding Hybrid clones of Eucalyptus, producing 30 to 35 MT per ha of pulp wood which is necessary to meet the ever increasing national demand of pulp wood.

Extent: 450 ha of degraded forest area have been proposed for afforestation under this model.

Technique- 1 year + rammets (clones), raised and tended in modern nursery will be planted in pits of size (0.60 m + 0.45 m) /2 x 0.45 m x 0.45 m (refer to Figure 6-2) at a spacing of 2.5 m x 2.5 m. Normal tending and application of manure will be done after 20-25 days of planting. Two (2) more tendings will be done at 2nd and 3rd year of planting after the onset of monsoon. Planting interval is 2.5 x 2.5 m (1,600 plants /ha)

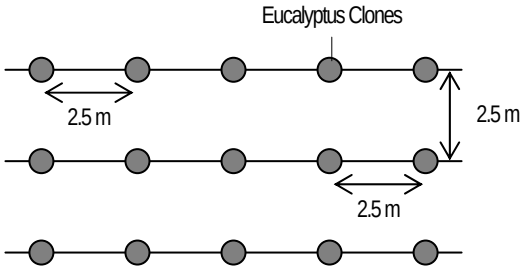


Figure 6-2 A1 High Yielding Eucalyptus Clones Plantation

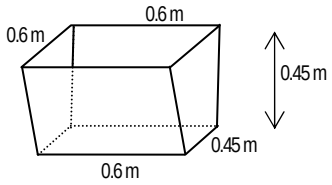


Figure 6-3 Pit for A1 High Yielding Eucalyptus Clones Plantation

Management- Mechanical thinning[2] will be done at 3rd year 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: 90% 3rd year: 85% 5th year: 80%

[2] Mechanical thinning: removes trees within a fixed spacing interval or removes all trees in strips with fixed distances between them.

6.5.1.2. 1A2: Plantation of Sal and Associate Species in South West Bengal

Objective: Production of mining timber like Poles, Posts, Cogging sleepers and production of timber, small timber, firewood and NTFPs like Myrobalans[3], Nuts, and other edibles.

General Description: This is an eco-friendly (mixed plantation by various indigenous species), habitat restoring model, which is likely to provide livelihood support to the JFMC members in the long run from the wealth of NTFPs available from regenerated tree species as well as from ground flora that will eventually come up.

Minimum Target Management Area per JFMC: 20 ha

Target number of JFMC: 180

Area: This plantation model will be raised in 12 Forest Division covered by 4 Districts.

Table 6-6 Target Area of A2 Plantation of Sal and Associate Species

Afforestation Model	Area Proposed (ha)	Minimum viable area (ha)	Maximum number of JFMC	District to be covered	Division
A2. Plantation of Sal & Associate Species in South Bengal	3,430	20	180	Paschhim Medinipore	Medninipore Rupnarayan Kharagpore Jhargram
				Bankura	Panchet Bankra N. Bankra S.
				Burdwan	Burdwan Durgapur
				Purlia	Purlia Kangsawati N. Kangsawati S.

Soil & Climate: Red lateritic soil- deep reddish-yellow loamy to clayey soil together with Alluvium of Damodar, Kangsabati, Ajoy, Rupnarain rivers. Well drained, low in organic matter and also in K and P. Hot dry summer, moderate winter, rainfall- 900 to 1500 mm spread over 150 to 180 days

Proposed Species- Sal with associates like *Pterocarpus marsupium, Ougeinia oojeinensis Dalbergia latifolia, Symplocos racemosa, Madhuka latifolia, Terminalia bellerica Terminalia chebula, Anogeissus latifolia, Schleichera oleosa, Buchanania lanzan Semecarpus anacardium, Soymida febrifuga* etc. Choice of species, however, will be guided by the community preference, subject to the fulfilment of silvicultural requirements.

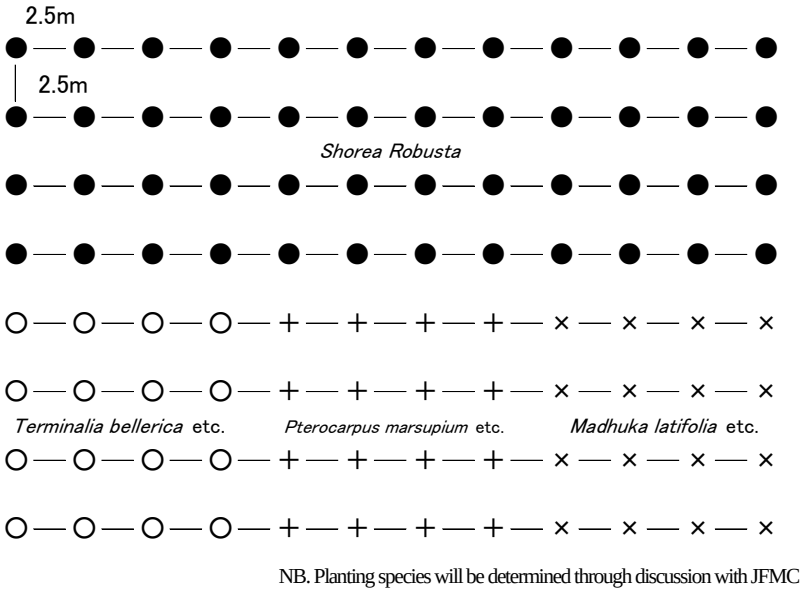
These are endemic species having community preference fulfilling much of their livelihood needs. Sizable numbers of JFMCs are functioning in the area in manageable clusters and as a result older plantations in the area are growing remarkably well. Such forest areas are allocated to Sal Working Circle of the Working Plan prescription.

[3] Fruit-bearing plants which is representative *Terminalia* species such as, *Emblica officinalis. Terminalia bellirica,Terminalia chebula,, Terminalia arjuna*

Extent- 3,430 ha of degraded forest land has been proposed under this model

Technique- This will be a mixed plantation, *Shorea robusta* being the main constituent (50%), with other natural associates. Planting interval is 2.5 x 2.5 m (1,600 plants /ha)

Seedlings will be planted at a spacing of 2.5 m x 2.5 m and the species mixture will be in strips of Sal and misc. hardwood alternating In miscellaneous strips blocks of 100 sq, m. having 16 plants of the same species in each block will be planted. Each strip will comprise 4 lines. Pit size is (0.75 + 0.6) / 2 x 0.6 x 0.6 m^3 (refer to Figure 6-4)



NB. Planting species will be determined through discussion with JFMC

Figure 6-4 Example of A2 Sal and Associate Species Plantation

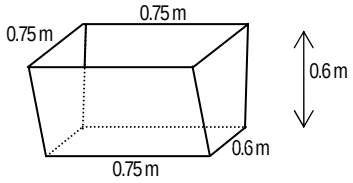


Figure 6-5 Plantation Pit

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: 90% 3rd year: 85% 5th year: 75%

6.5.1.3. 1A3: Quick Growing Small timber, Fuel & Fodder Plantation in South Bengal

Objective: Production of pulpwood, small wood, firewood and some NTFPs.

General Description: This plantation model is supposed to cater to the needs of the people, particularly the JFMC members. Species chosen for this model are fast growing and will fetch early return to the JFMC members from mechanical thinning out and thinning operations. Besides, the plantation will improve the potential of NTFP production in the long run, providing livelihood support to the JFMC/EDC members.

Minimum Target Management Area per JFMC: 20 ha

Target number of JFMC: 300

Area: This plantation model will be raised in 14 Forest Divisions covered by 7 Districts.

Table 6-7 Target Area of A3: Quick Growing Small timber, Fuel & Fodder Plantation

Afforestation Model	Area Proposed (ha)	Minimum viable area (ha)	Maximum number of JFMC	District to be covered	Division
A3. Quick growing & small timber spp. plantation in South Bengal	6,000	20	300	Paschhim Medinipore	Medninipore Rupnarayan Kharagpore Jhargram
				Bankura	Panchet Bankra N. Bankra S.
				Burdwan	Burdwan Durgapur
				Purlia	Purlia Kangsawati N. Kangsawati S.
				Nadia	Nadia-Murshidabad
				Murshidabad	
				Birbhum	Birbhum

Soil & Climate: Red lateritic soil- deep reddish-yellow loamy to clayey soil together with Gneiss gravely soil- undulating topography with low soil depth, poor capacity for rain water retention, prone to severe soil erosion. Hot dry summer, moderate winter, rainfall-900 to 1500 mm spread over 150 to 180 days

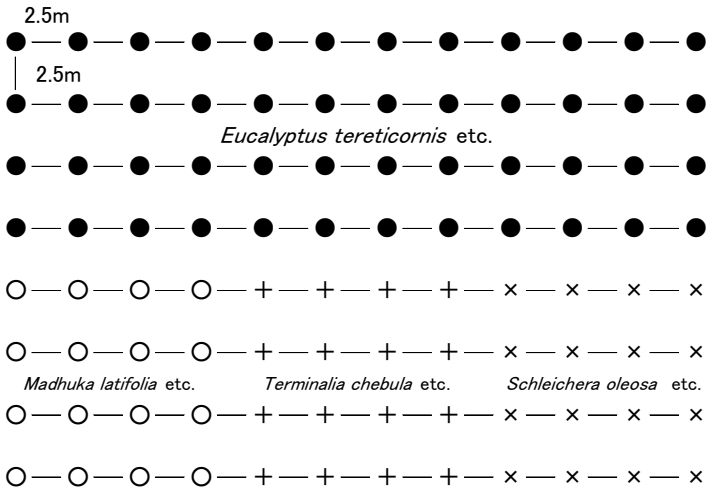
Species proposed: Miscellaneous species of economic importance like *Madhuka latifolia, Schleichera oleosa, Terminelia bellerica, Terminala chebula Pterocarpus marsupium* etc and others with fast growing species producing fuel, fodder and small wood such as *Acacia auriculiformis, Eucalyptus tereticornis, Terminalia arjuna, Anogeissus latifolia, Sapindus laurifolius, Schleichera oleosa, Buchanania lanzan, Azadirachta indica, Phyllanthus emblica, Haldina cordifoli,*etc.

This component has a strong social basis as well as a silvicultural basis. The species chosen can survive on fairly dry soil and will also fulfil the demand of fuel fodder and small wood of the

society. Most of JFMC will derive benefit and therefore will be instrumental in protection of the plantations. Such areas are allocated to Miscellaneous Working Circle of the Working Plan prescription.

Extent: 6,000 ha of degraded forest land will be planted up under this model.

Technique: Seedlings will be planted in pits of size (0.60 m + 0.45 m) /2 x 0.45 m x 0.45 m (refer to Figure 6-5) at a spacing of 2.5 m x 2.5 m (1,600 plants / ha). Spacing and other details also will remain the same.



NB. Planting species will be determined through discussion with JFMC

Figure 6-6 Example of Quick Growing Small timber, Fuel & Fodder Plantation

Management: The area treated through this model will fall under the category of Miscellaneous Working Circle of the Working Plan. Mechanical thinning, Silvicultural thinning[4] and final felling shall be carried out as prescribed in relevant Working Plan. Harvested produce shall be disposed of as per the extant benefit sharing mechanism.

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

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

6.5.1.4. A4: Rehabilitation of Degraded Sal Coppice Forests of South West Bengal

Sal coppice forests are degraded because of repeated coppicing on a very short rotation of 2-3 years by head loaders. The situation worsens in some of the areas because of grazing by free ranging animals. In some pockets adjoining interstate borders, organised gangs operate to pilfer timber, poles and posts.

This Model is based on the prescription of the Working Plans and cover Sal Coppice forests, degraded or otherwise. This has a large cover of the Forest Divisions of South-West Bengal.

[4] Silvicultural thinning is to be done by the way of removing the suppressed and defective trees from the lower crown classes. So long as no co-dominant trees are removed, low thinning result in little more than salvage of trees which will inevitably die; competition among the remaining trees shall be alleviated only to the extent the root competition is reduced. The greatest merit of low thinning lies in its inherent, logical simplicity and its close relationship to the natural course of development of the stand.

Objective: Production of poles, posts cogging sleepers to make the demand of coal mining companies in the public sector and production of small timber and firewood for local communities.

General Description: This Forest type has been and presently also, is the life line of the tribal population residing around such forest. The proposed model is a rehabilitation program to convert the degraded Sal forest of South West Bengal into luxurious Sal Coppice Forest through Silvicultural Operation.

Minimum Target Management Area per JFMC: 25 ha

Target number of JFMC: 300

This model is very popular with the local people who derive maximum of their livelihood needs from this type of forests. JFMCs exist in close proximity of these forests and the villagers are primarily responsible for both preservations as well as for degradation of the same. As mentioned the model is within the prescription of the Working Plan.

Area: 13 Forest Divisions covered by 5 Districts

Table 6-8 Target Area: A4 Enrichment of Degraded Forests

Afforestation Model	Area Proposed (ha)	Minimum viable area (ha)	Maximum number of JFMC	District to be covered	Division
A4. Enrichment of Degraded forests of South West Bengal	7,500	25	300	Paschhim Medinipore	Medninipore Rupnarayan Kharagpore Jhargram
				Bankura	Panchet Bankra N. Bankra S.
				Burdwan	Burdwan Durgapur
				Purlia	Purlia Kangsawati N. Kangsawati S.
				Birbhum	Birbhum

Soil & Climate: Red lateritic soil- deep reddish-yellow loamy to clayey soil and Alluvium of Damodar, Kangsabati, Ajoy, Rupnarain rivers together with Gneiss gravelly soil- undulating topography with low soil depth, poor capacity for rain water retention, prone to severe soil erosion.

This forest type provided major income opportunity to the villagers and has the unique capacity of resilience to survive in spite of frequent coppicing.

Extent: Two (2) Silvicultural Operations have been proposed namely

(i) Rehabilitation of Degraded Forest (RDF) and (ii) Multiple Shoot Cutting (MSC).

Technique:

(i) Rehabilitation of Degraded Forest (RDF)

Sal has the exceptional quality to regenerate through coppicing. Taking advantage of this attribute, Sal stumps are cut flush to the ground with sharp cutting instrument to induce coppice regeneration. The operation known as Rehabilitation of Degraded Forest (RDF) is carried out in the month of February - March. Profuse coppice shoots start coming up within 20-25 days of stump cutting which is commonly termed as Coppicing. These shoots are to be protected from trampling by cattle in the initial stage.

Such rehabilitated areas also are treated at the 7th year through thinning. No other silvicultural operation is necessary till final felling. Such regenerated areas stand allocated to the Sal Coppice Working Circle. Rotation for the Rehabilitated Sal Coppice Forest will be fixed as per Working Plan prescription.

(ii) Multiple Shoot Cutting (MSC)

At the 3rd year of RDF operation multiple shoots coming out of the stumps are thinned out by retaining 2-3 strong and healthy shoots per stump and removing the rest.

Cut stumps coming out of RDF operation is distributed to the JFMC/EDC members. Similarly, thinned out coppice shoots coming out of MSC operation are also distributed to the JFMC/EDC members. Sal has the exceptional quality to regenerate through coppicing. Taking advantage of this attribute, Sal stumps are cut flush to the ground with sharp cutting instrument to induce coppice regeneration.

Profuse coppice shoots start coming up within 20-25 days of stump cutting which is commonly termed as Coppicing. These shoots are to be protected from trampling by cattle in the initial stage.

6.5.1.5. 1A5: Miscellaneous Plantation in North Bengal

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

Target number of JFMC: 120

Area: 9 Forest Divisions under 5 Districts

Table 6-9 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 Bengal	1,050	10	120	Darjeeling	Kurseong Darjeeling
				Jalpaiguri	Baikunthapur Jalpaiguri Wildlife-III BTR East BTR West
				Malda	Malda
				N. Dinajpur	Raigaunj
				S. Dinajpur	

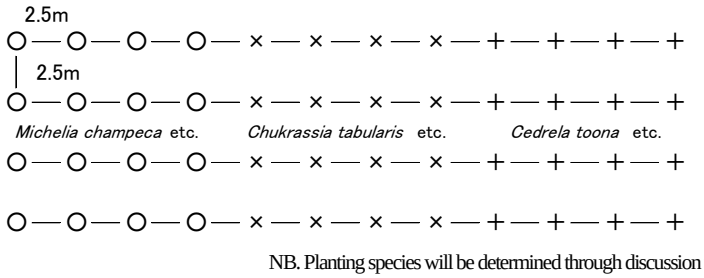
Soil & Climate: Alluvial plains of Teesta, Torsha, Mahananda. Deep to moderate alluvial deposit of course to fine loamy texture with problems of water logging and Terai soil of the Himalayan foot hills having moderately deep alluvium deposit, faces severe flood hazards.

Species: Schima wallichii, Michelia champaca, Amoora rohituka, Amoora wallichii, Gmelina arborea, Cedrela toona, Terminalia tomentosa, Terminalia myriocarpa, Terminalia myriocarpa, Chukrassia tabularis, Kaijelia 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

Figure 6-7 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%

6.5.1.6. 1A6: Plantation of Sal and Associates Species in North Bengal

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

Target number of JFMC/EDCS: 60

Area: 7 Forest Divisions covered by 2 Districts

Table 6-10 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.

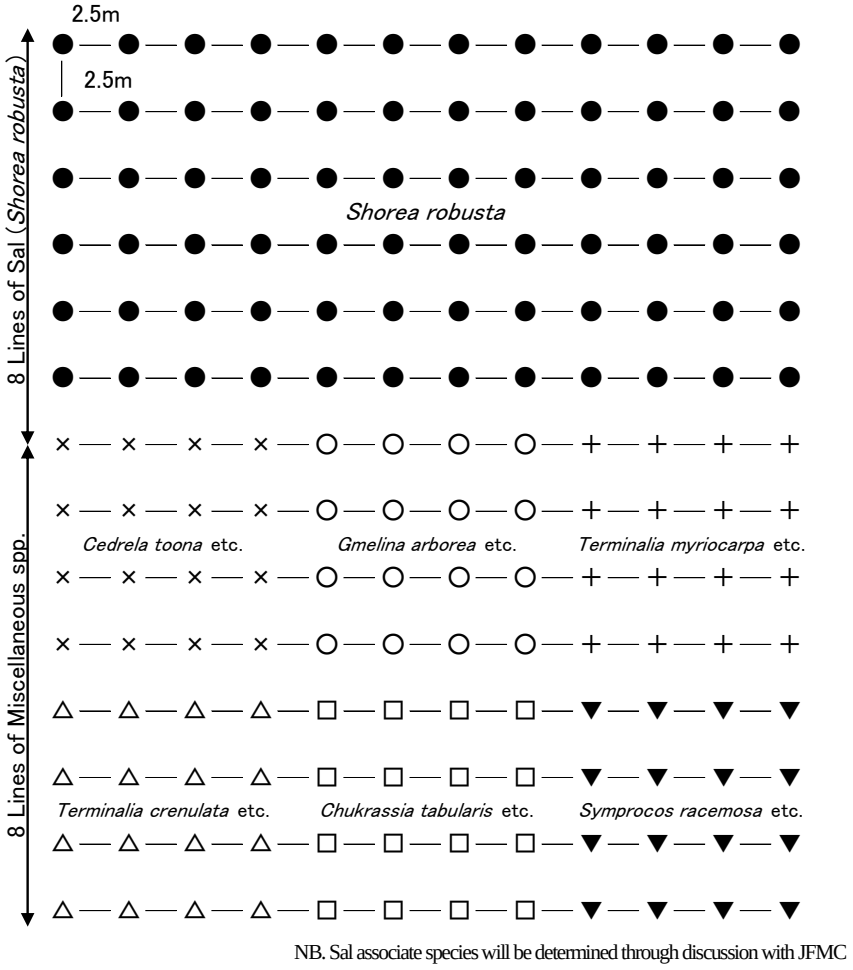
Species: Sal and its associate species such as *Schima wallichii Symplocos racemosa, Chukrassia tabularis, Cedrela toona, Gmelina arborea, Amoora rohituka, Amoora wallichii,Terminalia myriocarpa, Terminalia crenulata, Chukrassia tabularis* etc.

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 6-8 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%

6.5.2. Component 1B: Tree Plantation Outside Forest (TPOF) Area (Social Forestry)

Plantations in models A1 to A6 will be confined to recorded forest lands while the models presented in this component will cover non-forest areas under the control of Government or

Community.

General Description: There is ample scope of increasing green cover through tree farming in land outside forests. Under the Project, the land owned by government or communities shall be targeted for the plantation area. Individual land, however, is out of the target.

Selection criteria for non forest area shall be determined separately from that of the forest land because this component will be implemented under non JFM area. Yet candidate sites will be identified by PMU in the preparatory stage of the Project and the long list will be developed.

The area will be selected by considering location of land, land availability and flexibility of Forest Department. These non forest lands shall be community or governmental land and private land is out of scope.

Two activities have been envisaged for the purpose i.e. (i) Strip Plantation and (ii) Block Plantation

Table 6-11 Component 1B: Physical Target of Tree Planting Outside Forest

No.	Activities	Physical Target (ha)
1B1	Strip Plantation in Road side / Canal side / Railway side	1,400
1B2	Block plantation in Non-Forest land	1,400
	Total	**2,800**

6.5.2.1. B1: Strip Plantation in Road side / Canal side / Railway side.

The State has extensive network of roads and canals. Long stretches of flanks of railway tracks, embankments are yet to be planted up. These will primarily be the target area for this model. Areas where beneficiaries will show an interest for protection will be preferred.

Area: 11 Forest Divisions covered by 13 Districts

Table 6-12 Component 1B: Target Area of Strip Plantation

Afforestation Model	Area Proposed (ha)	Minimum viable area (ha)	Maximum number of Village	District to be covered	Division
Strip Plantation	1,400	5	300	Paschhim Medinipore	Kharagpore
				Nadia	Nadia-Murshidabad
				Murshidabad	
				Howrah	Howrah
				Hoogly	
				Birbhum	Birbhum
				Purlia	Purlia Extn Forestry Div.
				24 Pargana N.	24 Pargana N.
				N. Dinajpur	Raigaunj
				S. Dinajpur	
				Malda	Malda
				Jalpaiguri	Siliguri SF Division Jalpaiguri SF Division
				Cooch Bihar	Coochibihar

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

- 1st year: 80% 3rd year: 70% 5th year: 65%

6.5.2.2. B2: Block plantation in Non-Forest land

Area: 12 Forest Divisions covered by 12 Districts

Table 6-13 Component 1B: Target Area of Block Plantation

Afforestation Model	Area Proposed (ha)	Minimum viable area (ha)	Maximum number of Village	District to be covered	Division
Block Plantation	1,400	5	300	Paschhim Medinipore	Kharagpore
				Birbhum	Birbhum
				Nadia	Nadia-Murshidabad
				Murshidabad	
				Purlia	Purlia Extn Forestry Div.
				24 Pargana N.	24 Pargana N.
				North Dinajpur	Raigaunj
				South Dinajpur	
				Malda	Malda
				Cooch bihar	Coochibihar
				Bankra	Panchet Bankra N. Bankra S.
				Jalpaiguri	Siliguri SF Division

Soil & Climate: On account of the wide range of variation in soil and climate species will have to be chosen accordingly. Such species are to be chosen to match favourably with the soil and climatic variation.

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

- 1st year: 80% 3rd year: 75% 5th year: 70%

(1) Selection of Species, Technique and Management for Strip and Block plantation

Species will be selected by identified beneficiaries in consultation with Forest Department during the preparation stage of the Project. Species for this model should have either one of the following attributes at least (i). Browse hardy, (ii) Fast growing, (iii) Shade providing, (iv) Aesthetically attractive and (v) Useful for communities. Several species may be mixed in response from Panchayat and availability of seedlings.

Table 6-14 Species Proposed by Region for Strip and Block Plantation

Region	Species	Local Name
Species for South Bengal	*Eucalyptus tereticornis*	*Eucalyptus*
	Acacia auriculiformis	*Akasmoni*
	Dalbergia sissoo	*Sissoo*
	Cassia siamea	*Minjiri*
	Terminalia arjuna	*Arjun*
	Albizzia procera	*Sada Sirish*
	Anthocephalua cadamba	*Kadam*
	Peltoforum feruginum	*Radhachura*
	Ailanthus excelsa	*Gokul*
	Delonix regia	*Krishnachura*
	Syzigium cuminii	*Jaman*
	Lagerstroemia flosreginae	*Jarul*

Region	Species	Local Name
Species for North Bengal	*Chukrassia tabularis*	*Chikrasi*
	Albizzia lebbek	*Kala Sirish*
	Anthocephalus cadamba	*Kadam*
	Dalbergia sissoo	*Sissoo*
	Melia azedirach	*Ghora-neem*
	Cassia siamea	*Minjiri*
	Syzigium cuminii	*Jaman*
	Cassia fistula	*Amaltas*
	Cassia nodosa	-
	Cassia javanica	-
	Swietenia macrophylla	*Mahoginy*
Central Bengal	*Eucalyptus tereticornis*	*Eucalyptus*
	Dalbergia sissoo	*Sissoo*
	Cassia siamea	*Minjiri*
	Anthocephalus cadamba	*Kadam*
	Cassia fistula	*Amaltas*
	Cassia nodosa	-
	Cassia javanica	-
	Swietenia macrophylla	*Mahoginy*
	Acacia auriculiformis	*Akasmoni*

Source: JICA Survey Team

Technique- Planting and tending procedure will be the same as has already been described against miscellaneous plantation for South-West and North Bengal respectively, only difference being that seedlings for these models of plantations will be raised in field nurseries.

(2) Steps of TPOF

This model of plantation will be raised on Road side, Canal bank, Railway embankment and community owned land etc. Although these lands belong to different Government Departments or communities yet for effective management, usufructs may be vested with the local Panchayets who will manage the asset involving the local people and in a sustainable manner so that the area may be replanted after final felling. Necessary dialogue has to be made with the concerned stake holders and a suitable mechanism in this regard has to be developed prior to undertaking plantation activities.

Steps involved:

- Beneficiary villages are identified by the Bon O Bhumi Sanaskar Sthayee Samity of Panchayat Samity.
- Selection of beneficiaries along the proposed area of plantation. Individual beneficiaries are selected by an Executive Committee of the beneficiary village comprising of the following members as per Forest Department's notification No.: 2204-For/D/1/6M-7/93;

    a. Sabhapati or any member of Bon O Bhumi Sanskar Sthayee Samity (Forest and Land Reforms Standing Committee) nominated by the Sabhapati

    b. Gram Pradhan (chief) or any member of local Gram Panchayet(s) as may be nominated by the Pradhan(s)

c. Elected representatives of beneficiaries (not exceeding 6)

d. Beat Officer- Member Secretary

Beneficiaries do not require any registration as the same are constituted under the provisions of the Governmental notification referred to above.

- Memorandum of understanding (MOU) shall be signed among three parties such as Beneficiaries (Panchayet), Land owner and West Bengal Forest Department.
- Beneficiary Committee shall be established by Panchayet and registered.
- Members of Beneficiary Committee shall be selected from farmer group or landless people by Panchayet.
- Consultation with beneficiaries regarding selection of species and sites for field nursery.
- Raising of nursery by beneficiaries with input, both material and technical, from Forest Department
- Planting, tending during the year of plantation and maintenance up to third year by the beneficiaries
- Benefit system: Basically, beneficiary Committee shall get 25 percent of total logging revenue after deducting cost of replanting and 75% will be allocated to the government although usufructs shall be shared with Beneficiary Committee as per existing government orders.

Management- After establishment will be handed over to the Gram Panchayet. Beneficiaries will have the right to collect grass, fuel, fodder from the plantation including produce obtained through mechanical thinning; the plantations will be harvested at maturity by the Forest Department in consultation with the Panchayet. The Forest Officer shall arrange distribution of the pre-specified percentage of harvested produce to the selected beneficiaries at confessional rate or free of cost in consultation with the Forest and Land Reforms Standing Committee (Bhumi Sanskar Sthayee Samity[5]). However the direct cost of establishment protection and maintenance of plantation will stand recoverable to meet the cost for raising future plantations.

6.5.3. Benefit Sharing Mechanism with JFMCs/EDCs

Benefit sharing mechanism with JFMCs/EDCs is governed by existing governmental resolutions. These resolutions have been already mentioned under item 2.5.5.1. (2) Evolution of JFM. This sharing mechanism is one of very important factor for success of JFM. Next table shows sharing mechanism by forest products.

[5] Forest and Land Reforms Standing Committee is a Committee of representatives of people at the level of Panchayat Samity (Block level) and Zilla Parishad (District level). These Samities decide on execution of plan and non-plan schemes related to forests and other forms of landuse within their jurisdiction.

Table 6-15 Benefit Sharing Mechanism

Item	Benefit Sharing	Responsibility		
		Harvesting & Collecting	Store	Process
Timber /Small timber/mining timber /pulpwood /poles /firewood	North Bengal: 25% of net sale proceeds from thinning and cultural operations. 15% of the sale proceeds of timber at final harvest. In south West Bengal 25% of poles and fuel wood harvested during thinning, cultural operation and final harvest of coppice coupes.	By the WBFD in association with the WBFDC Ltd. Taking help of JFMCs	In Depots located at Range or Beat Headquarter under the control of WBFD and WBFDC ltd.	WBFD /WBFDC sell timber and other forest produce through auctions and tender. Mining timber and pulpwood are sold to coal mining companies in the public sector through allotments. Some pulpwood companies also receive allotments pulpwood. There are sold at prices determined by the Price Fixation Committee of the State Govt.
	In case of strip plantations, plantations are handed over to Gram Panchayat at the end of the third year. Only a specified % of the harvested produce is distributed amongst beneficiaries in consultation with Ban O Bhumi sanskar Sthayee Samity.	Forest Department in consultation with Gram Panchayat	Forest Department in depots selected in consultation with Gram Panchayat	No mechanism of sharing of produced harvested from lands of private persons. No resolution in private land
Fallen twigs , grass, fruits flowers, mushrooms ,leaves and medicinal plants	100%	JFMC under guidance of WBFD	JFMC under guidance of WBFD	JFMC under guidance of WBFD
Bamboo	Resolution does not specify; bamboos. In case this is interpreted as NTFP JFMCs may have claim to 100% less harvesting costs. Bamboo if interpreted as poor man's timber, JFMCs will have right to 25% of share	WBFD with the assistance of JFMC	WBFD at depot sites selected in consultation with JFMC	Usufructs may be shared in cash or kind
Sal leaves	100 % for JFMC	Private traders contracted with the help of WBFD. JFMC members are free to choose their clientele and the price at which they will sell. Sal leaves are generally made into plates /cups before selling	Private traders contracted with or without the assistance of WBFD	Private traders contracted with WBFD
Honey	Honey from Sunderban is collected by WBFDC ltd. with the help of WBFD and marketed after filtration and packaging. Honey from other forest areas is treated as NTFP. There is no sharing mechanism under the existing resolution. A proposal has been mooted for sharing and this is under the consideration of the State Govt.	JFMC/EDC members are used in collection wherever possible	In depots under the control of WBFD.	WBFDC Ltd markets through their agents and retail sale centres
Other NTFPs including medicinal plants, Mahua (*Madhuca indica*) seeds and other oil bearing seeds etc.	100% for JFMC as per existing regulation. Usufruct sharing will be subject to restrictions imposed on account of silvicultural and management requirements.	100% for JFMC	100% for JFMC	100% for JFMC

Source: JICA Survey Team

6.5.4. Component 1C: Soil & Moisture Conservation in Forestry Treatment Areas

All degraded areas treated through activities A1 to A4 will have a sub-component of soil and moisture conservation activities. Such activities will include digging Contour trenches, which involve simple earth work that may be undertaken by the villagers/ JFMC/EDCS members under the guidance of Forest Officer. Contour trenches are used both on hill slopes as well as on degraded and barren waste lands for soil and moisture conservation and afforestation purposes. The trenches break the slope and reduce the velocity of surface runoff. It can be used in all slopes irrespective of rainfall conditions (i.e., in both high and low rainfall conditions), varying soil types and depths.

As has already been mentioned the soil type of most of the forest areas in South West Bengal,

covering the Districts of Purulia, Bankura, Paschim Medinipur, Birbhum and western part of Burdwan are highly vulnerable to different degrees of soil erosion. Such erosion is common to areas under Red Lateritic soil and Gneissic gravely soil with low to medium soil depth, poor capacity of water retention and have frequently occurring surface encrustations. This unstable character of the soil coupled with undulating terrain of the tract often lead to severe run off and intense soil erosion. Therefore it is imperative that all afforestation activities must be effectively safeguarded with suitable soil conservation measures.

Afforestation and reforestation activities will be confined to degraded forest areas with signs of sheet erosion and reel erosion of different intensities. There is a need therefore to adopt simple soil and moisture conservation measures in the form of Contour trenches. Accordingly, the component of soil conservation activities has been provided in respect of the following Afforestation Models chosen for South West Bengal.

- A1. Plantating with High Yielding Eucalyptus Clones in South West Bengal
- A2. Plantation of Sal and Associate Species in South Bengal
- A3. Quick Growing Small timber, Fuel & Fodder Plantation in South Bengal
- A4. Rehabilitation of Degraded Sal coppice Forests of South West Bengal

Details of the above soil and moisture conservation measures are given below.

Contour trench: Trenches of 5.0 m length and 0.45 m x 0.45 m size are dug all over the plantation area 5.0 m apart in contour lines, in a staggered manner, the lines being at 10.0 m interval. This is done to check run off, arrest soil and conserve moisture.

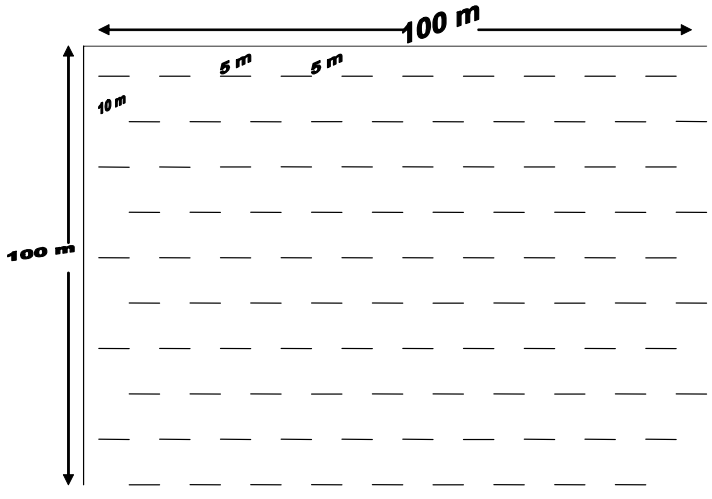


Figure 6-9 Spacing of Contour Trench

6.5.5. Component 1D: Production of Quality Planting Material

6.5.5.1. General Description

Plantation creation programs, now-a-days, are largely dependent on seedlings raised in Central Nurseries where seedlings are better looked after and healthier than those raised in Field Nurseries. Besides, in Central Nurseries older seedlings may be available for planting and this essential requirement for slow growing species. *Shorea robusta* (Sal), *Madhuca indica* (Mohua), (*Schleichera triiuga*) Kusum etc. It has been seen that extra investments made for Central Nurseries are more than compensated by the performance of saplings in the plantation, in respect of survival, growth and health.

Seedling quality is primarily controlled by collection seeds from seed trees /seed stands and from clonal orchards maintained for a variety of clones for Eucalyptus hybrid. Use of agro-sheds and production of seedlings in root trainers (Hycopots) in mist chambers have greatly improved the quality of seedling.

With this understanding, it has been proposed that all the afforestation models in South West & North Bengal except Enrichment of Sal Degraded Forest (A4) will be provided with Quality Planting Materials (QPM).

In this component, four activities are proposed such as 1) Capital cost of setting up hi-tech 20 modern central nurseries, 2) Capacity expansion of existing 20 hi-tech Nurseries, 3) Production of 1 year old quality Eucalyptus clone: 900,000 seedlings, 4) Production of 1 year old quality seedlings: 22,040,000 plants, 22,940,000 seedlings in total.

6.5.5.2. Capacity Expansion of Nurseries

As the plantation models A1 to A3 and A5 to A6 will require Quality Planting Materials (QPM), 20 new Modern (hi-tech) Central Nurseries and 20 expansions of existing Modern Nurseries have been proposed under the project. By these constructions, production capacity of nursery can be expanded at least 20 million (200 lakh) seedlings per year. The details of production of seedlings and the nurseries proposed to be created are furnished in the table below.

Table 6-16 Required Number of Nursery by Area and Production Capacity

Type of Nursery	Number of Nursery	Production Capacity will be raised (seedlings / year)
New Modern Nursery	20	10,000,000
Expansion of existing Modern Nurseries	20	10,000,000
Total	40	20,000,000

(1) Capital cost of setting up Hi-tech Central Nursery

For the purpose of meeting the requirement of QPM, 20 new Modern Nurseries will be established by installing necessary mist chambers, raised beds with structures for shade cloth (agronets), root trainers (Hycoports) supplemented with associated civil works.

(2) Capacity expansion of existing Hi-tech Central Nursery

Capacity expansion of 20 existing Central Nurseries will be will be undertaken through acquisition of additional mist chambers, adequate no of raised bed, provision of sheds with shade cloth (agronets) and supply of root trainers (Hycopots) etc.

6.5.5.3. Production of Seedlings

1 year Quality Planting Material seedlings raised and tended in Central/Modern Nurseries are to be provided in all plantation models, except models B1 and B2, necessary provision for the same has been made in the project proposal. The requirement of QPMs for different afforestation models are furnished below model wise on the basis of which seedlings will be raised and maintained in Central /Modern Nurseries that will be established /upgraded.

Table 6-17 Number of seedlings (QPM) Required

Model no.	Number of seedlings(QPM) required			
A1	450	ha x	2,000 plants / ha =	900,000
A2	3,430	ha x	2,000 plants / ha =	6,860,000
A3	6,000	ha x	2,000 plants / ha =	12,000,000
A5	1,050	ha x	2,000 plants / ha =	2,100,000
A6	540	ha x	2,000 plants / ha =	1,080,000
Total				22,940,000

(1) Production of 1 year old quality clone

All plantations shall be raised at spacing of 2.5 m x 2.5 m. against the actual requirement of 1,600 clones, an additional 200 seedlings will be raised to casualties during the year of creation and more 200 seedlings will be prepared for replanting. Totally, 2,000 plants / ha is needed to meet the requirement.

(2) Production of 1 year old quality seedlings

In a planting pattern of 2.5 m x 2.5 m spacing, 1600 seedlings are required and an additional 200 seedlings will be raised to casualties during the year of creation and more 200 seedlings will be prepared for replanting. Totally, 2,000 plants / ha is needed to meet the requirement.

6.5.5.4. About Quality Planting Materials (QPM)

QPM means healthy seedlings of different species proposed to be used against each plantation models which should originate from properly established seed orchards, clonal orchards, plus trees and produced in an environment of hi-tech nurseries. A hi-tech nursery (modern nursery) is characterised by the following;

- UV plastic covered chambers with mist irrigation and fogging facilities. Such chambers are provided with 50% or 60% shade netting on the roof and 30% or 40% on the sides. The irrigation pipe generally have 2.5 cm outlet and rated at 3 horse power capable of generating 30-40 lbs psi of pressure. Irrigation lines are made of threaded PVC pipe

- The nursery will have 360 degree fine spray nozzles with an affective radius of covering 2 m. Structural members are of galvanised pipe and angle iron.
- The shade house (for the Hardening Chamber) generally has shade netting rated at 30% to 40% on the sides.
- Root trainers (Hycopots) are used for raising seedlings in the hardening chamber. Size of such Hycopots varies on the requirement of species. These are made of hard plastic in the shape of cones with ridges on the inner surface for guiding the tap roots vertically down and adding to the growth of fibrous root.
- Raised beds are generally used for storing seedlings in the hardening chambers.

QPM should have proven track record of high survival percentage in the field ensuring improvement in productivity of the plantations, faster growth, higher yield, resistance to pest and diseases, adaptability to local bio-physical, climatic and socio-economic conditions, and with high market demand. Those are the advantage of QPM and the disadvantage is high initial cost of modern nursery that demands various equipments.

6.6. Component 2: Wildlife Management and Habitat Improvement

To strengthen biodiversity conservation in West Bengal with focus on the main issues, the following sub-components are included in this component: A) Improvement of wildlife habitat in protected areas, B) Mitigation of man-animal conflict, and C) Research on wildlife and Biodiversity. By implementing these in combination, it is expected that man-animal conflict will be alleviated, conservation of key animal species be enhanced, and unique/diverse ecosystems be restored and developed.

Table 6-18 Contents of Wildlife Management and Habitat Improvement

No	Component	Sub-Components	
2	Wildlife Management and Habitat Improvement	2A	Improvement of Wildlife Habitat in Protected Areas
		2B	Mitigation of Man-animal Conflict
		2C	Research on Wildlife and Biodiversity

For sub-component A), three types of habitat improvement are proposed in seven protected areas in the north: 1) grass and fodder tree plantation in the plains; 2) bamboo under-planting in Mahananda; and 3) fodder tree plantation after removal of maling bamboo in the hills.
For sub-component B), various mitigation measures are proposed for five types of conflict: 1) elephant and gaur in the north; 2) elephant in the south-west; 3) leopard in the north; 4) tiger in Sunderbans; and 5) smaller animals in the central.
For sub-component C), total five research subjects are proposed to be carried out for inventory and status survey, ecological study for conservation/management, and impact assessment for habitat management.

6.6.1. Improvement of Wildlife Habitat in Protected Areas

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 basis 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 up to 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 465 ha in six years: 300 ha for grass and fodder tree plantation, 90 ha for bamboo under-planting and 75 ha for fodder tree plantation after bamboo removal.

Table 6-19 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) Jaldapara WS (WIII) Buxa TR (BTR-E/W)	60 ha (20 ha/year) 90 ha (30 ha/year) 150 ha (50 ha/year)	300 ha	5 years (3-7th year)
Bamboo under-planting in Mahananda	Mahananda WS (WI)	90 ha (30 ha/year)	90 ha	5 years (3-7th year)
Fodder tree plantation after bamboo removal in the hills	Singhalila NP (WI) Senchal WS (WI) Neora Valley NP (WII)	15 ha (5 ha/year) 45 ha (15 ha/year) 15 ha (5 ha/year)	75 ha	6 years (3-8th year)
Total	7 PAs	465 ha (155 ha/year)	465 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 planed 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.

(1) 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 (*Arundo donax*), Khagra (*Pharagmites karka*), Bhutta ghash (*Coix lachrymajobi*), Banspati (*Setaria* sp.), Purundi (*Alpinia alughas*), etc. The tree species planed are: Sissoo (*Dalbergia sissoo*), Chapalish (*Artocarpus chaplasha*), Kumbi (*Careya arborea*), Chalta (*Dillenia indica*), Jogdumur (*Ficus hispida*), 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.

(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.

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 planed are all indigenous: Bhalu bans (*Dendrocalamus sikkimensis*), Choya bans (*Dendrocalamus hamiltonii*), Mala bans (*Bambusa nutans*), Kalai makla (*Bambusa vulgaris*) and Muli bans (*Melocana baccifera*). The plot size of one plantation is 1 ha in minimum.

(3) 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*), Lepcha kowla (*Machilus edulis*), Buk (*Quercus lamellose*), 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.

6.6.2. Mitigation of Man-animal Conflict

As the human population increases, the wildlife population increases and the wildlife habitat becomes limited, man-animal conflict is the major problem for biodiversity conservation in the state. In terms of damage and compensation (human, livestock, hut and crop), conflict with elephant is the most serious, followed by gaur, tiger and leopard. For this project, five types of man-animal conflict have been identified as priority for mitigation needs, which are: 1) elephant and gaur in the north; 2) elephant in the south-west; 3) leopard in the north; 4) tiger in Sunderbans; and 5) smaller animals in the central. Most of the mitigation measures are referred in the relevant management plans.

(1) Elephant and Gaur Conflict in the North and South-west

To reduce damage by elephants, alleviate distress of affected people and rescue wounded elephants, different strategies will be taken for the two populations in the north and the south-west, considering the patterns of forest distribution, land use and elephant movement as well as the perception of local people.

a) Northern Population

The northern population of elephants is restricted to Jalpaiguri and Darjeeling Districts, moving between Assam, West Bengal and Nepal. There is a series of large tracts of forest and many small villages are located adjacent to and sometimes in the forests. In this region, electric fences are quite effective to protect the villages and farms from elephant raiding if properly maintained. According to a field manager, no persons have been killed by elephants after installing electric fences for five years in some village, while 14 persons killed in a nearby village with no electric fence during the same period. In this region, it is proposed to take the following mitigation measures:

- Erection of proper electric fences with iron angle or wooden posts (40 km) and improvement of old ones (30 km).
- Creation of a fully-equipped mobile squad for elephant/gaur rescue and translocation, provided with a vehicle with transport cage, vehicles for patrolling and various field equipment. The base of the mobile squad will be set up at Mal or Khunia in Wildlife Division II.
- Engagement of skilled labour for driving off elephants, provided with *hulla* (burning torches), crackers and search-lights.

Priority areas to implement these activities is given to those along the major elephant migration route, particularly around Mahananda WS, Gorumara NP, Jaldapara WS and Buxa TR, which

provide the core habitat for elephants. The location of electric fencing will be identified by: 1) extent/frequency of damage; 2) adjacency to the protected areas or recorded forest areas; 3) request by villagers with their prior commitment for maintenance; and 4) no obstruction for major elephant migration and corridors. To fix the actual sites for the erection, it needs to consider the topography, the direction of elephant movement, straying habits of elephants and the traffic of villagers through assessment by ROs/BOs and consultation with villagers. They may be erected along the forest edge or surrounding the villages/farms depending on the situation.

As for conflict with gaur, a main mitigation measure is to tranquilise and translocate strayed animals from villages/farms back to forests. This will be taken along with the mitigation measures for elephant conflict, particularly by using the mobile squad.

b) South-western Population

The south-western populations of elephants, originating from Dalma area in Jharkhand State, come seasonally to West Midnapore, Purulia and Bankura Districts, covering very large area of about 1500km^2, and extend to farther north and east in recent years. Some of them became resident in the region. The patchy distribution of forests in the vast cultivation area forces elephants to roam through the large tract to search food, water and cover. This makes it difficult to effectively protect villages/farms from elephant that stray into the areas on all sides by electric fences. Furthermore, local people in the region have senses of aversion for electric fences as nuisance. They keep elephant herds in one place, where crop raiding becomes very serious, and interrupt people's traffic in their surroundings. In fact, a length of electric fences was erected in this region in 1980's but all were destroyed and removed by the local people. Because of these reasons, it is difficult to adopt electric fencing and then, only driving off elephants is regarded as a practical and effective measure in this region. Therefore, it is proposed that skilled labour be engaged for driving off elephants, provided with *hulla* (burning torches), crackers and search-lights.

All the above operations in the both ranges will be supervised by DFOs who are responsible in the project sites and implemented by ROs/BOs according to the work level. Skilled and non-skilled labour will be hired from EDC/JFMC members in the project sites for electric fencing, constructing watch towers and driving off elephants from villages/farms (not from their own areas but from other areas upon request). The operations will have been supported for five years by the project.

(2) Leopard Conflict in the North

Conflict with leopard often occurs along a tea garden belt in Hashimara-Birpara-Nagrakata region in the north Bengal. Leopards sometimes cause serious injury to people, being required to be captured for their safety and treatment. On the other hand, leopard cubs, which are left by a mother while escaping from people, are often captured and handed over to the Forest Department. To improve capturing and transporting such animals by the Forest Department, it is proposed to provide DFOs covering the jurisdiction of Mahananda WS, Gorumara NP, Jaldapara WS, Buxa

TR and nearby recorded forest areas with necessary equipment, such as small truck hiring, light-weight cages, nylon nets and skilled labour. They will be hired from EDC/JFMC members in the project sites. The operations will have been supported for five years by the project.

(3) Tiger Conflict in Sunderbans

In Sunderban TR, tigers sometimes come out of mangrove forests to search prey and stray into inhabited villages, killing livestock and frightening people. Tiger straying into villages has been a serious issue for tiger protection, which makes it difficult to get understanding and support from the local people. To mitigate man-tiger conflict, two strategies are adopted for the project: 1) to prevent tigers coming out of the forests; and 2) to respond quickly to capture, transport and release tigers back to the forests.

For the first strategy, the Forest Department has been investing to elect nylon net fencing around Sunderban TR, which is well-reputed by nearby villagers; in some hearing by the department officer, more than 90% of respondents considered it very useful or useful. The department also has been attempting to increase the prey basis for tiger by releasing chital (spotted deer). For the second strategy, it requires to establish a system to make fast response possible to reach the affected villages and to capture the problem animals and return to the wild after veterinary check and treatment. In line with these strategies, the following measures are proposed to be supported by the project:

- Erection and replacement of nylon net fences along the forest fringe outside Sunderban TR: 16 km for new election with RCC posts and 20 km for replacement with wooden posts. The location of fencing will be identified later at the sites where tigers are prone to stray in consultation with the relevant villagers. It needs to have prior commitment from villagers for the maintenance of fences.
- Creation of two fully-equipped mobile squads for tiger protection and rescue, provided with launch hiring, speedboats and various capturing and field equipment. The base of the squads will be set up at Shajnekhali and Jharkhali.

The Field Director of Sunderban TR and DFO of 24 Parganas-South will cooperate to implement all the work related to create the mobile squads. The tiger rescue operation will be supervised by the same officers and implemented by ROs/BOs for the both jurisdictions respectively in the field. The nylon net fencing will be supervised by DFO and implemented by ROs/BOs of 24 Parganas-South. Skilled and non-skilled labour will be hired from EDC/JFMC members in the project sites for electing and replacing the fences and assisting the tiger rescue operation. The operations will have been supported for five years by the project.

(4) Conflict with Smaller Animals in the Central

Incidents by monkeys (macaque and langur) in raiding houses/shops and injuring people are common in Kolkata and other cities in Howrah, Hooghly, Nadia, Burdwan and 24 Parganas-North Districts in the central Bengal. There are similar problems by other small animals, such as fishing cats, leopard cats, civets and snakes, killing poultry, injuring people and sometimes killed

by people. Some of these nuisance animals are also regarded as a component of local biodiversity to be protected under the Wildlife Protection Act (1972): fishing cat (*Prionailurus viverrinus*) and leopard cat (*Prionailurus bengalensis*) belonging to Schedule I of the Act and classified as vulnerable by ZSI (2005). The Forest Department is obliged to capture, rescue and transport the animals for their survival. However, the dispersed nature of such incidents, generally occurring far away from the department offices, makes it difficult to respond timely to meet public demand for interventions; which aggravates the situation at the sites.

It is, therefore, proposed that competent NGOs or the Honorary Wildlife Wardens (HWW: a civil society member appointed by the Chief Wildlife Warden) in the above six districts be contracted as focal points to deal with the incidents of animal conflict so that they can move to the sites and handle the problems quickly before the department officers arrive at the sites. Five DFOs responsible to the six districts will supervise the activities of NGOs or HWWs. ROs/BOs will keep liaison with them, providing each focal point with transport and various equipment necessary for the operation. A set of treatment chamber, post mortem room and quarantine as well as veterinary assistance will be provided to all the DFOs. The operations will have been supported for five years by the project.

Table 6-20 Proposed Activities for Man-animal Conflict Mitigation

Species/Range	Division	Activity	Facility/Equipment/Labour	Duration
Elephant/gaur in the north	WI, WII, WIII, BTR-W, BTR-E	Electric fencing	Erection of new fences (40 km), Improvement of old fences (30 km)	5 years (3-7th year)
	WI, WII, WIII, BTR-W, BTR-E	Mobile squad & driving-off	Vehicle for transporting animals (1), Vehicle for patrolling (2), Van/truck hiring, PA system (5), Radio com. (5), Search light (25), Walkie-talkie (25), Night vision (5), Watch tower (5), Field gear & driving tools, Skilled labour (1200 MD /division / year)	6 years (2-7th year)
Elephant in the south-west	Rupnarayan, Kharagpur, Bankura-N, Purulia, Jhargram	Driving-off	Van/truck hiring, PA system (5), Radio com. (5), Search light (25), Walkie-talkie (25), Night vision (5), Watch tower (5), Field gear & driving tools, Skilled labour (1200 MD /division/ year)	6 years (2-7th year)
Leopard in the north	WI, WII, WIII, BTR-W, BTR-E	Rescue & transport	Truck hiring, Transport cage (10), Nylon net, Protective gear (50), Field gear, Skilled labour (150 MD / division / year)	6 years (2-7th year)
Tiger in Sunderbans	24 Parganas-S	Nylon net fencing	Erection of new fences (16 km), Replacement of old fences (20 km)	5 years (3-7th year)
	24 Parganas-S, STR	Mobile squad	Launch hiring (2), Speed boat (2), Cages (2), Radio com. (2), PA system (2), Search light (30), Nylon net, Protection gear (30), Skilled labour (1200 MD / year)	6 years (2-7th year)
Smaller animals in the central	Kolkata (HQs), Howrah, Nadia-Murshidabad, Burdwan, 24 Parganas-N	Rescue, transport & treatment	Van hiring, Treatment chamber/ quarantine (5), Trap cage (18), Bird cage (12), Snake stick (12), Fridge (10), Trap net, Skilled labour (300 MD /district /year), Veterinary assistance, NGO support	6 years (2-7th year)

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

6.6.3. Research on Wildlife and Biodiversity

A main objective of research by the Wildlife Wing of the Forest Department is to obtain better understanding and knowledge of wildlife, ecosystems and biodiversity, of which information is vital for taking appropriate conservation and management actions in/around the protected areas. However, there is a paucity of information on biological, ecological and socio-economic subjects for the protected areas because of no institutional setup and resources for research and lack of budget and coordination with research institutes. By this project, therefore, it needs to generate such critical information through undertaking basic and applied research on the relevant areas with high priority.

(1) Priority Areas for Research

The priority areas for research to be conducted by the project are determined as follows:

- Inventory and status of flora/fauna species of conservation concerns to have basic knowledge for the population, distribution, habitat and threats.
- Biology and ecology of key species (threatened, keystone, umbrella, etc.) to improve conservation and management: population, distribution, habitat preference, prey-predator relationship, breeding biology, genetic identity, etc.
- Habitat management and impact assessment to review and improve the current practice: habitat degradation, regeneration, restoration, species composition, nutrient cycling, carrying capacity, etc.
- Man-animal conflict and mitigation measures to review the current practice and develop alternative measures, including interaction between human activities and protected area management.

(2) Criteria for Research Selection

The following are criteria used to select research subjects for the project.

- Research to addresses subjects related to other sub-components of the wildlife management and habitat improvement.
- Research to address information critical to the long-term management of wildlife and protected areas.
- Research to establish benchmark for the long-term monitoring of biodiversity status.
- Research to address information critical to the conservation of threatened, rare and other key species.
- Research that aims to develop species conservation plans/strategies or provide scientific basis for protected area management plans.

(3) Proposed Research Subject

To select research subjects to be undertaken by the project, firstly a long list was prepared based on a proposal by the Wildlife Wing (HQs), hearing form field managers and management plans

for the relevant protected areas. In reference to the above selection criteria, five research subjects are proposed as shown in following table.

Table 6-21 Proposed Research Subjects

No	Subject	Objective	Content	Outcome	Duration
1	Inventory and status survey for butterflies in the north Bengal	To know the status of butterflies in the north, to create the database, and to generate awareness among staff/public	Species identification, Population, Distribution, Habitat preference, Conservation value	Inventory, Compilation of book, Generation of staff/ public awareness, Basis for conservation measures, Reference for dealing with illegal collection	3 year (2-4th year)
2	Status survey of gaur and leopard in the north Bengal foot hills	To understand population dynamics and habitat preference of gaur and leopard	Population, Habitat preference, Carrying capacity	Basis to improve mitigation measures for conflict: to maintain sustainable population (for gaur); and to create inviolate areas in/around forests (for leopard)	4 year (3-6th year)
3	Population dynamics, actual niche and seasonal variability in distribution of tiger in the north Bengal	To understand population dynamics, habitat preference and seasonal variation in distribution of tiger in the forests with emphasis of Neora Valley NP, Mahananda WS and Jaldapara WS	Population estimate and individual identification by DNA fingerprinting, Habitat preference in relation with individuals, Seasonal change of distribution pattern	Basis to improve future management of tigers and their habitats in the north Bengal	4 year (3-6th year)
4	Population dynamics, movement pattern and habitat utilisation of elephant in the north and south-west Bengal	To understand population dynamics, habitat preference and habitat utilisation pattern of elephant in the two regions	Population tend, Seasonal movement and habitat use in relation to forests and farms, Migrants and residents	Basis to minimise elephant conflict outside the forest areas by exploring the possibility of: confining elephant movement in selected forest patches; introducing alternative crop pattern in depredation areas (for the north); and creating suitable habitat to restrict elephant movement in forest patches (for the south-west)	4 year (3-6th year)
5	Impact of canopy manipulation and grassland restoration on habitat utilisation pattern and carrying capacity of herbivores in Jaldapara WS, Gorumara NP and Mahananda WS	To know impact and effectiveness of grassland creation/ restoration on habitat utilisation of herbivores and carrying capacity of the habitat	Change of floristic composition, Habitat preference of various herbivores (ungulates in particular), Quantity and frequency of the habitat utilisation by herbivores	Scientific basis for the habitat manipulation for biodiversity conservation in PAs, Bench mark and input to PA management plans	5 year (3-7th year)

(4) Research Advisory Committee

Although the research subjects were selected through the Preparatory Survey, it is proposed that the subject will be reviewed for approval by the Research Advisory Committee (RAC) set under the Wildlife Wing. It is considered better to do so because of the following reasons: 1) broad and professional advice from prominent scientists and field managers are essential; 2) availability of research institutes to be contracted for each subject may be changed with their convenience; and 3) there might be some change of research priority before the project implementation, affected by the third party's plan and work.

The current committee, chaired by the Chief Wildlife Warden, was set in line with *Guidelines for Scientific Research in the Wildlife Protected Areas* prepared by the Ministry of Environment and Forests. For the sake of the project, the committee will be requested to have six members in maximum, which consists of reputed scientists from research institutes, such as Wildlife Institute of India and Zoological Society of India. Subject-matter specialists and/or field managers may be invited to discuss the relevant subjects.

It is proposed that RAC be given the following responsibility for the project purpose:

- To review and approve the research subjects in reference to the existing information.
- To review scientific and academic capability for research institutes to be contracted.
- To review interim reports for quality control, providing comment and advice.
- To evaluate final reports in terms of output.
- To confirm application of the research outputs into conservation/management actions.

(5) Research Arrangement

In consideration of advice by RAC, the Chief Wildlife Warden will authorise the research subjects to be carried out by the project. To select research executors, an open tendering system will be adopted to ensure fare selection and accountability. The Wildlife Wing (HQs) will serve as the secretariat for the sub-component of research to ensure smooth implementation, including collection of the existing information, preparation of the tender documents, review of the research reports, and coordination between researchers and field managers.

Each contracted researcher will be responsible for planning and arranging the research work and may be requested to stay in the field for some period and engage qualified research assistants. EDC/JFMC members will be involved in the field work whenever appropriate.

6.7. Component 3: Community Development

6.7.1. General Description

This component is indispensable component of the Project in order to archive the Project purpose through the JFM approach. There are close relationship between forest degradation and high population pressure of forest dwellers people who depends highly on forest resource and live at the poverty level.

It was also realised that the fringe population must be recognised as the main resource management group. All development activities must originate through them and benefits from these activities go to them as rightful share of responsible and honorable partner in the management group.

In that context, West Bengal Forest Department has promoted JFM as previously mentioned. As on March 2010, there are 4,271 JFMC/EDCs in the State comprising of total number of 486,779 members protecting the total forest areas over 562,526.96 ha. The total number of EDCs in the State is 115 comprising of 23,197 members protecting 83,264.49 ha of Protected Areas In all JFMCs and EDCs, the spouses are joint members[6]. But it is hardly said that forest degradation has been stopped. Although, due to progressive degradation, coppice felling area in South West Bengal has already declined from around 3,200 ha in the early eighties to 800 ha in 1986[7].

Therefore, existence of JFMC only will not guarantee protection of forest resources. They need to be motivated and committed. There are areas where JFMC have functioned indifferently. This may have arisen because of non-receipt of share of usufructs as no sal coppice forests were harvested in areas allocated to them or a situation of conflict amongst JFMC/EDCs in adjoining areas. Forest has been degraded because of repeated coppicing on short rotations of two to three years by head loaders[8]. Those JFMC could not be treated in totality during past projects and ongoing state plan or centrally sponsored schemes. Such degraded lands have been proposed to be treated with afforestation/reforestation activities under the Project. The Project aims at strengthening JFM movement to enable JFMC to improve their level of performance by involving their communities not only in afforestation / reforestation activities but also creating an environment of trust and confidence between them and forest personnel on the frontline. Moreover, community assets inputs can create immediate interest of the people to participate in the project activities.

Capacity development of the JFMC members through training and livelihood improvement activities through existing or newly creating Self Help Groups also developed in the Component.

Creating SHG and introducing revolving fund for micro credit and micro enterprises. Target of SHG is not only for women's group but forest dependent people; landless farmers and poor also are included.

6.7.2. Selection of Target Group (JFMC)

There must be is a link between this Community Development component and Afforestation component. In order to select target group, 3 criteria and 2 considerations items are set as following;

[6] State Forest Report 2009-2010
[7] Detailed Project Report, West Bengal Forest Department, December, 2010.
[8] Head loaders mean women or men (mostly women) who cut and collect bundles of young 1-2 year old coppice shoots and carry bundles of these on their heads to the nearest markets for sale as firewood. This gives them support for their livelihood.

i) Working Plan (Establishing a Long list of target area)

Each working models proposed in the Project within the recoded forest area will obviously need to conform to the working plan prescriptions to which such degraded areas are allocated. These efforts as far as possible will be made in areas where functioning JFMCs already exist on ground and they are willing to participate within the framework of existing JFM resolutions of the State Government.

Therefore, long list of target area as priority area for the afforestation / rehabilitation and wildlife conservation related works shall be developed by PMU according to the Working Plan during the early stage of the preparation period of the Project.

ii) Extraction of target area

Then, target area shall be extracted in accordance with requirement area and relevant natural conditions for each plantation model or requirement of wildlife conservation activities.

iii) Proximity of target group to forest

Proximity of target group to the forest should be within 1 km.

■ Other considerations

- Poverty and Dependency on Forest Resource

It is necessary to consider that economically disadvantaged community shall be selected as target village / groups however there is no existing poverty data for each group. Dependency on forest resource is liked to poverty and it also should be considered as one criterion to select the target. These parameters should be investigated by baseline survey.

- Cluster making

It may be necessary to form clusters while selection stage and preparing micro plans in order to avoid dispersion of the target areas. *(It is proposed that such clusters should be made on the basis of criteria of presence of two or more JFMC in a Beat having more than 30ha of degraded forest land for afforestation within the forest areas demarcated against such JFMC)*

- Percentage of SC/ST population among JFMC members

6.7.3. Selection of Target Group (EDC)

There must be is a link between this component and Biodiversity Conservation. In order to select target group, 5 criteria shall be set as following;

i) Proximity to forest : EDC within 1km of Protected Area

ii) EDC undertaking the Project Activities

iii) Presence of Endangered Species in the Protected Area

iv) Incidences of Man/Animal Conflicts

v) Percentage of SC/ST population among EDC members

6.7.4. Physical Target Number of Target Group

Under this component, physical target number of the JFMCs/EDCs is set as 600 approximately. Of the total, 550 are JFMCs and 50 are for EDCs. Target group will be selected as previously noted and micro plan will be made up during the preparation phase of the project for all JFMC.

6.7.5. Mobilisation and Making of Micro Plan

After selection stage, contact with target JFMC/EDCs and procedure for micro plan making shall be started. Mobilisation will be done as first contact and adequate explanation on the Project and working condition under the JFM should be done from the Project to the selected groups. Then, Micro Plan shall be promoted only after reaching their adequate and voluntary consensus to the Project.

6.7.6. Community Development Infrastructure

Community support activities proposed intend to create community assets to provide for social infrastructure of forest dependent communities.

Forest Department, Government of West Bengal has through implementation of JFM very successfully built up good rapport with fringe and forest dwellers through formation of JFMCc/EDCs/SHGs. These groups have come forward for protection and regeneration of the forest resources resulting in remarkable regeneration of forests in the tracts of South-west Bengal. Changes in the attitudes of communities involved in JFM and the forest personnel working on the ground have been perceptible creating a congenial environment of mutual faith and trust. This environment needs to be sustained and strengthened.

With a view to enduring such efforts, the project has decided on initiatives with a set of community development for the forest fringe dwellers. This endeavor will rejuvenate rapport building efforts in areas of perceptible decline and strengthen the bond with the members of JFMCs, EDCs and the SHGs, in other areas. Communities will have a higher degree of motivation protecting the forest resources. The benefits of the community development will accrue to forest dwellers and forest fringe communities and therefore it is expected that some community assets will be created. The creation of community assets will secure sustainability of the components envisaged in the project.

Table 6-22 Tentative List of Community Development Infrastructure

No	Activities proposed	Area	Authority of Execution	Monitoring	Targeted Beneficiaries/selection method
1	Construction / Extension of roads in forest fringe areas for improving access for forest dwellers and forest fringe communities	North & South Bengal	Forest Department	Forest Department	Forest dwellers in forest villages of North Bengal and forest fringe communities in Southwest Bengal, Site will be selected through micro planning
2	Construction of School Bldg for North Bengal and south Bengal JFMCs with toilets, water supply etc	North & South Bengal	Forest Department in association with JFMC & EDC	Forest Department	School going children of the communities
3	Rock Checks / Earthen checks, gully treatment measures and earthen dams for water harvesting	North & South Bengal	Forest Department in association with JFMC & EDC	Forest Department	Members of JFMCs & EDCs and the people dwelling in the areas. Sites will be selected on the basis of social/bio physical criteria during micro planning
4	Boring and installation of shallow tube well and MDTW[9] duty including cost of kutcha/ pucca [10] conveyor channels	North & South Bengal	Forest Department in association with JFMC & EDC	Forest Department	Members of JFMCs & EDCs and the people in adjoining areas. Sites to be selected in consultation with WRIDD[11] and the communities.
5	Boring and installation of deep tube well--300 to 500 ft. depth--including cost of pucca conveyor channels	South Bengal	Forest Department in association with JFMC & EDC	Forest Department	Members of JFMCs & EDCs and the people dwelling in the areas. Sites to be selected in consultation with WRIDD and the communities.
6	Construction of sanitary toilets for JFMC/ EDC members	North & South Bengal	Forest Department in association with JFMC & EDC	Forest Department	JFMC/ EDC members

During the preparatory survey site visits were undertaken in the field and JFMC/EDC's viewpoints obtained through interaction. The above-mentioned list is indicative and need not be taken as sacrosanct. Need has to be assessed through micro planning during the preliminary phase. Selection items can only be firmed up after preparation of micro plans for JFMCs/ EDCs. Activities suggested also have the back-up of the Forest Departments' experience of execution of West Bengal Forestry Project (1992-97) and Ecodevelopment Project in BTR and UNDP sub-programmes in Jaldapara and Sunderbans.

Through the proposed community support activities a variety of assets will be created. Such assets have to be maintained for sustainability through a mechanism of sharing responsibilities by the Forest Department and the communities involved in JFMC/EDC/SHG.

Infrastructure development shall be programmed only within a set budget by village. Tentative list of the infrastructures will be agreed between JICA and WBFD but final selection of infrastructure will be determined only after preparation of micro-planning.

6.7.7. Operation and Maintenance Mechanism

Assets created under this component and proposed operation and maintenance mechanism is furnished in the table:

[9] MDTW: Medium Duty Tube Well
[10] kutacha: earthen conveyor channels without any lining / Pucca: conveyor channels lined with brick masonry or concrete
[11] Water Resources Investigation & Development Department

Table 6-23 Example of Maintenance Mechanism by Assets

No.	Assets	Operation	Maintenance Mechanism
1	Construction / Extension of roads in forest fringe areas for improving access for forest dwellers and forest fringe communities	Villagers are principal users and no operation is required basically.	Forest Department
2	Construction of School Bldg for North Bengal and south Bengal JFMCs with toilets, water supply etc	School Education Department / Village Communities	Forest Department with contribution from communities
3	Rock Checks/Earthen checks, gully treatment measures and earthen dams for water harvesting	No operation is required basically.	FD in association with communities in JFMC/EDC
4	Boring and installation of shallow tube well and MDTWs duty including cost of kutcha/ pucca conveyor channels	Water users' association (WUA) formed out of beneficiaries in JFMC/EDC	Communities in JFMC/EDC with the assistance of FD
5	Boring and installation of deep tube well--300 to 500 ft. depth--including cost of pucca (bricks) conveyor channels	Water users' association (WUA) formed out of beneficiaries in JFMC/EDC	Members of WUA in JFMC/EDC
6	Construction of sanitary toilets for JFMC/ EDC members	SHG formed out of beneficiaries in JFMC/EDC	SHG in JFMC/EDC

Engineering features for the following items have been prepared and suggested by the Survey Team. Typical drawings are also provided

- Soil conservation and water harvesting measures are considered to treat areas degraded by sheet and gully erosion and to create storage structures for the facility of providing water for surface irrigation to lands of forest fringe population including JFMC members. Rock check dams and earthen check dams with boulder pitching and grass turfing would be done for gully treatment. These will be placed in cascading series. These soil conservation and water harvesting schemes are popular amongst the beneficiaries and therefore allocation has been made accordingly.

- Road development in the forest areas and forest fringe areas has been considered for use by the forest personnel and to provide for facilities of all weather roads to act as market link for population include in JFMCs/EDCs.

- School Building would be constructed both in North Bengal & South Bengal. Sites will be selected through micro planning.
- Provision of minor Irrigation facilities through installation of shallow and Medium Duty tube wells with the assistance of the Department of Water Resources Investigation and Development Department keeping view environmental criteria. Specifications of such system will be:

  Medium Duty Tube Well (MDTW): This type of tube well is constructed for discharging 100 cu. M per hour. Water is lifted by a submersible pump set capable of discharging 100 cu m per hour to irrigate 20 ha of land. Underground pipelines originating from one

elevated chamber distributes water. The distribution chamber serves as the link between pump sets and delivery pipeline system. The chamber regulates pump discharge to match the discharge of the pipe distribution system in addition to ensuring equal streams to each of the two pipelines

Shallow Tube Well (STW): These are constructed in areas where water table is within suction limit. Water is lifted by one centrifugal pump set capable of discharging 30 cu m of water per hour to irrigate 6 ha of land through open channel.

Typical floor plans, specifications, and preliminary structural details of items mentioned are provided in Annexure 3.

Community development Infrastructure in particular for EDCs may be proposed following items;

- Alternative energy development by promoting improved *chulhas* (stoves), LPG (Liquefied Petroleum Gas) and etc., in cooperation with related department or agency such as West Bengal Renewable Energy Development Agency.
- Introducing of solar street light

6.7.8. Livelihood Improvement Activities

■ Selection of target Self Help Group (SHG)

Livelihood improvement activities will be implemented through the strengthening of SHGs. Minimum two SHGs will be selected from one JFMC and if there are no existing SHGs, new SHG should be established cooperating with Rural Development Department, NGOs and other related agencies. In case that there are more than two SHGs in the village, JFMC which has JFMC/EDC members in the group shall be preferentially selected as a target SHGs. Forest dependent people, landless farmers, poor and women shall be main target for SHGs

■ Capacity Development for SHGs and Introduction of Seed Fund

As a livelihood improvement activities by maximum use of NTFP such as Sal leaves, medicinal plants. Moreover, various activities can be developed through these activities in order to create new income resource.

When new income resource comes to SHG, it is necessary to manage their fund. Therefore, book keeping capacity enhancement shall be executed by extension workers who will be hired by the Project. In order to keep sustainability of SHG's activities, this book keeping capacity enhancement is essential because proper book keeping technique can keep financial transparency.

A seed fund to meet the capital expenditure needs of SHGs will be introduced maximum INR 30,000 per one SHG. Business plan development and marketing of their income generation activities shall be supported by local NGOs in cooperation with related line agencies such as rural development department.

■ Activities of SHG

As a livelihood improvement activities by optimise the use of NTFP such as Sal leaves, medicinal plants, seed oil crops should be considered preferentially since when NTFPs are used in a sustainable way (with proper forest management systems), providing economic incentives for forest conservation. The economic value of NTFPs is highly significant to rural and national economies in terms of the provision of material needs, cash income and employment;

Following activities may be proposed as income generation activities for SHGs although they will be proposed through the micro planning.

- Supply of Sal leaf plate making machine (manual operation)
- Supply of sewing machine (manual operation)
- Supply and installation of oil distillation plant + grinder and accessories for processing of NTFP collected by the FPCs - electrical operation
- Installation of production unit for ayurvedic drugs
- Supply of handloom machines to the FPC/EDC beneficiary
- Provision of poultry, duckery & piggery units
- Promoting home gardens for medicinal plants and orchard

6.8. Component 4: Institutional Capacity Development

This Institutional Capacity Development component consists of six components as following;

Table 6-24 Component 4: Institutional Capacity Development

No	Components	Sub-Components	
4	Institutional Capacity Development	4A	Base line Survey of the State's Forest Resource at the Start of the Project
		4B	Training & capacity Building of Project Implementing Officials, Field &Office Staffs and Other Stakeholders
		4C	Infrastructure development for TPOF (Social forestry), training, research, GIS, forest protection etc including Building, Equipment &Vehicle
		4D	Forestry Research Activities
		4E	Mid-term Monitoring & Evaluation including periodic biodiversity & community development studies
		4F	End-term Monitoring and Evaluation

6.8.1. Baseline Survey of the State's Forest Resource at the Start of the Project

In the past projects no effort was put in direction creating a benchmark for the resource targeted for improvement and socio-economic conditions of the people and communities proposed to be covered under such projects. Achievements were assessed only on physical parameters against different component activities. There was no way to measure the success of projects with reference to changes in the growing stock both qualitative or quantitative or changes in socio-economic conditions of the people involved in the regeneration/ resuscitation of forests in target areas including their behavioral pattern to manage such resources sustainable.

The present project wants to make a departure in this regard. Creation of a baseline therefore has been made imperative during the first two years of the preliminary phase. In order to evaluate

effect of the Project, same survey will be implemented in the end of the Project also. Therefore, survey will be implemented two times in total. Following two types of survey shall be implemented.

6.8.1.1. Baseline Survey of the Forest Growing Stock, Soil & Water quality, NTFP Working Circle, M.F.P. Div. & Research Circle and Soil nutrient in about 2 lakh ha forest area covered under the JFMC

The project is designed to consolidate the benefits derived from past projects and strengthening JFM has been accepted as a tool to carry out the program of building up forest cover through afforestation, reforestation in degraded forest lands through adoption of different models with due consideration of working plan prescriptions and rehabilitation degraded Sal forests through coppicing.

The project also intends to use the provision under community support activities to raise the level of motivation and commitment amongst targeted communities through and provide alternate livelihood. Provisions under this component though not adequate to meet the aspiration of communities but this if wisely used can effect some changes in the economic level of economically disadvantage communities of JFMCs/EDCs. This will also create an atmosphere of mutual trust and confidence between forest fringe communities and forest dwellers in areas of project execution. The baseline survey will concentrate on the following:

- Study of growing stock in general both in natural forests and plantations, quality of forest cover under different canopy density classes and distribution of major tree species of timber in plantations. Such study will also cover about 200,000 (2 lakh) ha of forests an plantations brought under the cover of JFM
- NTFP content of plantations and natural forests including rehabilitated Sal coppice forests of South-west Bengal and assessment of potential production of important NTFPs the collection and processing of which can significantly add to the enhancement of income beyond the project period. This will also identify areas for preservation of gene pool of medicinal herbs and shrubs in different forest types distributed in this tract.

6.8.1.2. Baseline Survey in Socio-Economic Conditions of the Target Population by NGO/Governmental Agencies over about 2 lakh ha forest area covered under JFMC

Conducting a baseline survey to ascertain socioeconomic status of communities involved in JFMCs/EDCs covering areas of execution of project components. Following modules and items should be covered by baseline survey;

- Household level
  - General information about the household: (identification of the household, basic information on its composition and main characteristics including family composition, proximity to roads and markets, education, member of what kind of group or

cooperative etc.)

- Income (per household)
- Structure of Income (Agriculture, Off-farm income, income from Forest Products and NTFP, Labour income, and debt etc.)
- Household assets (it can be one of indicator of income)
- Income distribution of house hold
- Perception of the status of forest by comparing past and present

- Community or (JFMC/EDC) level

  - Review and collection of all available information and sources
  - Number of SHG or organisations which are active and their status of activities (Total transaction of last one year, actual deposit amount and etc.)

Such studies may be conducted through agencies of reputed institutes or competent NGOs. This component will be supervised by the PMU with the help of the GIS cell at HQ and Monitoring and Evaluation Unit of the Forest Department. Sample survey procedures have to be determined keeping in view of the quality of output.

6.8.2. Training and Capacity Building

The existing organisation has the requisite training and skill for execution of projects of this nature as officers and staff have the exposure and experience in handling externally aided projects during last three decades. Stakeholders including officers and staff included in JFMCs/ EDCs have also been trained in specific areas relevant for them during WB projects on West Bengal Social Forestry, West Bengal Forestry Project and the India Eco-development Project. However each project throws new challenges and opportunities and

This necessitates and building up a capacity development plan for achieving the desired degree of success during execution of project components.

Capacity development programs have designed to for different target groups in the context of demands both from the project and the need for updating of knowledge and skill in relevant areas of forest and wildlife management. Modules and areas suggested are:

Table 6-25 Tentative List of Training Themes

No.	Areas and modules	Duration	Q'ty	Methodology	Procurement
1. Package-I for Senior Officers*					
	Themes: Carbon sequestration, resource survey and accounting, Biodiversity conservation and management, Climate change and adaptation, Timber certification	10-15days	30 officers (DFO level & above DFO level)	Nomination to identified foreign institutes	Selection by FD and deputation for training
2 Package-II for Middle and Junior level officers**					
	Long-term training themes: (Target: Range Officer or DFO) GIS- Remote sensing, Wildlife and biodiversity management	60-90 day	10 officers	Nomination to identified institutes in India	Selection by FD and deputation to training institutes

No.	Areas and modules	Duration	Q'ty	Methodology	Procurement
	***Short term themes*:** (Target: DFO) Soil and water conservation , Tropical Forest management, Project formulation & monitoring Wildlife biodiversity management	10-15 days	25 officers	Nomination to identified institutes in India	Selection by FD and deputation to training institutes
3. Package III- For Junior level Officers and FRs					
	Themes: Designing of soil conservation structures; QPM & containerised nursery management, seed technology and certification	10-15days	20 officers	Nomination to identified institutes	Selection by FD and deputation to training institutes
4. Package-IV Frontline staff and JFMC/EDC/SHGs					
	I. Training of frontline staff, JFMC members in micro planning PRA Capacity Building	2-3 day workshop /Group	400 days in Total	NGOs at district level under the guidance of NGOs at the regional level	Selection through screening of NGOs by District Facilitation units under the guidance of PMU Executive body
	ii. Micro finance, Accounting, Capacity Development for JFMCs/EDCs	1 day workshop /Group	400 days in Total	NGOs at district level under the guidance of regional level	Selection through screening of NGOs by District Facilitation units under the guidance of PMU
	iii. Mid-Project Capacity Development in Accounting and Micro Financing	1 day workshop /Group	50 days in Total	NGOs at district level	Selection through screening of NGOs by District Facilitation units under the guidance of PMU

Note: Preference will be given to those officers working in the Project. No officer other than employed in the PMU shall be shortlisted for second time training under this Project.
* Senior Officer: Officers of DFO level, above DFO level or IFS. ** Middle Officer: Officer up to DFO level

Trainings for senior / middle level /junior level officers will be organised through reputed International and Indian institutes. For training for frontline staff and members of JFMC/EDC will be organised through induction of NGOs/CBOs working at the district level. Such organisations will be selected through a prescribed procedure in conformity with JICA guidelines.

6.8.3. Infrastructure Development

6.8.3.1. Administration Building Construction

Expansion of existing administrative building 'Aranya Bhavan' in Kolkata, two floors will be added to accommodate a strengthened GIS cell, an Information Centre on forest resources and biodiversity, a library and a conference room.

Construction of an Administrative Building at Siliguri with the object to bring in all the offices of CCFs, CFs and DFOS under one roof for better communication, coordination amongst the officers of different wings and establishment of proper GIS cell . This will also have conferencing and training facilities

A building at Salt lake to accommodate an Archive and a Research laboratory for knowledge enhancement and to facilitate undertaking collaborative research with Universities/Institutes

36 front line officers' office complex shall be constructed in the Project Area.

All this will enhance the internal efficiency of the organisation and contribute to the quality of execution. Sites for construction of administrative building and archive are in possession of the

Forest Department.

Site selection for frontline office complex will be decided upon during the 1st. phase keeping in view the requirements of the project.

Floor plans for the administrative building at Siliguri have been suggested. But this may require some revision with reference to the site at the preparatory stage of the project. It will be better to have the architectural design and then go for preparation of the estimate. The present estimate is on the basis of floor space and specifications suggested.

For the archive the site is located at Salt Lake and an approximate floor of 5000sft. Aranya Bhavan (Existing Forest Department building) has sanctioned plan for expansion (two more floors will be added on the existing building)

All Offices Complex have been estimated on basis of the floor area, floor plans and specifications.

Typical floor plans, specifications and preliminary structural detail have been provided in **Annexure 3.**

Table 6-26 Tentative List of Construction of Buildings for Forest Directorates

	Name of Work	No of Unit	Location	Floor Area (Sq.ft)	Composition	Purpose of Construction	Remark
1	Beat Office Complex (1)	15	To be identified during the preparatory stage of the Project	375	- 4 Rooms	- Effective support of JFM, wildlife conservation activities and the Project	New construction.
2	Beat Office Complex (2)	10		475	- 4 Rooms		New construction.
3	Range office Complex	5		670	- 3 Rooms		New construction.
4	Expansion of existing administrative building	1	Aranya Bhavan (HQ. West Bengal Forest Dept.)	7200 x 2 floors =14,400	- GIS & Image Processing Lab (2500Sq.ft) - ICT Training Centre (2000Sq.ft) - Information Centre on Forest Resources and Biodiversity (4000Sq.ft) - Library (2500 Sq.ft) - Conference Room (2500Sq.ft)	- Effective support of JFM and Project - Effective management and monitoring of the Project and whole activities of the directorate - Capacity Development of personnel	Two floors will be added on the existing building.
5	Building at Salt Lake	1	AE-391, Salt Lake	5,000	- Archive (1800Sq.ft) - Research Laboratory (1800 Sq.ft)	- Effective management and monitoring of the Project and whole activities in North Bengal	New construction.
6	Administrative Building at Siliguri	1	Siliguri Divisional Forest Office	20,000	- GIS Room (1500 Sq.ft) - Space for offices of CCFs CFs, DFOs (18000 Sq.ft), - Conference room (2000 Sq.ft) - Library (2000Sq.ft) - Training Hall (1500 Sq.ft)	- Effective management and monitoring of the Project and whole activities in Wildlife Wing HQ.	New construction.

Note: No need of land acquisition for all the above works.

6.8.3.2. Equipment for GIS/MIS Project:

This has been identified as a priority needs to strengthen Forest Management Information System and delivery of services. Strengthening of GIS (Geographic Information System) infrastructure will require acquisition hardware, software and associated equipments. Detailed design should be executed in the preparatory phase of the Project.

(1) Proposed GIS Setup and Inter-unit connectivity

Connectivity for GIS between different administrative units: With the fast development of Information & Communication Technology data transfer and information dissemination is an easy task if the necessary basic infrastructure is provided. Here the infrastructure is allocated keeping in mind the imminent development of FMIS (Forest management Information System) through e-Governance. The remaining infrastructure would be built up in near future.

The process of data transfer between the Central GIS Cell and 2 Sub-units (Wildlife Wing at Salt Lake and one sub-unit in North Bengal (Siligri) and one sub-unit in South Bengal) may be through internet while keeping in mind data security. Physical transfer of paper maps and bulk data would be required from time to time between the Central GIS Cell and 2 Sub-units. Internet access is available even at the Division level, but should be extended to all Range Offices. Data transfer from Beat to range may be through mobile phones and GPS enabled. GPS data may be directly sent to the Central GIS Cell or sent via nearest Range or Division Office.

As data standardisation and seamless integration is required in the creation of a large GIS database it is suggested that spatial data is prepared only in the Central GIS Cell.

(2) Locations of GIS Infrastructure Development (A1, A2 & B as mentioned below)

- **A1: GIS & Image Processing Lab** at WBFD HQ, Aranya Bhavan– *2500 sq. ft. area* to look after work entire State)
- **A2: ICT Training Centre** at WBFD HQ, Aranya Bhavan– *2000 sq. ft. area* for GIS and ICT training
- **B: GIS subsidiary data collection units** at Siliguri (to look after GIS work in North Bengal) and existing Wildlife sub-unit at Bikash Bhavan– 1200 to *1500 sq. ft. area*

(3) GIS related Hardware & Software Requirement at the respective locations:

(Required numbers mentioned at the end of the items included the number of existing software & hardware)

- **A1: Advanced GIS & Image Processing Lab at Head Office, Aranya Bhavan, Salt Lake Kolkata**
  1) Arc GIS Workstation/Desktop 1 license
  2) Arc View 4 nos,
  3) ERDAS Professional 2 nos
  4) Computers total 10 nos (4 with 4 GB RAM, rest of 2GB RAM) & UPS
  5) Light tracing table 1
  6) A0 Scanner -1,

7) A1 Colour Plotters 2 nos
8) A3 Colour Printer 1
9) A4 BW Printers 2,
10) Server for LAN connectivity and Internet in few computers,
11) GPS Data download and conversion facility,

The GIS Lab in Aranya Bhavan already has a setup. Hence required adjustments in procurement have to be made accordingly.

- **A2. Infrastructure for ICT Training Centre in Salt Lake:**
  1) Computers 20 nos
  2) WiFi Connectivity
  3) LCD Screen 1

- **B: Self Sufficient GIS Lab and subsidiary data collection units at Bikash Bhavan (Wildlife Unit in Salt lake), in North Bengal stationed at Siliguri -2 sub-units in West Bengal**

Items required at each unit -

1) Arc View 2 nos
2) ERDAS 1 no
3) Light tracing table 1
4) A1 Colour Plotter 1
5) A4 BW Laser Printer 1
6) Computers total 4 nos (1 with 4 GB RAM, rest of 2 GB RAM)
7) A0 Colour Scanner 1 (or may be outsourced if local facility is available)
8) Server for LAN connectivity and Internet in few computers
9) GPS handset and GPS Data download and conversion facility

The GIS Lab for Wildlife has a small setup in Bikash Bhavan, Salt Lake, and Kolkata; hence required adjustments in procurement have to be made. Later this unit may be integrated into the main GIS Centre at Aranya Bhavan so as to effectively use the resources.

- **C: Internet and GPS data down load and GIS viewing facility at Division level. 41 Units under Territorial (22), Wildlife(9), Social Forestry(7) and Soil Conservation (3) have been considered**
  1) Computer total 2 nos with 1 large screen (at least 1 with 4GB RAM)
  2) A4 Colour Laser Printer 1
  3) A3 Colour Scanner 1
  4) Internet connectivity in 2computers,
  5) GPS handset 1 set

- **D: Internet and GPS data collection facility at Range level (329 Units under Territorial (243) and Wildlife (86))**
  1) GPS handset 1 set

6.8.3.3. Provisions of Vehicles for Mobility of Officers and Staff:

It has been proposed to go in for procurement of 10 vehicles and 100 motor bikes to give mobility to the inspecting/supervising officers and the frontline staff like Range Officers and Beat Officers during the project period. Most of the vehicles and motor bikes will be deployed in the field.

6.8.3.4. Miscellaneous management inputs

The project recommends one post of Addl. PCCF and 2 posts of CCFs. In order to smooth implementation of the Project, incremental organisational stuff will be required during the Project on contractual basis.

- Creation of two posts of Addl. PCCF and CCF to man the posts of the Project Director
- 200 personnel in skilled staff in DFU to be located in Divisional and Range Facilitation units. They will be recruited on contractual basis from 2nd year to 7th year of the Project period.
- 100 personnel in semi-skilled staff in DFU to be located in Divisional and Range Facilitation units. They will be recruited on contractual basis from 2nd year to 7th year of the Project period.
- 4 personnel in skilled staff in PMU. They will be recruited on contractual basis from 1st year to 8th year of the Project period
- 2 personnel in semi-skilled staff in PMU. They will be recruited on contractual basis from 1st year to 8th year of the Project period
- 320 personnel for first two years as forest extension workers to assist territorial DFOs for the preparation of TPOF related activities basically.
- Necessary Management Cost for PMU shall be kept

6.8.3.5. Forestry Research Activities

Forestry research in West Bengal focuses on standardisation of nursery techniques, plantation management techniques through appropriate tending and a thinning regime production of quality planting material, introduction of new species / varieties both in raising plantations in recorded forest areas and non-forest areas. These all have the singular objective of enhancing the productivity of forests.

The research wing also in charge of maintenance of preservation plots, linear sample plots under the guidance of ICFRE (Indian Council of Forestry Research &Education) and also participates in co-coordinated research program in collaboration with IFP (Institute of Forest Productivity) located at Ranchi.

The research wing carries out tree improvement program through selection / maintenance of candidate plus trees, seed stands and supply of certified seeds, QPM in the form of seedlings and ramets[12]. 21 species of broadleaved / conifers have been covered under seed tree program and in recent years seed stands of four species have been added.

[12] a single cloned organism such as one produced by tissue culture

During the project it is intended to carry forward such activities through the project and expanded in specified areas to meet the requirements of different project components. Activities proposed are: 1) Tree Breeding Research and 2) Field Research on Nursery Technique.

Detailed TOR of these researches shall be developed by PMU during the preparation stage of the Project immediately.

(1) Forest Tree Breeding Research

Forest Tree Breeding Research including expansion of seed certification procedure, establishment of candidate plus trees, seed stands, seed orchards and clonal trials will be implemented. Selection of new seed trees and stands will focus on species proposed under different models of plantations

Objective: Enhancing the forest productive through improvement of forest tree species.

Output of Survey: Plus Trees holding superior characteristics on growth, wood quality, tolerance, and/or adaptability are selected on five species under mentioned.

Table 6-27 Five Species for Forest Tree Breeding Research

Specie	Brief Description of the Specie
1. *Casuarina equisetifolia*	Exotic species from Australia adopted and introduced mainly on sandy soils of coastal area. Excellent firewood and soil improvement, NTFP (The bark extract is used in local medicine to treat chronic diarrhea and dysentery. Fresh leaf decoction is used to treat colic pain, dried leaves as fuel)
2. Acacia auriculiformis	Excellent firewood and soil improvement. Fast growing.
3. Pterocarpus marsupium	Indian Kino Tree, Medicinal Plant The leaves, bark, and gum is used for curing a number of ailments. Because of its medicinal properties, the plant species is cultivated for commercial purpose in many parts of the world.
4. Eucalyptus tereticornis	Excellent firewood and soil improvement. Fast growing.
5. Gmelina arborea	Fast growing and good quality wood for constructions, furniture, musical instruments and artificial limbs, etc.

Contents of Survey:

i. Selection of Candidate Plus Trees
ii. Trial of identified clones
iii. Trial of F1 generation in multi-location
iv. Trial of F2 generation in multi-location
v. Trial of F3 generation in multi-location
vi. Identification of seed production area
vii. Evaluation of seed Production area

Implementation period: from 1st year to 8th year.

(2) Field Research in Nursery

Objective:

- Field research on nursery techniques, spacing of plantation species, multi locational trials for species including rooting trials.

Output of Survey:

- Nursery protocols on 10 species are developed
- Plantation model protocols on 10 species are developed

Contents of Survey:

i. Experiments of germination
ii. Rooting of cuttings
iii. Pest and disease control
iv. Soil
v. Potting mixture, container size

Implementation period: 1st year to 8th year

6.9. Monitoring and Evaluation

6.9.1. Monitoring System

The project execution period is 8 years. Afforestation/ reforestation models will be implemented from 3rd year onwards. Other components will generally have a span of 6 to 7 years. Forest Directorate has an in house mechanism for monitoring plantations. They are usually carrying out monitoring of plantations. Monitoring reports are generally delayed and timely intervention for rectification of deficiencies does not get assured. This organisation may continue with plantation monitoring and ongoing evaluation of the same in specified areas. This organisation also may also be associated with participatory monitoring to give exposure to all frontline staff.

A midterm evaluation therefore is necessary at 4th year through a competent NGO/ Institute having exposure to undertaking evaluation of similar projects. The services of NGO/Institute may be hired through National Competitive Bidding. The issues to be covered during such evaluation are:

- Analysis of baseline survey data outlining characteristics of vegetation in different zones favorable for consolidation of JFM
- Areas of JFMC/EDC covered by micro plans and examination of micro plans to specify their strengths and weaknesses. Suggest measures for improvement
- Assessment of distribution of usufruct shares amongst JFMC/EDC beneficiaries form the date of commencement of project execution
- Progress (both physical and financial) for all work components with emphasis on models of afforestation/reforestation and community support activities
- Examine the quality of plantations through sample check in specified zones. Parameters of survival percentage, composition and growth data of species may be used to determine quality.
- Assessment of impact of community support activities on opening up opportunities for alternate livelihood development of JFMC and EDC beneficiaries
- Assess the trend of man-animal conflict in identified tracts and suggest mid-course correction in methods put in place to reduce the same.
- Check the training/exposure schedule of target groups to point out deficiencies for mid-course correction.

- Examine the quality of implementation of habitat improvement program and the use of such sites by large wild herbivores.

End term evaluation may include all these items included in mid-term evaluation. But more importantly, the focus should be on:

- Assessment of growing stock and quality of cover in catchments of JFMC/EDC operating in different zones.
- Assess the change on socio-economic conditions of forest fringe communities in the catchments of JFMC/EDC on the basis of designed parameter.
- Measure improvements in women's participation and inclusion of target population of ST/SC
- Assessment of market access of such communities for NTFPs, value addition effected through processing and contribution of NTFPs to their family income.
- Examine the sustainability of community/ individual assets created during project execution. Examine causes for success or failures.

This evaluation will also be through induction of qualified NGOs / Institutes through National Competitive Bidding.

6.9.2. Monitoring of Survival Rate

6.9.2.1. Organisation

Survey, monitoring and evaluation of plantations including TPOF are undertaken by the Monitoring Circle headed by a Conservator of Forests. The Circle has two divisions Monitoring (North) with HQ. at Siliguri and Monitoring (South) with HQ. at Kolkata. Monitoring (North) is responsible for all the divisions in North Bengal while the Monitoring (South) Division does it for all the Divisions in the South.

6.9.2.2. Methodology

Monitoring of plantations will be done for the 1st year, 3rd year and the 5th year after the plantation. Parameters monitored in the 1st. and 3rd. year are survival percentage and height of seedlings. In the 5th year, collar girth of seedlings is also measured in addition to these parameters.

Execution of survey and monitoring has three stages namely, Pre-survey works, Field works and Calculation of survival percentage.

(1) Pre-survey works include:

- Copies of regeneration plans along with plantation journal are obtained form respective divisions
- A grid line is laid over the plan with quadrates of 50mx50m in scale and serially numbered
- Sample plots are chosen randomly using statistical random tables

- Selection of plots is done in such a manner so as to have proper representation of the area

(2) Field works cover the following:

- Identifications of selected plots in the field
- Corners of these plots are clearly marked with raised earthen mound having a central painted peg
- Carrying out total enumeration species wise in different height classes

(3) Calculation of the survival percentage

This will is done on the basis of enumeration at 7.5 % sampling intensity in case 1st year plantations and 5% sampling intensity in case of 3rd and 5th year plantations This means that in case of 1st year plantation, three sample plots of 50 m x 50 m are taken for a 10 ha plot whereas for 3rd and 5th year plantations two sample plots of 50 m x 50 m are taken for a 10 ha plot. Survival percentage is found out as the ratio of the actual number to the number prescribed in the regeneration plan. Weighted Survival Percentage (WSP) of total plantations is calculated for a particular division under each scheme and average WSP for that division is calculated to rate its performance in plantation activity.

6.9.3. Operation and Effect Indicators

6.9.3.1. General

JBIC introduced operation and effect indicators in 2000 as performance indicators to enable project monitoring and evaluation through comparison with data that has been consistently measured in previous pre- and post-stages of a project.

Operation and effect indicators are used to evaluate the performance of each activity and the effectiveness of the functions of the Project, and the efficiency of operation and maintenance activities after the Project implementation.

In order to evaluate the achievements of the Project quantitatively, the benchmarks of operation and effect indicators are set up based on the discussion with WBFD and current available data.

6.9.3.2. Determination of Operation and Effect Indicators

In this project, the activities will be implemented according to the following four project components:

- Afforestation and Allied Works
- Biodiversity Conservation
- Community Development
- Institutional Capacity Development

Therefore, it is desirable to determine indicators which correspond to each component. For the monitoring and evaluation, it would be better to take quantitative data which is related directly

to the project objective as indicators. However, when it would be difficult to get quantitative data, qualitative data could be used also as indicators. The following table shows operation and effect indicators proposed by the Survey Team.

Table 6-28 Operation and Effect Indicators (Proposal)

Category	Indicators	Target Value	Means of Verifications
1. Afforestation and Allied Works	Area Planted (treated) (ha)	1A1: 450 1B1: 1,400 1A2: 3,430 1B2: 1,400 1A3: 6,000 1A4: 7,500 1A5: 1,050 1A6: 540	Project Document produced by PMU
	Survival ratio (%) (1st year / 3rd year / 5th year after plantation)	1A1: 90/85/80 1B1: 80/70/65 1A2: 90/85/75 1B2: 80/75/70 1A3: 85/80/75 1A5: 85/80/75 1A6: 85/80/75	Project Document produced by PMU Survey Monitoring Report (Regular monitoring report from Monitoring Unit with a Circle Conservator and DFOs)
	Forest Cover	Baseline is 14.86% (SFR2010) Target shall be set as 15.11 % (2019)	State Report / WBFD GIS Cell / WBFD
	Total area treated by contour trench works	17,380 ha	Project Document produced by PMU
	Number of Seedlings (QPM) produced by 20 project supported nurseries.	- 50,000 sdlgs /year/nursery - 7 million in total during the Project period	Project Document produced by PMU
	Number of Nurseries supported by the project	- Number of New Nursery constructed: 20 - Number of nursery expanded its capacity : 20	Project Document produced by PMU
2. Biodiversity Conservation	Number of species planted by the Project	20 endemic species	Project Document produced by PMU
	Area grass/fodder trees/bamboos planted	465 ha	Project Document produced by PMU
	Length of electric fences erected/improved	40 km for new erection 30 km for improvement	Project Document produced by PMU
	Length of nylon net fences elected/replaced	16 km for new erection 20 km for replacement	Project Document produced by PMU
	Number of human injury/death by animal conflict	Increase ratio to be lower in the target divisions than other areas	Reports for man-animal conflict produced by DFOs
	Area of crop damage by animal conflict	Increase ratio to be lower in the target divisions than other areas	Reports for man-animal conflict produced by DFOs
	Number of bio-diversity related research completed	5 researches with outcome	Project Document produced by PMU
3. Community Development	Number of Micro planning prepared	600	Project Document produced by PMU
	Number of Beneficiary Group created	200 beneficiary groups for 1B1 200 beneficiary groups for 1B2 (maximum number is set as 300 for both B1 & B2)	Project Document produced by PMU
	Employment creation	5,017,900 man-day *Component 1: 4,825,300 man-day* *Component 2: 192,600 man-day*	Project Document produced by PMU
	Number of SHG supported by the Project	600 groups	Project Document produced by PMU
	Estimated Income of JFMC/EDC members	Income per JFMC/EDC members' HH goes up 20 % than before project (This target will be determined by baseline survey)	Baseline survey and end-term survey
	Item & Number of infrastructure constructed	This number will be determined during the preparation stage of the project through micro planning	Project Document produced by PMU Micro-plan developed

Category	Indicators	Target Value	Means of Verifications
4. Institutional Capacity Development	Number of trainees (Number of training held)	Package I: 30 pers Package II: 10 pers. (Long Term) 25 pers. (Short Term) Package III: 20 persons Package IV:750 days	Project Document produced by PMU
	Item & number of infrastructure constructed	- Construction of Beat Officer Office Complex (1) : 15 units - Construction of Beat Officer Office Complex (2): 10 units - Construction of RO's Office Complex: 5 units - Expansion of existing administrative building : 1 unit - Building of Salt Lake: 1 unit - Administrative Building at Siliguri: 1 unit	Project Document produced by PMU
	Number of forestry research completed	2 researches with outcome	Project Document produced by PMU

Note: 1.A1: Plantation of High Yielding Eucalyptus hybrid clones in South West Bengal, 1.A2: Plantation of Sal and Associate in South Bengal, 1.A3: Plantation of Quick Growing Small timber, Fuel & Fodder Species, 1.A4: Enrichment of Degraded Forests of South West Bengal through coppice regeneration, 1.A5: Economic Plantation of Miscellaneous Species In North Bengal, 1.A6: Plantation of Sal and Associates Species In North Bengal, 1.B1: Strip Plantation, 1.B2: Block Plantation
Package-I for Senior Officers, Package-II for Middle and junior level officers, Package III- Junior level Officers, Package-IV Frontline staff and FPC/EDC/SHG

Source: JICA Survey Team

6.10. Procurement Methods

The project execution will require procurement of labor, material, services including the services of Consultant Teams, Institutions, NGOs at the State level and district level. Such procurement shall primarily be done following provisions of Financial Rules of the State and the framework of delegation of financial powers at each level of the Forest Department's hierarchy.

While devising procurement methods in areas identified under different components, "Guidelines of "JICA for Procurement under Japanese ODA loans" and "Guidelines for Employment of Consultants under Japanese ODA loans" shall be adhered to. The tender and contract packaging will be guided by the nature of goods and services and such packaging should be optimal to have a fair participation of eligible suppliers/contractors to ensure a fair competition. For contract packages of substantial quantum or value, it may also be necessary to go in for short listing of prospective bidder through EOI. While packaging for procurement of materials for plantations , it has to be in an a decentralised manner to ensure that inputs for components get delivered on proper time keeping in view the regime of creation and tending.

For Consultancies involving substantial financial investment, selection, quality and cost-based selection procedure in conformity with JICA guidelines will be followed.

Within the ambit of principles enunciated, the following procurement method is suggested.

Table 6-29 Procurement Method by Items

Item	Proponent/Owner	Supplier/ Contractor	Method
Baseline Survey	Forest Department	NGOs/Institutes	Local bidding on approved TORs
Training /Capacity Building	Forest Department	Repute Indian Institutes /International Institutes in relevant areas NGOs for frontline staff and JFMC/EDC members	Through nomination. Through district level NGO/CBO selected through parameters of reputation and proven track record
Infrastructure Development	Forest Department	Civil Contractors	Through Local Bidding in suitable packages
Infrastructure Development for GIS and e-governance	Forest department	Civil Contractor /Supplier of equipments	Local Bidding for constructions /International bidding for procurement of hardware, software and other equipments
Community Development (Micro-planning)	Forest Department/ Community organisations	NGOs	Local bidding/ Direct Contracting
Community Development (Income Generation Activities)	Forest Department/ Community organisations	NGO/Civil Contractors/Suppliers	Local bidding/ Direct Contracting
Community Development (Infrastructure Development)	Forest Department/ Community organisations	Civil Contractors/Suppliers	Local bidding/ Direct Contracting
Mid-term/end term evaluation	Forest Department	NGOs/ Institutes	National Competitive bidding on approved TORs
Forestry research	Forest Department	State institutes/ Universities	Identification and negotiation
Afforestation and allied works	Forest Department	Labor from JFMC/EDC and other fringe communities / Suppliers	Local bidding / Price quotations for Materials depending on the package
Tree Planting Outside Forest (Social forestry)	Panchayat communities identified as beneficiaries	Identified beneficiaries and others	Direct engagement
Soil and Moisture Conservation Works	Forest Department	JFMC/ EDC and other Forest fringe communities	Direct engagement of labor
Protection	Forest Department	Civil Contractors/Suppliers	Local bidding
Habitat Management	Forest Department	EDC and other communities in fringes	Direct engagement of labor
Man-Animal Conflict mitigation	Forest Department	JFMC/EDC members/ Suppliers	Local bidding for procurement of vehicles and other equipments,
Adaptive Research	Forest Department	Indian Institute / NGOs operating in related field of wildlife	Identification and negotiation

Source: JICA Survey Team

6.11. Implementation System

6.11.1. Options for Institutional Set Up

West Bengal Forest chose society mode in view of the advantage during the Fact Finding Mission. To formulate Society Mode of the Project, it should be registered under Societies Registration Act have functional independence with certain statutory obligations;

- Memorandum of Association and By-Laws.
- General Body or any other empowered body – as the highest decision making body to oversee and facilitate implementation of activities.

- Annual audit of accounts by qualified chartered accountants
- Submitting annual administrative report along audited statement of accounts to the registrar of societies
- Access to funds from State / Central Government, or other recognised bodies with the permission of the Government

Moreover, it should be noted that bye-laws/accounting manual may need to be prepared in advance and prompt registration is a required for smooth initialisation of the Project. Project Management Structure for the Society Mode described as hereinafter.

6.11.2. Project Management Structure

High Power Committee

1. Chief Secretary to the Govt. of West Bengal - Chairperson
2. Additional Chief Secretary, Department of Forest – Vice Chairperson
3. Secretary, Department of Finance - Member
4. Secretary, Department of Panchayat and Rural Development – Member
5. Secretary , Backward Class Welfare Department - Member
6. Secretary, Department of Horticulture - Member
7. Secretary , Department of Animal Resources - Member
8. Secretary , Department of Fisheries & Aquaculture
9. Secretary, Department of Water Resources Investigation and Development
10. PCCF and HOFF - Member
11. PCCF, Wildlife and Biodiversity- Member
12. PCCF, Research& Monitoring- Member
13. Project Director,-- Member Secretary

This High Power Committee (HPC) will be the highest decision making body and responsibilities as described below will devolve on them:

- Approval and endorsement of the establishment of the PMU and terms of reference of PMU.
- Approval of the management manual of the PMU
- Approval of annual work plans and budget of the project as prepared by the Empowered Committee
- Coordination amongst related Departments of the State Govt.
- Undertake half-yearly review of the progress of implementation of the project
- Resolve conflicts problems arising in different regions during implementation program.
- Facilitation of the process of policy change to strengthen JFMCs/EDCs /SHGs operating in forest areas and their fringes

Governing Body

The Governing Body has to be a cohesive group to facilitate faster decision making so that project

implementation on ground goes on smoothly. The Governing Body may comprise of the following members:

1. PCCF and Head of Forest Force :Chairperson
2. PCCF, Wildlife and Biodiversity: Member
3. PCCF, Research & Monitoring: Member
4. Additional PCCF, Finance: Member
5. Additional Project Director & CCF:Member
6. Project Director & Addl.PCCF:Member Secretary

The governing body will have similar roles and responsibilities as those of the Empowered Committee but they will have to guide the process of registration of the Society.

Project Management Unit (Executive Body)

There is need for constitution of a Project Executive Body and this body will focus on speedy implementation of the project and always strive to work towards bringing in a scenario of synergy amongst different Wings of the Forest Directorate at different levels of implementation.

The Executive Body will consist of the members as delineated below:

1. Project Director in the rank of Addl. PCCF
2. All Additional Project Director in the rank of CCF
3. Territorial CCFs/ CCFs in Wildlife Wing
4. CF, Monitoring
5. CF, Wildlife
6. CF, Research
7. Chartered Accountant

The posts against items 1 &2 need be created anew for this project. The posts against 4&5 may filled up by adjustment of the sanctioned cadre posts inducting officers having exposure to such responsibilities in the Directorate. A Chartered Account has to be inducted on contractual basis to take charge of finance and accounts related to the project execution and he will be placed with the Project Director.

Roles functions of the Executive Body will generally be limited to the following;

- Procurement of consultant teams as required under the guidance of the Governing Body
- Preparation of annual work plans and budgets
- Supervision of implementation of the project as per approved work plan and budget
- Coordination with the Forest Directorate and other stakeholders of the project
- Monitoring and evaluation of the project
- Provision of guidance to District Facilitation UNIT
- Supervise technical assistance provided by one or more consultant teams inducted on contractual basis

The Society mode will also have District Facilitation Units and composition and functions of the same will be similar to those as suggested for the Departmental Mode.

District Facilitation Unit

At the district level it will be useful to constitute District Facilitation Unit to ensure coordination and smooth implementation of project activities at the district level as in many districts there will be more than one DFO implementing project activities. Some of the districts will have 3-4 DFOS belonging quite often to different wings of the Directorate.

This unit may have the following structure:

1. Conservator of Forests(Territorial/ Wildlife)- Project Coordinator
2. All DFOS in the District implementing project activities
3. 3-4 Range Officers to be inducted from Divisions under the Project
4. 2-3 District level NGOs/CBOs associated with the implementation of the project

All Divisional offices will require induction of skilled staff to facilitate project activities as 50 staff each for 6 years and supporting staff to work as accountant, computer operator and office assistant as 25 each for 6 years. Extension workers to facilitate micro-planning shall be engaged during the preparatory period (first and second year) and engagement of contract basis160 workers by each year have been programmed.

All such facilitation staff will be recruited on contractual basis and the responsibility of such induction will vest with the Project Coordinator of the concerned District under the guidance of the Project Executive Unit.

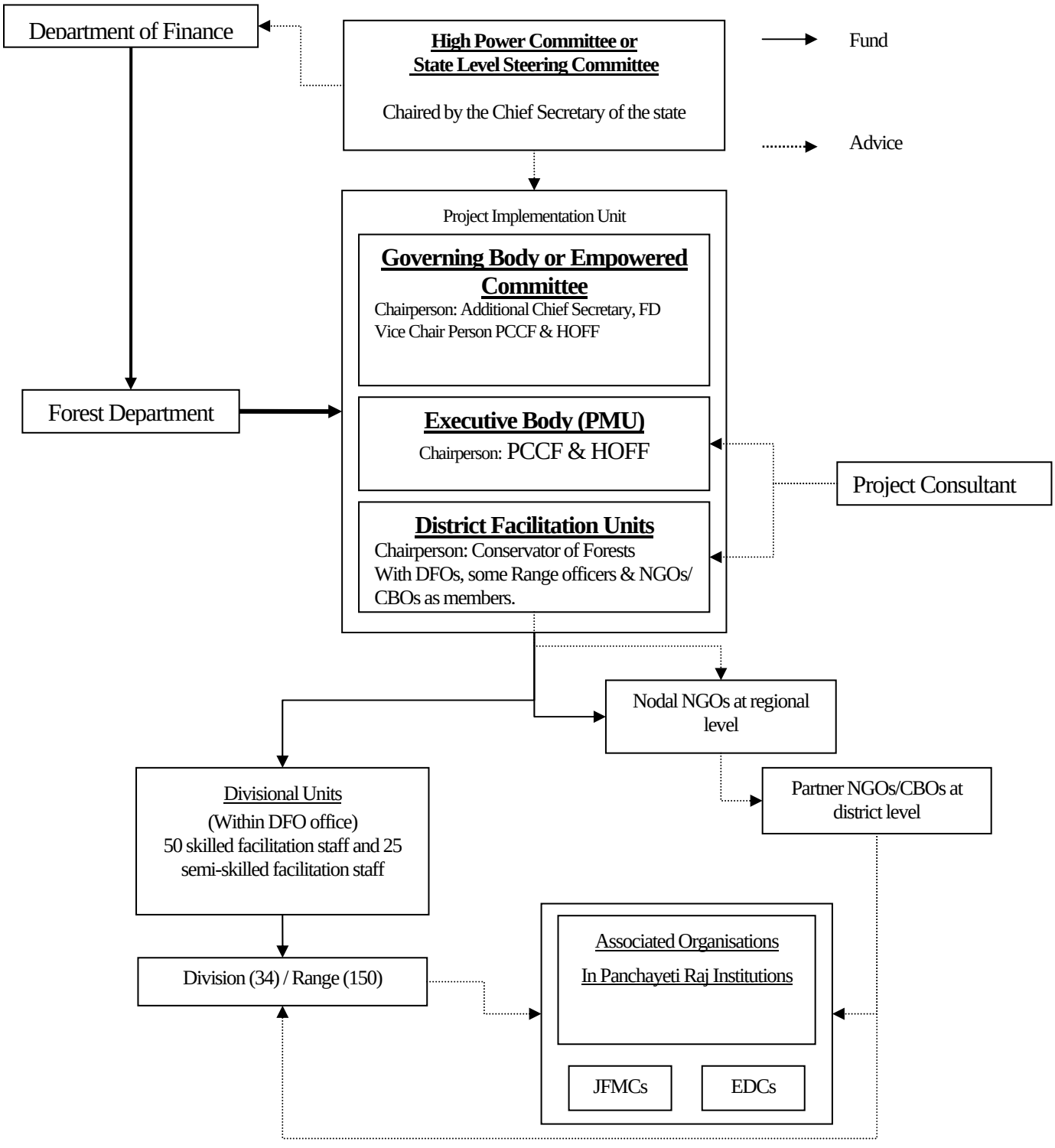


Figure 6-10 Project Implementation Structure

6.12. Implementation Structure

6.12.1. Decision making

Regarding of decision making under society modes, it is necessary to have clarity and adequacy about delegation of financial powers to the PMU. More often this does not happen as the Govt. may find it difficult in the context of working of modalities of other Departments. Forest Department may not be treated as more than equal amongst all departments of the Govt. Existing system of smooth fund flow may be impeded on imposition of quarterly credit limits by the Department of Finance during the course of implementation of the project. Thus, the project shall utilise the existing decision making of the district level such as District Facilitation Unite for smooth implementation, and the PMU shall has responsible to manage fund distribution to the District and supervise the progress of the implementation.

6.12.2. Cash flow

As far as cash flow is concerned, this state is very different from other States. All DFOs / Conservator of Forests are Treasury Officers and they are authorised to draw money from SBIs against their budgetary allocations and proper sanctions. External agencies who have executed past external aided projects had specifically in their completion report have identified this situation as a favorable one for smooth implementation of projects. In the Society mode the PMU can place funds directly with the DFOs. This is clearly a positive point in favor of the adoption of the society mode.

All implementing units at the divisional level such as District Facilitation Unite in this Project will have to execute a number of State Plan Schemes and Centrally Sponsored schemes. In case of fund flow in the Society mode under this project many of such implementing units may be in a dilemma to attach priorities to the work components under this project because funds under other plan schemes will flow from allocations coming from the PCCF and the Head of the Forest Force. But placing PCCF and HOFF as the Chairman of the Governing Body may mitigate this situation.

Coordination between Forest Directorate and the autonomous Society may require additional efforts both during implementation and post project handover.

6.12.3. Project Implementation System

Use of the existing organisational infrastructure

The Project Director supported by the Governing Body or the Empowered Committee will be responsible for implementation of project activities all over the State. The existing structure of the Forest Directorate of Circles and Divisions will be used for implementation of the forestry and wildlife components.

Strengthening of existing organisation

As brought out in the structure for implementation, the post of an Addl. PCCF and two posts of CCF to man positions of the Project Director and Addl. Project Director is a requirement. Creation of two posts of CCF to man the post of Addl. Project Director is concerned; it may be explored whether this can be adjusted from the existing cadre strength of IFS officers. The proposed Divisions of Wildlife and NTFP may be placed in position through recruitment of staff against proposed categories and each of this Division may be headed by an officer from the IFS/ WBFS cadre.

The execution of the project will place additional demands on the Divisions and the Ranges largely but some of the Circles will also will be affected their offices will require strengthening through incorporation of facilitation units. These units will primarily comprise of Accountant (Computer literate), Computer Operator and Office assistant/Field assistant. As these units will operate during a specified part of the project period they can be inducted on contractual basis.

For execution of the component of Tree Planting Outside Forest, forest extension workers have to be placed in different Divisions of the forested tract and non-forest areas. This will facilitate more intensive interaction with communities for selection of sites, identification of beneficiaries in consultation with panchayat and successful establishment of strip plantations

As all activities will have to be supported by the micro-planning and this has to cover large grounds.

6.13. Operation and Monitoring System

The project will be operated by the Project Implementation Unit with the support of the Governing Body and guidance by the PMU (Executive) body. The existing Monitoring Unit with a Circle Conservator and two DFOs is doing routine monitoring of plantation activities through their Range level units. Monitoring reports are also published analyzing composition, survival and growth rates. Because of the delay there is also a time gap in organising interventions to rectify deficiencies diagnosed through such monitoring. In this context and the fact that community motivation in the project catchments will largely determine the success or failure of the project, a monitoring mechanism has to be put in place to derive maximum benefits through feed-back from the grass root level. The support of the existing Monitoring Units may be drawn to guide such monitoring.

Monitoring and evaluation are particularly important in forestry projects for local community development because of the diversity and innovative nature of these projects. These projects require new skills of foresters and involve different participants. Monitoring focuses on a project's inputs, activities, management and outputs to improve the operation of the project as designed. Evaluations re-examine the design of the project and assess its impact

Such monitoring mechanism will obviously have to keep in view the goals:

- Operational control of a variety of activities proposed under the project components
- Organise quick feed-back for project effectiveness
- Ensure flow of benefits to identified communities in JFMC/EDC and other people living in areas adjoining
- Provide inputs for better design of activities included under the component of community support.

This mechanism takes care of the major issues outlined below:

- Provide better means of service delivery
- Planning and allocation of optimal resources for allocation of community support and suggest means to derive maximum benefits from such allocations
- Demonstrate result (success and failure)

The present project has a large base of stakeholder in JFMC/EDC communities. Forest Department has large stake in this project as responsible and responsive stakeholder in conservation and development initiatives in the field of natural resources. The communities also have a lot of things to improve their social and environmental understanding to contribute to sustainability of major share of components of activity under the project.

The present trend is to take recourse to participatory monitoring and evaluation in projects where communities are the focal point of achieving targets and their roles and responsibilities in protection of the resources regenerated and their sustainability is of prime importance. This kind of monitoring has definite merits in areas mentioned below:

- Empowerment of stakeholders to take action
- Improvement in areas of public accountability.
- Provision of improved inputs for planning at different levels
- Timely identification of bottlenecks in carrying out activities to ensure timely adjustments to plans , schedules and /or budgets
- Opportunity to improve the effectiveness and efficiency of activities
- Encouragement of institutional reforms towards more participatory structure
- Enhancement of degree of motivation of staff of the PMU, stakeholders in communities and NGO/CBOs associated with such monitoring
- Checks and helps in updating of understanding of society and development

For successful monitoring some issues are of prime importance. Goal setting by partners is the first step. There has to be clarity of objectives of the work components to be monitored and the stages of monitoring. Participants need to agree on methods of monitoring, timing of and frequency of information collection. The choice of method will obviously depend on available time, skills, technology and resources.

To undertake such participatory monitoring a fairly large number of NGOs/ CBOs in three distinct areas of operation of North Bengal, South-west Bengal and Sunderbans is suggested. The

selection of such NGOs may be done from the existing organisations through a method of screening by a committee constituted by the PMU. This Committee will have a look at the sphere of activities, their experience, qualification of Members and the track record. These NGOs will need guidance for three Nodal NGOs selected for each of the three regions.

Collation of inputs will be done by the Conservator of Forests, Monitoring with the help of two DFOs and critical information relating to rectification of gaps / deficiencies will be disseminated to executing agencies and their supervising Officers keeping the PMU informed. Such monitoring reports should be discussed in quarterly meetings of the PMU Executive Body. Annual Monitoring Reports have to be published taking help of the Nodal NGOs and circulated amongst all implementing units

6.14. Implementation Program

6.14.1. Implementation Schedule

6.14.1.1. Implementation Period

The total project period is 8 years from January 2012 to December 2019. The project period compose three phases namely **Preliminary Phase** (2 years), **Implementation Phase** (3 years), and **Consolidation Phase** (3 years).

(1) Preliminary Phase

1) Preparatory Works

Institutional arrangement, selection and appointment of consultants, selection of target villages, customisation of standard management manuals (for JFM, TPOF, and EDC), preparation of program and tender documents (for Base line Survey, Training & Capacity Building, and Monitoring & Evaluation), and preparation of detailed design and tender documents (for Facilities and Equipment for Biodiversity Conservation, and Buildings and Equipment & Vehicle for Institutional Capacity Development) will be carry out as major preparatory works during early stage of this Preliminary Phase. Base line survey of the state's forest resources, training & capacity building of project implementing officials, field & office staffs and other stakeholders also start in this early stage.

2) Implementation of some part of components during Preliminary Phase

Some activities of project components will commence in this period such as production of QPM for the first year planting in 2014. Tender and evaluation and procurement of equipment for man-animal conflict mitigation, selection of research firms for biodiversity conservation by open tender will start at the middle of this phase.

As a preparation for afforestation and community development (JFM), micro planning through PRA by the help of local NGOs will be taken place and completed in the last stage of this Preliminary Phase.

Selection of contractor/supplier by open tender for infrastructure development for Forest Department of West Bengal will be taken place and Equipment for GIS/MIS Pilot Project Purchase of Vehicles including motorbikes for better mobility of staff and officers are procured before Implementation Phase start.

(2) Implementation Phase

During this phase, all activities planned for implementation in the preliminary phase will be put into operation.

Advance Soil and Creation Works of Degraded Forest Land, Tree Planting outside Forest Area (Social Forestry) will be done during this phase. Soil & Moisture Conservation in Forestry Treatment Areas as allied works also carried out in parallel. Production of Quality Planting Material for 2015 and 2016 will be continued.

Advance works and creation of fence for Grassland restoration and fodder tree planting in PAs in the north Bengal, Bamboo under-planting in Mahananda WS, and Fodder tree planting after removal of maling bamboo in PAs in the hills as Habitat Management, and Man-Animal conflict mitigation measures for Elephant (gaul) in the north and south-west Bengal, Leopard in the north Bengal, Tiger in Sunderbans, and Smaller animals in the Central Bengal will be carried out as Component of Biodiversity Conservation.

In accordance with the result of selection of research subject and bidding, Biodiversity Research will also start in this phase.

Income Generation Activities, Community Infrastructure Development for JFMC as a Community Development Component will start at the same time in all target villages.

Training & Capacity Building for junior level Officers and FRs and Frontline staff and FPC/EDC/SHG, and construction of Building as a component of Infrastructure development will be continued.

As Forestry Research Activities, Research work in Tree Improvement program (Tree breeding), Field Research on Nursery and Plantation techniques and plantation models to improve productivity

Mid-term Monitoring & Evaluation will be taken place in the middle of this phase.

(3) Consolidation Phase

Works of this phase are mainly maintenance works of Afforestation Works and Habitat Management. Man-Animal conflict mitigation measures and some research work of biodiversity conservation and forest research will be continued.

During this phase, immediate remedial action should be taken for any component observed delay in this phase. However, no new activities will be expected during this phase except maintenance of whatever has been carried out during implementation phase, catching up of the

delayed components, or such activities which are deemed necessary from the remedial point of view and in the overall interest of the project.

End-term Monitoring and Evaluation will be carried out at the end of this phase.

Table 6-30 The Tentative Schedule of the Project

Activities		Period				
	Conclusion of Loan Agreement	**Dec-2011**				
I.	**Preliminary Phase**	**Apr-2012**	**-**	**Mar-2014**	**24**	**months**
2.	Selection of Consultants	Jan-2012	-	Dec-2012	12	months
3.	Institutional Arrangement	Apr-2012	-	Sep-2012	6	months
4.	Selection of Target Villages	Jul-2012	-	Dec-2012	6	months
5.	Customization of Standard Management Manual	Jan-2012	-	Jan-2012	1	months
6.	Preparation of Programme and Tender Documents	Feb-2012	-	Feb-2012	1	months
7.	Preparation of Detailed Design and Tender	Mar-2013	-	Apr-2013	2	months
II.	**Implementation Phase**	**Apr-2014**	**-**	**Mar-2017**	**36**	**months**
1.	Afforestation and Allied Works	Dec-2012	-	Dec-2019	86	months
2.	Biodiversity Conservation	May-2013	-	Dec-2019	81	months
3.	Community Development	Nov-2013	-	Mar-2016	29	months
4.	Institutional Capacity Development	Jul-2012	-	Dec-2019	91	months
	Base line survey	Jun-2013	-	Dec-2013	7	months
	Training & Capacity Building	Apr-2013	-	Apr-2015	25	months
	Infrastructure Development	May-2013	-	Dec-2014	20	months
	Forestry Research Activities	Jul-2012	-	Dec-2019	91	months
	Mid-term Monitoring & Evaluation	Apr-2015	-	Sep-2015	6	months
III.	**Consolidation Phase**	**Apr-2017**		**Mar-2020**	**36**	**months**
	End-term Monitoring and Evaluation	Jul-2019	-	Dec-2019	6	months

Source: JICA Survey Team

ITEM
Preliminary Phase
Implementation Phase
Consolidation Phase
Conclusion of Loan Agreement
Effectiveness of Loan Agreement
Loan Period
Project Period
Work Items
I. PREPARATORY WORKS
1. Selection and Appointment of Consultants
2. Institutional Arrangement
3. Selection of Target Villages
4. Customization of Standard Management Manual
5. Preparation of Programme and Tender Documents
6. Preparation of Detailed Design and Tender Documents
II. IMPLEMENTATION OF COMPONENTS
1. Afforestation and Allied Works
1.1 Afforestation of Degraded Forest Land
1.4 Production of Quality Planting Material
2. Biodiversity Conservation
2.1 Habitat Management
2.2 Man-Animal conflict mitigation
2.3 Research
3. Community Development
3.1 Meeting
3.2 Microplan
3.3 Income Generation Activities
3.4 Community Infrastructure Development for JFMC
4. Institutional Capacity Development
4.1 Base line survey
4.2 Training & Capacity Building
4.3 Infrastructure Development
4.4 Forestry Research Activities
4.5 Mid-term Monitoring & Evaluation
4.6 End-term Monitoring and Evaluation
III. Consulting Services

6.15. Consulting Services

A project of this magnitude having large social and environmental implications will need to be supported by consultancy services for a large part of the project period to ensure that the execution is on course, to effect course correction and above all to ensure through continuous monitoring that quality is not getting compromised in procurement of materials or execution of different work components.

During the preparation stage of the Project, it will be necessary to prepare a series of tender documents, manuals or guidelines formats / questionnaires for monitoring and evaluation Terms of references of the baseline survey or research studies in sectors of forestry and wildlife need to be attended to.

West Bengal Forest Department has the technical capacity to execute the project but there are areas where deficiencies are perceptible. One such area is environmental and social considerations for project execution in general and participatory planning in particular. The project has the prime objective of putting in place JFM on sound social considerations to ensure its sustainability.

Specific objectives of looking for consulting services are:

- To provide advisory services for smooth implementation of the Project
- To assist / facilitate project implementing officers through necessary documentation works such as tender documents, manuals and guidelines etc. and advisory instructions in the preparation stage of the project.
- To monitor and assess the progress and ensure execution of the project in conformity with JICA guidelines as relevant for the project activities.
- To supervise , monitor conduction of mid/end term evaluation
- To assist in assessment of social and environmental benefits accruing from the project

The composition of the Consultants Team and their Terms of Reference may be decided through a more intensive consultation with the Forest Department. Such Team has to be organised to ensure that the services of an International Consultant and a National Consultant with strong background of handling such JICA –funded projects in developing countries are made available. The induction of Specialists on Social /Environmental consideration and Procurement cannot be over-emphasised.

6.16. Collaboration with other Departments, Institutions and NGOs

During the Project execution period Forest Department has to collaborate with a number of Departments – the most important of them being the Department of Panchayat and Rural Development. Functionaries at different levels have to interact with their counterparts in P&RD to ensure flow of funds under their schemes to forest fringes targeting the economically disadvantaged communities to have synergies with the proposed project. This

issue may also be discussed at the State Level Steering Committee. Interaction with Panchayati Raj Institutions has to be intense as Ban-O-Bhumi Sanskar Sthayee Samity (Forest and Land Reforms Standing Committee) has defined roles in the sphere of selection of labour and sites for afforestation and reforestation.

The project includes some minor irrigation schemes. For execution of these, the Implementing units of the Forest Department may require some assistance for district level officers of the Department of Water Resources, Investigation and Development. Permission for ground water abstraction also has to be obtained from State Water Investigation Directorate.

The project has to induct the services of NGOs/CBOs for micro planning and participatory monitoring and studies to be conducted on socio-economic studies proposed to be instituted at the commencement and end-term evaluation. It may be necessary to interact with Confederation or Coordination Bodies of such organisations to resolve problems arising in the course of utilisation of their services during project execution. Their services also may be useful in screening NGOs at the District level.

As far as Institutes are concerned the Indian Council of Forestry Research & Education and Indian Institute of Wildlife are of prime importance. Their assistance may have to be sought for in framing research studies in sectors of forestry and wildlife. Some Universities like Jadavpur and Kolkata are likely to be called upon for collaborative research. Bose institute and Indian Institute for Chemical Biology at Kolkata are reputed institutions in their fields. They may also be approached for collaboration in their related fields by the research Wing of the Directorate.

Chapter 7 PROJECT COST

7.1. Conditions and Assumption

7.1.1. General

The followings are the basic conditions for the Project cost estimate.

(1) The Project consists of four components as described below.

Table 7-1 Components and Sub-components of the Project

Components	Sub-Component
1. Afforestation and Allied Works	1.A Afforestation of Degraded Forest Land in Recorded Forest Area
	1.B Tree Planting Outside Forest Area (Social Forestry)
	1.C Soil & Moisture Conservation in Forestry Treatment Areas
	1.D Production of Quality Planting Material
2. Biodiversity Conservation	3.A Habitat Management
	3.B Man-Animal conflict mitigation
	3.C Research
2. Community Development	2.A Meeting
	2.B Microplan
	2.C Income Generation Activities
	2.D Community Development Infructracture Development of for JFMC
4. Institutional Capacity Development	4.A Base line survey of the Socio-economic Conditions of the target population by NGO/Govt.Agencies over about 2 lacs ha forest area covered under the Forest Protection Committee
	4.B Training & Capacity Building of Project Implementing Officials, Field &Office Staffs and Other Stakeholders
	4.C Infrastructure development for Social forestry, training, research, GIS, forest protection etc including Building, Equipment &Vehicle
	4.D Forestry Research Activities
	4.E Mid-term Monitoring & Evaluation including periodic biodiversity & community develpment studies
	4.F End-term Monitoring and Evaluation

Source: JICA Survey Team

(2) The funds required for labor and material cost for the Component of Afforestation and Allied Works will be financed by a foreign loan.

(3) The funds required for the construction and procurement of goods for each component will be financed 100% by a JICA ODA loan.

(4) The funds required for land acquisition and compensation, if there is, will be financed by the local budget.

(5) The implementation of Component 1 - Afforestation and Allied Works will be done by JFM system.

(8) The project will take 8 years from January 2012 to December 2019.

7.1.2. Unit Price, Exchange Rate, Price Escalation and Physical Contingency

(1) Labor wages for this project is based on "MINIMUM RATES OF WORKERS ENGAGED IN FORESTRY OR TIMBER OPERATIONS "

(2) The exchange rate of currencies is US $1.00 = Yen 83.40. Accordingly, the rates Rs. 1 = Yen 1.85 and US $1.00 = Rs 45 are applied.

(3) The cost is classified into foreign and local currency components.

(4) An annual price escalation of 1.6% and 6.6% are applied to the foreign currency portion (F/C) and the local currency portion (L/C) respectively.

(5) A physical contingency of 10% of the total cost of base cost and price escalation is counted.

7.1.3. Composition of Project Cost

The Project cost consists of the direct construction cost (base cost), price contingency, physical contingency, consulting service cost, government administration cost and service tax , interest during construction, and commitment charge.

(1) Procurement/Construction Cost

The Procurement/Construction Cost are estimated by adopting the unit cost basis multiplied by the corresponding work quantity.

1) Material cost

All the unit prices include transition fees to the project site. These prices are counted into the local currency component.

2) Labor cost

The escalation rate of minimum rates of workers engaged in forestry or timber operations shows quite high. Table blow shows the change of wage in the past 5 years from 2006.

Table 7-2 Labor Cost

Period	Monthly (Rs)	Daily (Rs)	Rate of escalation			
			6 months		Yearly	
			monthly	daily	monthly	daily
July06- December06	1,865	72				
January07-June07	1,922	74	3.06%	2.78%		
July07-December07	2,010	77	4.58%	4.05%		
Januaryo8-June08	2,010	77	0.00%	0.00%	7.77%	6.94%
July08-December08	2,171	84	8.01%	9.09%		
January.09-June09	2,295	88	5.71%	4.76%	8.01%	9.09%
July09-December09	2,488	96	8.41%	9.09%		
January10-June10	2,638	101	6.03%	5.21%	14.60%	14.29%
July10-December10	2,962	114	12.28%	12.87%		
January11-June11	3,124	120	5.47%	5.26%	19.05%	18.75%

Source: Government of West Bengal Office of the Labour Commissioner

Since wage escalation is quite high comparing the project escalation stated above, the incremental addition of wage should be considered in order to prevent a shortage of budget allocation for wage.

Therefore, aside from 6.6 % of annual escalation for the whole project activities, annually 10 % of incremental addition of wage is considered, especially component of “Afforestation and Allied Works”, which labour cost shares around more than 80 %.

(2) Consulting Services

Total cost of Consulting Services is estimated around 4.4 % of the total project cost (eligible portion + non-eligible portion).

(3) Administration Cost

The cost is estimated around 10.79 % of the total direct cost (Procurement / Construction and Consulting Services) including price escalation and contingency.

(4) Government Tax

Around 125 million Rupee of Service tax is estimated at 3.35 % of the sum of the total cost.

7.2. Fund Requirement

7.2.1. Required Funds

The required funds for execution of the Project is estimated at 4,000 million Rs (Indian Rupee) consisting of an eligible portion (loan portion) of 3,324 million Rs + 128 million

Yen, equivalent to 3,393 million Rs which account for less than 85% of total project cost, a non-eligible portion (local currency Indian portion) of 484 million Rs (including Service Tax), and 178 million Yen, equivalent to 96 million Rs, of interest during construction and 50 million Yen, equivalent to 27 million Rs, of Commitment Charge. A summary of the required funds is shown in following table.

Table 7-3 Required Funds

unit: million

Item	Foreign Currency Japanease Yen (Yen)	Local Currency Indian Rupee (Rs)	Total in Yen	Total in Rs
A. ELIGIBLE PORTION				
I. Procurement / Construction	**0**	**3,213**	**5,943**	**3,213**
1. Afforestation and Allied Works	**0**	**1,363**	**2,521**	**1,363**
1.A Afforestation of Degraded Forest Land in Recorded Forest Area	0	779	1,440	779
1.B Tree Planting Outside Forest Area (Social Forestry)	0	258	478	258
1.C Soil & Moisture Conservation in Forestry Treatment Areas	0	124	229	124
1.D Production of Quality Planting material	0	202	373	202
2. Biodiversity Conservation	0	161	299	161
2.A Habitat Management	0	34	63	34
2.B Man-Animal conflict mitigation	0	109	201	109
2.C Research	0	19	34	19
3. Community Development	**0**	**282**	**522**	**282**
2.A Meeting	0	6	11	6
2.B Microplan	0	6	11	6
2.C Income Generation Activities	0	60	111	60
2.D Community Development Infructracture Development of for JFM(	0	210	389	210
4. Institutional Capacity Development	**0**	**411**	**760**	**411**
4.A Base line survey of the state's forest resources at the start of	0	10	18	10
4.B Training & Capacity Building of Project Implementing Officials, Field &Office Staffs and Other Stakeholders	0	61	113	61
4.C Infrastructure development for Social forestry, training, research, GIS, forest protection etc including Building,	0	306	565	306
4.D Forestry Research Activities	0	23	42	23
4.E Mid-term Monitoring & Evaluation including periodic biodiversity & community develpment studies	0	8	15	8
4.F End-term Monitoring and Evaluation	0	4	7	4
Base cost	0	2,217	4,101	2,217
Price escalation	0	704	1,302	704
Physical contingency	0	292	540	292
II. Consulting services	**128**	**111**	**333**	**180**
Base cost	110	80	257	139
Price escalation	6	21	46	25
Physical contingency	12	10	30	16
Total of A. (I + II)	**128**	**3,324**	**6,277**	**3,393**
B. NON ELIGIBLE PORTION				
a Procurement / Construction	**0**	**0**	**0**	**0**
Contingency & Administrative Expenditure	0	0	0	0
Base cost for JICA financing	0	0	0	0
Price escalation	0	0	0	0
Physical contingency	0	0	0	0
b Land Acquisition	**0**	**0**	**0**	**0**
Base cost	0	0	0	0
Price escalation	0	0	0	0
Physical contingency	0	0	0	0
c Administration cost	**0**	**358**	**662**	**358**
d VAT	**0**	**126**	**232**	**126**
e Import Tax	**0**	**0**	**0**	**0**
Total (a+b+c+d+e)	**0**	**484**	**895**	**484**
TOTAL (A+B)	**128**	**3,807**	**7,171**	**3,876**
C. Interest during Construction	**178**	**0**	**178**	**96**
Interest during Construction(Const.)	178	0	178	96
Interest during Construction (Consul.)	0	0	0	0
D. Commitment Charge	**50**	**0**	**50**	**27**
GRAND TOTAL (A+B+C+D)	**356**	**3,807**	**7,400**	**4,000**
JICA finance portion (A)	**128**	**3,324**	**6,277**	**3,393**

Source: JICA Survey Team

7.2.2. Annual Fund Requirement

The annual fund requirement is shown table below and detailed fund requirement with price escalation and physical contingency by components is in Table 7-5.

Table 7-4 Annual Fund Requirement (million)

Year	Eligible Portion				Non Eligible Portion				Interest during				Commitment Charge				Grand Total			
	Foreign Currency	Local Currency	Total in		F.C	L.C	Total in		F.C	L.C	Total in		F.C	L.C	Total in		F.C	L.C	Total in	
2012	28	36	94	51	0	7	13	7	0	0	0	0	6	0	6	3	34	43	114	62
2013	34	454	873	472	0	67	124	67	5	0	5	3	6	0	6	3	45	521	1,010	546
2014	10	582	1,087	588	0	84	155	84	12	0	12	7	6	0	6	3	28	666	1,261	682
2015	19	704	1,322	714	0	102	188	102	21	0	21	11	6	0	6	3	46	806	1,537	831
2016	20	791	1,483	801	0	114	211	114	30	0	30	16	6	0	6	3	56	905	1,730	935
2017	0	353	653	353	0	50	93	50	34	0	34	18	6	0	6	3	40	403	786	425
2018	0	254	470	254	0	36	67	36	37	0	37	20	6	0	6	3	43	290	580	313
2019	17	150	295	160	0	23	42	23	39	0	39	21	6	0	6	3	62	173	382	207
Total	128	3,324	6,277	3,393	0	484	895	484	178	0	178	96	50	0	50	27	356	3,807	7,400	4,000

Note: F.C: Foreign Currency LC: Local Currency

7.2.3. Consulting Services

Consulting services by foreign and local consultants will be required to assist with the implementation of the Project in review of design and project management. The cost estimated for the consulting services is provisional some of 127 million Yen + 102 million Rs which is less than 5 % of the total project cost at this time. Detail cost will be estimated based on the man-month schedule which will be shown in TOR to be prepared by Forest Department of West Bengal.

Table 7-5 Annual Fund Requirement (million)

Item	Total				2012			2013			2014			2015			2016			2017			2018			2019		
	FC	LC	Total		FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total
A. ELIGIBLE PORTION			Rs	Yen																							
Ⅰ) Procurement / Construction	**0**	**3,213**	**3,213**	**5,943**	**0**	**15**	**28**	**0**	**433**	**802**	**0**	**570**	**1,054**	**0**	**688**	**1,272**	**0**	**774**	**1,431**	**0**	**350**	**647**	**0**	**251**	**464**	**0**	**132**	**245**
1. Afforestation and Allied Works	**0**	**1,363**	**1,363**	**2,521**	**0**	**0**	**0**	**0**	**96**	**177**	**0**	**255**	**472**	**0**	**328**	**607**	**0**	**364**	**674**	**0**	**161**	**298**	**0**	**102**	**189**	**0**	**56**	**104**
1.A Afforestation of Degraded Forest Land in Recorded Forest Area	0	779	779	1,440	0	0	0	0	0	0	0	133	247	0	184	340	0	229	423	0	116	215	0	74	137	0	43	79
1.B Tree Planting Outside Forest Area (Social Forestry)	0	258	258	478	0	0	0	0	0	0	0	38	71	0	58	107	0	75	139	0	45	83	0	28	52	0	14	26
1.C Soil & Moisture Conservation in Forestry Treatment Areas	0	124	124	229	0	0	0	0	0	0	0	38	70	0	41	76	0	45	84	0	0	0	0	0	0	0	0	0
1.D Production of Quality Planting material	0	202	202	373	0	0	0	0	96	177	0	46	84	0	46	84	0	15	28	0	0	0	0	0	0	0	0	0
2. Biodiversity Conservation	**0**	**161**	**161**	**299**	**0**	**0**	**0**	**0**	**19**	**34**	**0**	**24**	**44**	**0**	**30**	**55**	**0**	**32**	**59**	**0**	**32**	**58**	**0**	**24**	**44**	**0**	**3**	**5**
2.A Habitat Management	0	34	34	63	0	0	0	0	0	0	0	2	5	0	8	14	0	10	18	0	9	17	0	3	6	0	2	3
2.B Man-Animal conflict mitigation	0	109	109	201	0	0	0	0	17	32	0	17	31	0	17	32	0	18	34	0	19	35	0	19	36	0	1	2
2.C Research	0	19	19	34	0	0	0	0	1	3	0	5	9	0	5	9	0	4	7	0	4	7	0	1	1	0	0	0
3. Community Development	**0**	**282**	**282**	**522**	**0**	**0**	**0**	**0**	**4**	**7**	**0**	**94**	**174**	**0**	**94**	**174**	**0**	**90**	**167**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
3.A Meeting	0	6	6	11	0	0	0	0	2	4	0	2	4	0	2	4	0	0	0	0	0	0	0	0	0	0	0	0
3.B Microplan	0	6	6	11	0	0	0	0	2	4	0	2	4	0	2	4	0	0	0	0	0	0	0	0	0	0	0	0
3.C Income Generation Activities	0	60	60	111	0	0	0	0	0	0	0	20	37	0	20	37	0	20	37	0	0	0	0	0	0	0	0	0
3.D Community Development Infructracture Development of for JFMC*	0	210	210	389	0	0	0	0	0	0	0	70	130	0	70	130	0	70	130	0	0	0	0	0	0	0	0	0
4. Institutional Capacity Development	**0**	**411**	**411**	**760**	**0**	**13**	**24**	**0**	**229**	**423**	**0**	**55**	**101**	**0**	**32**	**60**	**0**	**25**	**46**	**0**	**24**	**45**	**0**	**20**	**37**	**0**	**13**	**24**
4.A Base line survey of the state's forest resources at the start of project	0	10	10	18	0	0	0	0	5	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	9
4.B Training & Capacity Building of Project Implementing Officials, Field &Office Staffs and Other Stakeholders	0	61	61	113	0	0	0	0	26	48	0	26	48	0	10	18	0	0	0	0	0	0	0	0	0	0	0	0
4.C Infrastructure development for TPOF (Social forestry), training, research, GIS, forest protection etc including Building, Equipment &Vehicle	0	306	306	565	0	11	20	0	194	358	0	24	45	0	19	35	0	19	35	0	18	33	0	18	33	0	3	6
4.D Forestry Research Activities	0	23	23	42	0	2	4	0	5	8	0	5	8	0	2	4	0	3	6	0	3	5	0	2	3	0	1	2
4.E Mid-term Monitoring & Evaluation including periodic biodiversity & community development studies	0	8	8	15	0	0	0	0	0	0	0	0	0	0	2	3	0	3	5	0	4	7	0	0	0	0	0	0
4.F End-term Monitoring and Evaluation	0	4	4	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	7
Base cost	**0**	**2,217**	**2,217**	**4,101**	**0**	**13**	**24**	**0**	**347**	**641**	**0**	**428**	**791**	**0**	**484**	**896**	**0**	**511**	**945**	**0**	**217**	**401**	**0**	**146**	**270**	**0**	**72**	**133**
Price escalation	**0**	**704**	**704**	**1,302**	**0**	**1**	**2**	**0**	**47**	**87**	**0**	**90**	**167**	**0**	**141**	**261**	**0**	**192**	**356**	**0**	**101**	**187**	**0**	**82**	**152**	**0**	**48**	**89**
Physical contingency	**0**	**292**	**292**	**540**	**0**	**1**	**3**	**0**	**39**	**73**	**0**	**52**	**96**	**0**	**63**	**116**	**0**	**70**	**130**	**0**	**32**	**59**	**0**	**23**	**42**	**0**	**12**	**22**
Ⅱ) Consulting services	**128**	**111**	**180**	**333**	**28**	**21**	**66**	**34**	**20**	**72**	**10**	**12**	**33**	**19**	**16**	**49**	**20**	**17**	**52**	**0**	**3**	**5**	**0**	**3**	**6**	**17**	**18**	**50**
Base cost	110	80	139	257	25	18	58	30	16	60	9	9	26	16	11	38	16	11	38	0	2	0	0	2	3	14	10	32
Price escalation	6	21	25	46	0	1	3	1	2	5	0	2	4	1	3	7	1	4	9	0	1	2	0	1	2	2	7	14
Physical contingency	12	10	16	30	3	2	6	3	2	7	1	1	3	2	1	4	2	2	5	0	0	0	0	0	1	2	2	5
Total (Ⅰ+Ⅱ)	**128**	**3,324**	**3,393**	**6,277**	**28**	**36**	**94**	**34**	**454**	**873**	**10**	**582**	**1,087**	**19**	**704**	**1,322**	**20**	**791**	**1,483**	**0**	**353**	**653**	**0**	**254**	**470**	**17**	**150**	**295**
B. NON ELIGIBLE PORTION			0																								
a Procurement / Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Contingency & Administrative Expenditure	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Base cost for JICA financing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Price escalation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Physical contingency	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
b Land Acquisition	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Base cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Price escalation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Physical contingency	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
c Administration cost	0	358	358	662	0	5	10	0	50	92	0	62	115	0	75	139	0	85	156	0	37	69	0	27	50	0	17	31
d VAT	0	126	126	232	0	2	3	0	17	32	0	22	40	0	26	49	0	30	55	0	13	24	0	9	17	0	6	11
e Import Tax	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total (a+b+c+d+e)	**0**	**484**	**484**	**895**	**0**	**7**	**13**	**0**	**67**	**124**	**0**	**84**	**155**	**0**	**102**	**188**	**0**	**114**	**211**	**0**	**50**	**93**	**0**	**36**	**67**	**0**	**23**	**42**
TOTAL (A+B)	128	3,807	3,876	7,171	28	43	108	34	521	998	10	666	1,242	19	806	1,510	20	905	1,694	0	403	746	0	290	537	17	173	337
C. Interest during Construction	178	0	96	178	0	0	0	5	0	5	12	0	12	21	0	21	30	0	30	34	0	34	37	0	37	39	0	39
Interest during Construction(Const.)	178	0	96	178	0	0	0	5	0	5	12	0	12	21	0	21	30	0	30	34	0	34	37	0	37	39	0	39
Interest during Construction (Consul.)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D. Commitment Charge	50	0	27	50	6	0	6	6	0	6	6	0	6	6	0	6	6	0	6	6	0	6	6	0	6	6	0	6
GRAND TOTAL (A+B+C+D)	356	3,807	4,000	7,400	34	43	114	45	521	1,010	28	666	1,261	46	806	1,537	56	905	1,730	40	403	786	43	290	580	62	173	382
E. JICA finance portion (A)	128	3,324	3,393	6,277	28	36	94	34	454	873	10	582	1,087	19	704	1,322	20	791	1,483	0	353	653	0	254	470	17	150	295

Administration Cost = 10.55%
Service Tax= 3.35% of the expenditure of the eligible portion (Total service tax is estimated 129 million Rs)
Import Tax= 0.0%

Chapter 8 Project Evaluation

8.1. Project Evaluation

8.1.1. Approach

Economic viability of the forestry development project in West Bengal has been assessed within the broad framework of "Cost-Benefit Analysis", generally used for appraisal of public investment projects. The main objective of the analysis is to identify the project benefits and to compare them with project costs over the economic life of the project so as to justify its implementation. In case of financial analysis, the profits accruing to an individual entity making investment become the major factor for evaluation, whereas in economic analysis the benefits to the economy are the main criteria for evaluation. Accordingly, the costs to be considered in economic analysis are different than those in financial analysis. In financial analysis, total cost of project at market prices is considered. However, for economic analysis, financial costs are converted into economic costs, which are the net of taxes, duties and royalties.

The economic analysis involves comparison of project costs and benefits in economic terms and determining the Economic Internal Rate of Return (EIRR) of the project using Discounted Cash Flow (DCF) technique. This shows the return, which the society could expect from the proposed investment during the project life, i.e. analysis period of 38 years. The EIRR is then compared with the accounting rate of return of 12 percent considered as the cut-off point for investment decision by the Government of India and international funding agencies like the World Bank (WB) and the Asian Development Bank (ADB).

The main steps followed are:

i) Estimation of capital and maintenance costs (both regular and periodic) at economic prices, along with the capital cost phasing
ii) Estimation of economic benefits
iii) Comparison of annual streams of costs with benefits and estimation of EIRR on the basis of DCF technique.

The project is further subjected to sensitivity analysis by assessing the effects of adverse changes in the key variables on the base EIRR. This helps to gauge the economic strength of the project to withstand future risks and uncertainties.

8.1.2. Project Cost and Scheduling

The project cost consists of two main components:

i) Capital cost
ii) Maintenance cost

Economic analysis requires the conversion of financial costs into economic costs to take care of distortions in prices due to market imperfections. Taxes and duties are removed from financial prices as these are not real costs to the economy, but are only transfer payments. All financial costs have been converted into economic costs, which are net of taxes and duties, generally a factor of 0.85, as recommended by the World Bank or Asian Development Bank in the latest Guidelines for economic evaluation of infrastructure projects in India to convert financial cost into economic cost. However in the present case, the majority of the cost component is wages to labour force and payment for trained manpower. It has been assumed that on an average around 70% of the project cost is for payment of salaries and wages which normally does not have any transfer payment component. Thus the conversion factor adopted for this project is 0.96.The same conversion factor has been considered applicable both on the capital and the maintenance cost.

8.1.3. Capital Cost and Its Phasing

The capital cost of the project is spread over first eight years of the analysis period and estimated as Rs. 40000 lakhs

The economic cost of the project is worked out by applying the conversion factor of 0.955 to all financial costs. The phasing of the capital cost of the project both in financial and economic terms, are presented in the table below:

Table 8-1 Capital Cost of the Project (Rs. lakhs)

Year in order	Year	Financial Cost	Economic Cost (1)	Economic Cost (2) applying the conversion factor of 0.955	Remarks
1	2012	641	544	520	Assuming 70% is
2	2013	5,634	4,786	4,571	labour and other 30%
3	2014	6,803	5,439	5,194	using factor of 0.85,
4	2015	8,294	6,256	5,975	namely
5	2016	9,409	6,690	6,389	0.70+0.30x0.85=
6	2017	4,229	2,750	2,626	0.955
7	2018	3,108	1,864	1,781	
8	2019	1,881	1,028	982	
Total		**40,000**	**29,358**	**28,037**	

Source: JICA Survey Team

8.1.4. Maintenance Cost

The capital cost of the project is phased over a period of 8 years. This cost includes regular maintenance cost also. In the cost stream a separate maintenance cost component is required only after the eighth year. It is rationally assumed that the maintenance cost after eighth year will be 2% of the total capital cost trough the whole project period as follows.

Table 8-2 Maintenance Cost of the Project for some cardinal years

Year in order	Year	Maintenance cost (Rs.lakhs)	
		Financial Price	Economic Cost
Total Capital Expenses		800	764

Maintenance Cost 2% of Total Capital Expenses

Source: JICA Survey Team

8.1.5. Benefits of the Project

The benefits of the project has multiple aspects that include outputs consisting forestry products, benefits to the environment conserving the wildlife and biosphere, protection of endangered species and recreational value that could be generated from a forest. However, it is difficult to convert all the benefits in monetary terms which are acceptable unanimously. There are benefit aspects also where the quantum of benefit is so small, inclusion or exclusion of it in the cost benefit analysis doesn't make any difference. In the present project the most important benefits that could be express in financial terms, is outturn of timber and production of fire woods (during thinning and spacing)

In the without project scenario the benefits are considered only for those areas where the present forestry activity will be extended to the areas where no such activities prevails. It is assumed that the extension of the forestry at its best could be possible to those land areas where either no economic activities or economic activities at its minimum level.

8.1.6. Benefits

The benefits in with project scenario is based on certain considerations, those are adopted from the current practices. The value those are considered for the benefits assessment has variations over regions. To reflect the true picture in the benefit assessment, the entire benefit area is divided into three regions viz. the South Bengal, North Bengal and the Sunderbans. Values for different activities are adopted according to their representativeness in the areas. The following Table 0.3 presents the considerations for the benefit assessment. The table is self explanatory with activities.

Table 8-3 Benefit Assessment

Benefit Assessment										
Area	Type of Plantation	Harvesting In the Year	Mechanical Thinning In the Year	Thinning in the Year		Per Hectare Yield (Financial)				Remarks
						Mechanical Thinning	Thinning		Harvest	
							1st	2nd		
South Bengal	Eucalyptus Plantation (450 ha)	8 years							150000	
	Sal & Associates Plantation (3430 ha)	40 years	5th year	15th year		7500	15000		710000	
	Quick Growing (6000 ha)	12 years	4th year			7500			85000	
	RFD and MSC (7500ha)	15 years	3rd year	7th year		10000	18000		95000	
North Bengal	Misc. Species (1050 ha)	60 years	5th year	15th year	30th year	7500	36800	146000	1498000	
	Sal & Associates (540 ha)	70 years	5th year	15th year	35th year	7500	127000	731000	3450000	
Social Forestry	Strip plantation (1400 ha)	20th year		5th year			7500		110000	
	Block Plantation (1400 ha)	15th year		5th year			7500		90000	

Source: JICA Survey Team

Based on the above mentioned considerations the benefit of the project related to timber outrun is presented in the following Table. In some of the plantations the harvesting period is more than 50 years also. Therefore, in the present analysis the analysis period is considered for 70 years after the execution.

Table 8-4 Benefits from Timber Outturn

	A1	A2	A3	A4			A5	A6	B1	B2	
Type of Plantation	Eu.Clonal Plantation	Sal & Associates Plantation	Quick Growing	RDF	MSC	Total	Misc. Species	Sal & Associates	Strip Plantation	Block Plantation	Total Benefits
Area (ha)	450	3,430	6,000	7,500	7,500		1,050	540	1,400	1,400	
Activities											
1st Thinning	0	15th Year	0	7th	7th		15th Year	15th Year	5 th Year	5th Year	
2nd Thinning	0	0	0	0	0		30 Year	35 Year			
Mechanical Spacing	0	5th Year	4th Year	3rd year	3rd year		5th Year	5th Year			
Harvesting	8th year	40 th Year	12th year	15th year	15th year		60th Year	70th Year	20th Year	15th Year	
Yield (per ha)											
1st Thinning		15,000		18,000	18,000		36,800	127,000	7,500	7,500	
2nd Thinning							146,000	731,000			
Mechanical Spacing		7,500	7,500	10,000	10,000		7,500	7,500			
Harvesting	150,000	710,000	85,000	95,000	95,000		1,498,000	3,450,000	110,000	90,000	
Year 1						-					-
Year 2						-					-
Year 3				750		750					750
Year 4			450			-					450
Year 5		257				-	79	41	105	105	587
Year 6					750	750					750
Year 7				1,350		1,350					1,350
Year 8	675					-					675
Year 9						-					-
Year 10				1,350	1,350	2,700					2,700
Year 11						-					-
Year 12			5,100			-					5,100
Year 13						-					-
Year 14						-					-
Year 15		515		7,125		7,125	386	686		1,260	9,972
Year 16	675		450			-					1,125
Year 17						-					-
Year 18				750	7,125	7,875					7,875
Year 19						-					-
Year 20						-			1,540	105	1,645
Year 21					750	750					750
Year 22				1,350		1,350					1,350
Year 23						-					-
Year 24	675		5,100			-					5,775
Year 25					1,350	1,350			105		1,455
Year 26						-					-
Year 27						-					-
Year 28			450			-					450
Year 29						-					-
Year 30				7,125		7,125	1,533			1,260	9,918
Year 31						-					-
Year 32	675					-					675
Year 33				750	7,125	7,875					7,875
Year 34						-					-
Year 35						-		3,947		105	4,052
Year 36			5,100		750	750					5,850
Year 37				1,350		1,350					1,350
Year 38						-					-
Year 39						-					-
Year 40	675	24,353	450		1,350	1,350			1,540		28,368
Year 41						-					-
Year 42						-					-
Year 43						-					-
Year 44						-					-

	A1	A2	A3	A4			A5	A6	B1	B2	
Type of Plantation	Eu.Clonal Plantation	Sal & Associates Plantation	Quick Growing	RDF	MSC	Total	Misc. Species	Sal & Associates	Strip Plantation	Block Plantation	Total Benefits
Year 45		257		7,125		7,125			105	1,260	8,747
Year 46						-					-
Year 47						-					-
Year 48	675		5,100	750	7,125	7,875					13,650
Year 49						-					-
Year 50						-				105	105
Year 51					750	750					750
Year 52			450	1,350		1,350					1,800
Year 53						-					-
Year 54						-					-
Year 55		515			1,350	1,350					1,865
Year 56	675					-					675
Year 57						-					-
Year 58						-					-
Year 59						-					-
Year 60			5,100	7,125		7,125	15,729		1,540	1,260	30,754
Year 61						-					-
Year 62						-					-
Year 63				750	7,125	7,875					7,875
Year 64	675		450			-					1,125
Year 65						-			105	105	210
Year 66					750	750					750
Year 67				1,350		1,350					1,350
Year 68						-					-
Year 69						-					-
Year 70					1,350	1,350		18,630			19,980

Source: JICA Survey Team

8.1.7. The Project Return

Economic analysis is carried out to assess the feasibility of the investment proposal. Doing so, as stated above, the discounted cash flow technique is adopted. In this technique all the cost and benefit components are consider and the net effect on the project is verified in terms of IRR and the NPV.

The following Table presents the net costs and benefits.

The project IRR and the net present values are estimated as follows:

Table 8-5 Cost Benefit Assessment

Year in order	Year	Capital Expenses	Maintenance Expenses	Total Cost	Benefits	Net Cash Flow (Benefit - Cost)
1	2012	500	0	500	0	-500
2	2013	4426	0	4,426	0	-4,426
3	2014	5203	0	5,203	750	-4,453
4	2015	5983	0	5,983	450	-5,533
5	2016	6347	0	6,347	587	-5,761
6	2017	2636	0	2,636	750	-1,886
7	2018	1794	0	1,794	1,350	-444
8	2019	1086	0	1,086	675	-411
9	2020		764	764	0	-764
10	2021		764	764	2,700	1,936
11	2022		764	764	0	-764
12	2023		764	764	5,100	4,336
13	2024		764	764	0	-764
14	2025		764	764	0	-764
15	2026		764	764	9,972	9,208
16	2027		764	764	1,125	361

Year in order	Year	Capital Expenses	Maintenance Expenses	Total Cost	Benefits	Net Cash Flow (Benefit - Cost)
17	2028		764	764	0	-764
18	2029		764	764	7,875	7,111
19	2030		764	764	0	-764
20	2031		764	764	1,645	881
21	2032		764	764	750	-14
22	2033		764	764	1,350	586
23	2034		764	764	0	-764
24	2035		764	764	5,775	5,011
25	2036		764	764	1,455	691
26	2037		764	764	0	-764
27	2038		764	764	0	-764
28	2039		764	764	450	-314
29	2040		764	764	0	-764
30	2041		764	764	9,918	9,154
31	2042		764	764	0	-764
32	2043		764	764	675	-89
33	2044		764	764	7,875	7,111
34	2045		764	764	0	-764
35	2046		764	764	4,052	3,288
36	2047		764	764	5,850	5,086
37	2048		764	764	1,350	586
38	2049		764	764	0	-764
39	2050		764	764	0	-764
40	2051		764	764	28,368	27,604
41	2052		764	764	0	-764
42	2053		764	764	0	-764
43	2054		764	764	0	-764
44	2055		764	764	0	-764
45	2056		764	764	8,747	7,983
46	2057		764	764	0	-764
47	2058		764	764	0	-764
48	2059		764	764	13,650	12,886
49	2060		764	764	0	-764
50	2061		764	764	105	-659
51	2062		764	764	750	-14
52	2063		764	764	1,800	1,036
53	2064		764	764	0	-764
54	2065		764	764	0	-764
55	2066		764	764	1,865	1,101
56	2067		764	764	675	-89
57	2068		764	764	0	-764
58	2069		764	764	0	-764
59	2070		764	764	0	-764
60	2071		764	764	30,754	29,990
61	2072		764	764	0	-764
62	2073		764	764	0	-764
63	2074		764	764	7,875	7,111
64	2075		764	764	1,125	361
65	2076		764	764	210	-554
66	2077		764	764	750	-14
67	2078		764	764	1,350	586
68	2079		764	764	0	-764
69	2080		764	764	0	-764
70	2081		764	764	19,980	19,216
					EIRR	5.59%
					NPV	(10,564)

Source: JICA Survey Team

8.1.8. Sensitivity Analysis

The robustness of the project's viability is further demonstrated by the sensitivity analysis. Because of uncertainties pertaining to critical parameters related to cost and benefits, a sensitivity analysis is carried out, so as to test the economic strength of the project. The variations in the following parameters have been examined, considering them to be on the conservative side:

i) Increase in cost by 15 percent
ii) Decrease in benefits by 15 percent
iii) Increase in cost by 15 percent and decrease in benefits by 15 percent

The sensitivity analysis has been carried out for the scenario 1 only. The results of the sensitivity analysis are presented in the following Table: 8.6

Table 8-6 Sensitivity Analysis Results (Analysis period of 38 years)

Case	EIRR (in %)	NPV @ 12% (Rs. lacs)
Base Case	5.59%	-10,564
Increase in cost by 15 percent	4.67%	-13,600
Decrease in benefits by 15 percent	4.52%	-12,015
Increase in cost by 15 percent and decrease in benefits by 15 percent	3.66%	-15,050

Source: JICA Survey Team

8.1.9. Conclusion

The project achieves an economic rate of return of 5.59% in the base case. This is acceptable for a forestry project where other benefits, those are not taken into account. In the worst cast of sensitivity the project EIRR drop to 3.66%. It is strongly recommended to implement the project on the basis of its tangible and intangible benefits.

8.2. Carbon Sequestration

8.2.1. Estimated Amount of Carbon Removals by Trees

The carbon removals by the sinks as a result of the project activity is anticipated to be totally 382,500 tons of CO_2 for the components of "Afforestation of Degraded Forest Land in Recorded Forest Area", including 6 activities in the "Afforestation and Allied Works" and 2 activities in the "Tree Planting Outside Forest (Social Forestry)", the details are given in next table.

Table 8-7 Amount of Carbon Removal

Activities	Amount of Carbon Removal (100 tCO2equivalent)														
	1st	2nd	3rd	4th	5th	6th	7th	8th	10th	15th	20th	30th	40th	50th	60th
A. Afforestation and Allied Works															
A.1	-	0	6	10	19	29	40	51							
A.2	-	137	273	409	545	386	463	541	773	538	716	1,074	1,075		
A.3	-	239	477	716	954	676	811	946	1,352	940	1,253	1,879	1,880	1,880	
A.4	-	1	1	1	1	1	2	2	3	7					
A.5	-	42	84	125	167	118	142	166	237	165	219	329	329	329	329
A.6	-	22	43	64	86	61	73	85	122	85	113	169	169	169	169
SUB T (A)	-	440	883	1,326	1,772	1,271	1,531	1,790	2,486	1,734	2,302	3,451	3,452	2,378	498
B. Social Forest Afforestation															
B.1	-	0	20	31	59	90	124	157							
B.2	-	0	20	31	59	90	124	157							
SUB T (B)	-	1	39	63	118	181	247	315							
TOTAL	-	441	923	1,388	1,891	1,452	1,778	2,105	2,486	1,734	2,302	3,451	3,452	2,378	498
GRAND T.															3,825

Note) A1: Planting with High Yielding Eucalyptus clones in South West Bengal
A2: Sal & Associate Species Plantation in South Bengal
A3: Quick Growing & Small Timber spp. Plantation in South Bengal
A4: Rehabilitation of Degraded Sal Coppice of South West Bengal
A5: Miscellaneous Plantation in North Bengal
A6: Sal & Associate Plantation in North Bengal
B1: Strip Plantation
B2: Block Plantation
All values are round off to the 100 t. Total values don't meet the integrated value of entries in the table.

Source: JICA Survey Team

8.2.2. Condition and Methodology

The Project has totally 8 activities in of the 'Afforestation and Allied Works' and 'Social Forest Afforestation' which has function of the carbon storage through the afforestation, each activity has different condition and species shown below table;

Table 8-8 Activities, Conditions, Species and Location of the Afforestation in the Project

Activities	Conditions	Species and Location
A. Afforestation and Allied Works		
A.1 Planting with High Yielding Eucalyptus clones in South West Bengal	Rotation: 8 years Thinning: 3rd years Density of Stem Wood: 0.64	Species: Eucalyptus Location: South West and South
A.2 Plantation of Sal & Associate Species in South Bengal	Rotation: 40 years Thinning: 5th, 15th, 25th years Thinning: grade: 50 % Density of Stem Wood: 0.72	Species: Shorea robusta Location: South West and South
	Rotation: 50 years Thinning: 5th, 15th ,25th years Thinning grade: 50 % Density of Stem Wood: 0.64	Species: Associates Plants Location: South West and South
A.3 Quick growing & small timber spp. plantation in South Bengal	Rotation: 50 years Thinning: 5th, 15th ,30th years Thinning grade: 50 % Density of Stem Wood: 0.64	Species: Terminalia belerica, Pterocapus marsupium, Terminalia chebula Location: South West and South
A.4 Rehabilitation of Degraded Sal Coppice of South West Bengal	Rotation: 15 years Thinning: 7th years Thinning grade: 20 % Density of Stem Wood: 0.67	Species: Shorea robusta Location: South West and South
A.5 Economic Plantation in North Bengal	Rotation: 60 years Thinning: 5th, 15th, 30th years Thinning grade: 50 % Density of Stem Wood: Tectona Grandis is 0.72, Associates Plants is 0.64	Species: Tectona grandis Location: North
		Miscellaneous spp. Location: North

Activities	Conditions	Species and Location
A.6 Plantation of Sal & associate Plantation in North Bengal	Rotation: 60 years Thinning: 5th, 15th, 30th years Thinning grade: 50 % Density of Stem Wood: 0.72	Shorea robusta Location: North
	Rotation: 60 years Thinning: 5th, 15th, 30th years Thinning grade: 50 % Density of Stem Wood: 0.64	Species: Associates Plants Location: North
B. Social Forest Afforestation		
B.1 Strip Plantation B.2 Block Plantation	Rotation: 8 years Thinning: 3rd years Thinning grade: 50 %	Species: Eucalyptus

Note) The calculation of carbon sequestration should be done under the condition of Spacing, 2.5m×2.5m.
Source: JICA Survey Team

According to the above condition and species in the project activities, the calculations of Carbon Stock will be carried out through three steps; 1) Estimation of the Above Ground Biomass (AGB) volume or stem volume, 2) Estimate the Total Biomass (TB), and 3) Estimate Total Carbon Stocks (TC) and were performed for each species or each type of plantation.

Each step for the target species is described in below;

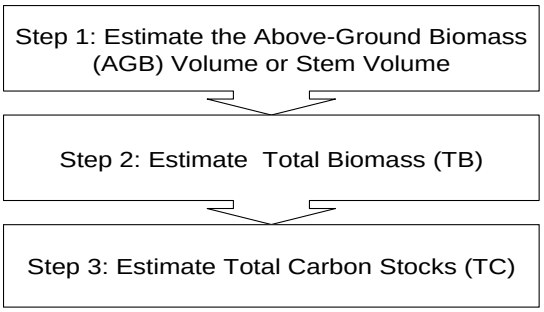


Figure 8-1 Method of Calculation of Carbon Stock

(a) Step 1: Estimate the above-ground stand volume

Allometric equations which are estimated in Working Plan are used for the estimation of the volume. If those allometric equations are not available, default allometric equations or volume tables of similar species are used. Allometric equations used are furnished in following Table.

Table 8-9 Allometric Equations and volume tables for the estimation of AGB and Stem Volume

Species	Allometric Equations and volume table	Reference
Eucalyptus hybrid	$(AGB) = 1.22 \cdot (DBH)^2 \cdot (Height) \cdot 0.01$	Ref: Reference No.5 page 4.115 Table
	$(DBH) = e^{(\log_e H - 4.416)/0.8153}$	Ref: Reference No.7 page 133
	$(Height) = 1.3231 + 4.0916 \cdot Log_e(Age)$	Ref: Reference No.7 page 133
Shorea robusta Biomass(southern part)	$(SV) = 0.00389 - 0.27516 \cdot (DBH) + 6.90733 \cdot (DBH)^2$	Ref: Reference No.7 page 122
	$(Girth) = 7.776086957 + 2.232865613t - 1.938735178 \cdot 10^{-2} \cdot t^2$	Ref: Reference No.7 page 120

Species	Allometric Equations and volume table	Reference
Shorea robusta Biomass (northern part)	$(AGB) = 0.00389 - 0.27516 \cdot (DBH) + 6.90733 \cdot (DBH)^2$	Ref: Reference No.8 page 155
	$(Girth) = -5.761632384 \cdot 10^{-3} \cdot (age)^2 + 1.3260032968 \cdot (age) + 1.204879772$	Ref: Reference No.8 page 153
Tectona grandis Biomass	Used the volume table	Ref: Reference No.14
Associates & miscellaneous Biomass	Used the volume table	Ref: Reference No.15

Note) AGB: Above-ground biomass volume (kg/tree) DBH: Diameter of Breast Height
SV: Stem Volume (m3/stem)

(b) Step 2: To estimate Total biomass

Total biomass is estimated by using Biomass Expansion Factor (BEF) and T/R ratio are selected from existing local and species specific. If not available, data of national and species specific or species specific from neighboring countries with similar conditions are selected from literature. If any data isn't available, we used default data from GPG-LULUCF1. The calculation has the two option, one is based on the Stem Volume and the other is based on the Above-Ground Biomass (AGB) as following and the Coefficient of Root Short Ratio (R) and the Biomass Expansion Factor (BEF) are shown the below table;

$$(TB)=(\text{Stem Volume}) \times (BEF) \times (1+R)$$

or

$$(TB)=(AGB) \times (1+R)$$

Table 8-10 Coefficient of Root Short Ratio and Biomass Expansion Factor with the Reference

Species	R/S			BEF		
	Coefficient	Reference	Note	Coefficient	Reference	Note
Eucalyptus hybrid	0.4	reference no.4 table3a.1.8	Eucalyptus species	-	-	-
Shorea robusta	0.42	reference no.4 table3a.1.8		3.4	reference no.10	
Mangrove	0.33	reference no.13 page 134	Avicenna spp.	-	-	-
Tectona grandis	0.42	reference no.4 table3a.1.8		3.4	reference no.10 table3a.1.10	
Associates and Miscellaneous	0.22	Reference no.15		1.2	Reference no.15	

(c) Step 3: The carbon stocks, expressed in CO2-e, will be estimated by the following equations:

$$(\text{TC within targeted area})=(TC) \times (\text{targeted area})$$

$$(TC)=44/12 \times (TB) \times (CF) \times 1{,}000$$

Where;

(TC): Carbon stock in tree biomass per ha at a given point of time in year t; t CO_2-e/ha

(TB): Total tree biomass per ha at a given point of time in year t;t d.m/ha.

(CF): Carbon fraction of tree biomass; t C t d.m.-1

A default value of 0.50 is used following IPCC GPG

[1] Good Practice Guidance for Land Use, Land-Use Change and Forestry

Reference

1 A/R Methodological tool "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities Version02.1.0"

2 Consolidated afforestation and reforestation baseline and monitoring methodology "Reforestation of degraded land_ver03"

3 Simplified baseline and monitoring methodology for small scale A/R CDM project activities implemented on wetland_Ver.01

4 IPCC Good Practice Guidance LULUCF 2003 Annex 3A.1 "Biomass Default Tables for Section 3.2 Forest Land

5 IPCC Good Practice Guidance LULUCF 2003 Annex 4A.1 "Tool for Estimation of Changes in Soil Carbon Stocks associated with Management Changes in Croplands and Grazing Lands based on IPCC Default Data"

6 Working plan of Jalpaiguri forest "CHAPTER VIII Statistics of Growth"

7 Working plan of Burdwan District "CHAPTER VIII Statistics of Growth & Yield" P116~

8 Working plan of Baikunthapur District Statistics of Growth

9 Working plan of BTR District Statistics of Growth.doc

10 CarbonSeq_Management

11 West Bengal Integrated Forest and Biodiversity Project Detailed Program Report (DPR)

12 Equation for estimating DBH of mangrove

13 Komiyama et al.,2008

14 Japanese Forestry Agency (2010) Growth database of planted forests in the world (ver 2.0). Comprehensive action for the promotion of A/R CDM (human resources development for planning and implementation of A/R CDM), FY 2009

15 PDD: Small Scale Cooperative Afforestation CDM Pilot Project Activity on Private Lands Affected by Shifting Sand Dunes in Sirsa, Haryana.

Chapter 9 Environmental and Social Consideration

JICA requires proponent countries, through the *JICA Guidelines for Environmental and Social Considerations (April 2010),* to assess project impacts in the earliest possible planning stage and examine alternative/mitigation measures to avoid or minimise adverse impacts on the environment and society during the implementation stage. The emphasis should be given to the schedule tribes and caste living in/around forest areas as they are socially vulnerable and major target groups for this project. Therefore, the Survey Team in collaboration with the Forest Department carried out the environmental and social considerations and prepared the Forest Dwellers Development Framework in line with the JICA Guideline.

9.1 Environmental and Social Consideration

Since this project is mainly composed of afforestation and biodiversity conservation, it is unlikely that the project will cause serious impact on natural and social environment. At the same time, however, the major target areas involve forest lands and protected areas and most of the target groups are the socially vulnerable including women. Thus, it is necessary to make adequate considerations on both environmental and social aspects for the project.

9.1.1. Applicable Regulation, Policies and Organisations

The implementation of the project should be in consistency with the existing legal and regulatory mechanisms associated with the relevant forestry, infrastructure and community development activities. The relevant acts, policies and organisations to the project with respect to environment and social considerations are mentioned below.

(1) Environmental Aspect

Table 9-1 Related Acts and Policies to the Project (Environment)

Act /Policy with Year
1. *The National Environment Policy (NEP), 2006* *administered by* Ministry of Environment & Forests (MoEF). i) The revised NEP expands to the control of wild life conservators in other areas where endangered species exist. ii) It deals with the problem of ground water pollution and discusses tackling the pollution from agricultural chemicals. iii) Suggests promotional measures like "a) intensive water and moisture conservation, b) enhancing and expanding green cover based on local species. iv) The revised policy forcefully argues for the rationalising of EIA principles and solving the problems of delays in clearances of projects.
2. *EIA Notification, 14 September 2006 administered by* Ministry of Environment and Forest (MoEF) Environmental Clearance (EC) is not required for certain types of projects which do not fall under the Schedule I.
3. *The Wildlife (Protection) Act 1972, Rules 1973 and Amendments up to 2006* It provides for the protection wildlife in general and has procedures for control of poaching and wildlife trade.
4. *The Forest (Conservation) Act 1980 and Rules 1981* It provides for the protection of and the conservation of the forests.
5. *The Environment (Protection) Act, 1986* Authorises the central government to protect and improve environmental quality, control and reduce pollution from all sources, and prohibit or restrict the setting and /or operation of any industrial facility on environmental grounds.

Act /Policy with Year
6. *The Water (Prevention and Control of Pollution) Act, 1974* Establishes an institutional structure for preventing and abating water pollution. It establishes standards for water quality and effluent. Polluting industries must seek permission to discharge waste into effluent bodies. The CPCB (Central Pollution Control Board) was constituted under this act.
7. *The Air (Prevention and Control of Pollution) Act, 1981* It provides for the control and abatement of air pollution. It entrusts the power of enforcing this act to the CPCB.
8. *The Noise Pollution (Regulation and Control) (Amendment) Rules, 2002* It lays down such terms and conditions as are necessary to reduce noise pollution, permit use of loud speakers or public address systems during night hours on or during any cultural or religious festive occasion.
9. *The Municipal Solid Wastes (Management and Handling) Rules, 2000* Applicable to every municipal authority responsible for the collection, segregation, storage, transportation, processing, and disposal of municipal solid wastes.
10. *The Insecticide Act, 1968* An Act to regulate the import, manufacture, sale, transport, distribution and use of insecticides with a view to prevent risk to human beings or animals, and for matters connected therewith.

Table 9-2 Relevant Organisations to the Project (Environment)

Relevant Organisation with Public Administrative Division	Description
Central Level	
Ministry of Environment & Forest, Govt. of India	This Ministry is the nodal agency in the administrative structure of the Central Government for the planning, promotion, co-ordination and overseeing the implementation of India's environmental and forestry policies and programmes.
Central Pollution Control Board	A statutory organisation, constituted in September, 1974 under the Water (Prevention and Control of Pollution) Act, 1974. It serves as a field formation and also provides technical services to the Ministry of Environment and Forests of the provisions of the Environment (Protection) Act, 1986. Further, CPCB has been entrusted with the powers and functions under the Air (Prevention and Control of Pollution) Act, 1981.
Central Ground Water Board	A subordinate office of the Ministry of Water Resources, Government of India, is the National Apex Agency entrusted with the responsibilities of providing scientific inputs for management, exploration, monitoring, assessment, augmentation and regulation of ground water resources of the country. Central Ground Water Board was established in 1970 by renaming the Exploratory Tube wells Organisation under the Ministry of Agriculture, Government of India. It was merged with the Ground Water Wing of the Geological Survey of India during 1972.
State Level	
Department of Forest, Govt. Of West Bengal	It looks after the conservation and development of forest, wildlife and bio-diversity. Due importance has also been given for conservation of wetlands and development of social/farm forestry.
Department of Environment West Bengal Pollution Control Board	The Environment Department was created in 1982, having following functions: i) Environment and ecology, ii) Prevention and control of pollution of air, water and land. iii) Co-ordination between departments and agencies of the State and the Union Government concerned with the policies and schemes relating to environment. iv) All matters connected with a) The West Bengal Pollution Control Board and b) Institute of Environmental Studies & Wetland Management
Department of Information & Cultural Affairs, Govt. of West Bengal	Under the purview of the Department, the West Bengal Town and Country (Planning & Development) Act, 1979 was formed and amended and up West Bengal Heritage Commission has been asset up in order to supervise the modification, enlistment and maintenance of all Heritage Buildings, Monuments, Precincts and sites within the purview of entire State of West Bengal.
Panchayats & Rural Development Department, Government of West Bengal	It is entrusted with the responsibility of constitution and framing policy related to functioning of the rural local self-government It aims at facilitating economic and social development in the rural areas of the State and organise community action in all development initiatives in the rural sector by utilising Central/State Sector programmes. The thrust areas of the Department include the following : 1. Augmenting livelihood opportunities for the rural population, 2. Sustainable development of natural resources, 3. Providing social security and safety nets to the disadvantaged and socially excluded, 4. Improving the social and physical infrastructure in the rural areas, 5. Improving service delivery in the field of elementary education and preventive health care in collaboration with the respective departments of the state government
District Level	
Public Health Engineering Department (PHED)	This was created as an independent full-fledged Department in 1987. It controls the Water Supply & Sanitation Budget of the State Government and undertakes programmes of implementation of water supply and sanitation services mainly through Public Health Engineering Directorate under its administrative control.

(2) Social Aspect

Table 9-3 Related Acts and Policies to the Project (Social)

Social Issues/Act/Policy	Description
Resettlement	
Forest Acts 1. The National Environment Policy (NEP) 2006 (so-called revised version) has been released by the Ministry of Environment and Forests (MoEF). 2. The Indian Forest Act, 1927 3. The Forest (Conservation) Act 1980 and Rules 1981	1. a) The policy reflect the concerns of a majority of the people especially the dalits, adivasis, women and other sections of the working people b) The improvement of people's access to resources cannot be done only through the grant of "traditional entitlements" and "community based management." It needs to have co-evolved structures for promotion and regulation to be in a position to protect the knowledge of local people and develop that knowledge in a way that the local communities can get the maximum benefit out of it. 2. It is one of the many surviving colonial statutes. It was enacted to 'consolidate the law related to forest, the transit of forest produce, and the duty leviable on timber and other forest produce'. 3. It provides for the protection of and the conservation of the forests with people's rights.
Heritage	
1.The Ancient Monuments and Archaeological Sites and Remains Act, 1958 2.The Ancient Monuments and Archaeological Sites and Remains (Amendment and Validation) Act 2010	1. An Act to provide for the preservation of ancient and historical monuments and archaeological sites and remains of national importance, for the regulation of archaeological excavations and for the protection of sculptures, carvings and other like objects 2.Further to amend the Ancient Monuments and Archaeological Sites and Remains Act, 1958 and to make provision for validation of certain actions taken by the Central Government under the said Act
Vulnerable People and Work Conditions	
Tribe, Cast and Minority: The Schedule Tribes and Forest Dwellers Act 2006	It provides an enabling environment to address conflicts related to rights, tenure, decentralised resource management and lays down responsibilities to protect and conserve biodiversity, ecological sensitive areas, wildlife and to prohibit activities that adversely affect conservation efforts.
Gender: 1. Protection of Women from Domestic Violence Act, 2005. 2. Hindu Women's' Right to Property, Hindu Succession Act, 1956	1.To protect women from "physical abuse" "sexual abuse" "verbal and emotional abuse" insults, ridicule, humiliation, name calling and insults or ridicule specially with regard to not having a child or a male child; repeated threats to cause physical pain to any person in whom the aggrieved person is interested etc. 2. This Act provides right of inheritance of property by a women.
Children: 1.Child Labor (Prohibition & Regulation) Act 1986	1. This Act provides prohibition of engagement of a child (below age 18 years) as a labour. It is a punishable act.
Work Condition: 1.The Minimum Wages Act 1948 2.The Plantation Labour Act 1951	1. The Statutory minimum wage has been fixed by the state governments. There are block level minimum wage inspector who is overseeing the matter under the labour department. 2. It applies to the following plantations - (a) to any land used or intended to be used for growing tea, coffee, rubber cinchona or cardamom which admeasures 5 hectares or more and in which fifteen or more persons are employed or were employed on any day of the proceeding twelve months

Table 9-4 Relevant Organisations to the Project (Social)

Relevant Organisation with Public Administrative Division	Description
Central Level	
Ministry of Social Justice & Empowerment, Government of India & the respective state government	The Government of India through this Ministry has been executing the schemes ICDS program (nutrition & pre school education), Juvenile Justice Board (Children in conflict with law), Juvenile Home (for taking cared of the children either physically and mentally challenged) etc.
Ministry of Environment & Forests, Government of India & Forest Department, Government of West Bengal and their line departments.	The department is looking after the protecting the Forest Resources from degeneration and undertaking afforestation program for regeneration of Forest Resources by involving the forest & Forest fringe dwellers. Joint Forest Management is the system which so far yielded satisfactory results.
Ministry of Labor, Government of India	The labor department has enacted the Child Labor (Prohibition & Regulation) Act 1986, adopted National Policy on Child Labor have formulated in 1987, setting up National Child Rights Commission and National Child Labor Project (NCLP) for safeguarding the labors. Statutory minimum wages is being implemented by the department.
State Level	
Department of Women & Child and Social Welfare & Jails, Government of West Bengal	The department has been executing the central government sponsored schemes and undertaking actions in association with the Line departments, Panchayati Raj Institutions (PRI), NGOs, West Bengal State Women Commission and West Bengal Police.
Department of Primary & Higher Education, Government of West Bengal	Under the department Government of West Bengal has been executing the schemes Anganwadi centres for nutrition & Pre-primary education to the children at the age 0-6 years, Primary Schools, Shishu Shiksha Kendras (SSK), Madhya (middle) Shiskha Kendras (MSK) etc.
Backward Classes Welfare Department, Government of West Bengal	This Dept. works for social, economic and cultural development of the people belonging to Scheduled Cast, Scheduled Tribe and other traditional forest dwellers in the State, and carry out 'Promotion and implementation of educational schemes', 'Issuance of caste certificates and enforcement of reservation rules, posts and educational institutions', 'Implementation of schemes including income generation schemes for economic upliftment', 'Strengthening of infrastructure and creation of community assets for integrated development of the backward classes' and 'Social and cultural development of the backward classes', by involving the Panchayati Raj Institutions (PRI) and the NGOs.
Labor Department, Government of West Bengal	This Dept. is dedicated to the cause of the toiling masses, and for providing them better standard of living through various laws and schemes implemented by different wings under its control. In order to protect children from abuse and misuse the department has created a post that is Child Protection officer at the District Level.
District Level	
Panchayat & Rural Development	Panchayat & Rural Development has been channeling their efforts through the Zilla Parishads, Panchayat Samity, Gram Panchayat, Gram Sansad, Nongovernmental Organisations (NGOs) and reaching benefits out of the various schemes like; NREGA (ensuring 100 days jobs a year), Old Age Pension, Widow Pension, Pension for the Disabled Persons, Janani Suraksha Yojana (JSY), IAY (housing), Low Cost Sanitation, Free electric connections for the BPL families etc.

9.1.2. Basic Information on the Environment

(1) Natural Environment

The state of West Bengal is primarily composed of plain land but variations are considerable if the entire landform from north to south and east to west is observed. In the

north is located the southern flank of the Himalayan mountain system. In the west there exists a topography that is only an eastern extension of the Deccan plateau complex. The eastern part of the southern West Bengal is a part of the Ganges-Brahmaputra delta (Sunderbans), which is the largest unit of landmass of its type in the whole world. The state experiences tropical monsoon type of climate, further classified under five climatic zones: (1) Humid on the northern mountain slope and humid coastal area, (2) Super humid terai and the southern montana slope, (3) Semi-humid north and south, (4) Sub-humid east and west, and (5) Humid coastal area.

Main forest types are tropical moist/deciduous forests, tropical dry deciduous forest, sub-tropical broadleaved hill forest, montane wet temperate forest, alpine forest and littoral and swamp forest. The different floral species of different forest types support high diversity of faunal species. The project will target recorded forest areas (protected/reserved forests), of which sites will be determined after the project initiation, for the component of afforestation. For the component of biodiversity conservation, nine protected areas are involved in the project: Sunderban NP, Sajnekhali WS, Buxa TR, Jaldapara WS, Gorumara NP, Mahanada WS, Neora Valley NP, Singalila NP and Senchal WS. In these areas, there are many forest-habitant animals including threatened species, for example: tiger (E) of Sunderbans and the northern forests, elephants (E) of the northern and south-western forests, rhinoceros (V) of Gorumara NP and Jaldapara WS, gaur (V) and leopard (V) in the northern plain forests, and Himalayan black bear (V) and red panda (V) in the northern hill forests (by IUCN Category: (E) Endangered; (V) Vulnerable).

(2) Social Environment:

The forest tract of West Bengal covering the districts Darjeeling, Jalpaiguri, Bankura, West Medinipur, Purulia, Burdwan, South 24 Parganas and Birbhum. Most of the project components will primarily be executed in these districts. The following table shows that the socio-economic condition of the people of the target areas, where major thrust will be given to the economically disadvantaged people and the people with BPL families. Many of these BPL families and the forest fringe and forest dwellers have already been included in the FPCs and EDCs.

Table 9-5 Number of BPL Families

Name of the District	No. of Families	No. of BPL Families (Total Score<=33)	Of BPL families (%)	No. of Houseless Families	No of Agricultural Labor	No. of Women Headed Families
Coochbihar	597817	309736	51.81	36418	353878	21453
Jalpaiguri	673090	239236	35.54	49364	340724	24403
Darjeeling	234590	57243	24.40	16754	92817	9670
Paschim Medinipur	1004065	365339	36.39	44580	423447	35680
Purulia	501789	164838	32.85	17396	205882	8284
Bankura	597569	172492	28.87	19038	252676	14272
Total :	3608920	1308884	36.27	183550	1669424	113762

Source: Census India, 2001

Table 9.6 provides information about the number of FPCs and details about the social situation. The number of FPCs is 4271 with total 486,779 members. Out of the total members, on an average 29.6% members belong to SC communities, 19.1% belong to the ST communities and 45.8% belong to the other traditional forest dwellers. There is a significant coexistence of the people belonging to BPL (economically weaker section) and the SC and ST (socially backward) and they have been residing in the forest fringe and forest areas.

Table 9-6 Population of Schedule Caste and Schedule Tribes

District	No of FPC	Total	SC	Age of SC (%)	ST	Age of ST (%)	Others	Age of other (%)
Darjeeling	182	10791	773	7.16	3100	28.73	6918	64.11
Jalpaiguri	176	27375	13530	7.16	7927	28.73	5918	64.11
Cooch Behar	51	8380	3233	38.58	2494	29.76	2653	31.66
West Medinipur	1302	149827	32713	21.83	40858	27.27	76256	50.90
Bankura	1370	229281	81423	35.51	43891	19.14	103966	45.34
Purulia	762	76153	16944	22.25	24915	32.72	34294	45.03
Total	3843	501807	148616	29.62	123185	24.55	230005	45.84

This is pertinent to note here that under there are 3 districts, namely West Medinipur, Purulia and Bankura, where in certain pockets have been sometimes an environment of socio-political unrest. Such situation of unrest is anticipated to be improved in the near future. Such unrest primarily arose from a sense of deprivation and thus, it is likely that opening up opportunities for substantial employment and improved livelihood may have a sobering effect on the existing situation.

9.1.3. Screening Form and Scoping

(1) Screening Form

The Screening Form was prepared by the Forest Department on 14 June, 2011 with the signature of PCCF (with Head of Forest Force) and submitted to JICA in accordance to the JICA Guidelines. Although the project is unlikely to have significant adverse impact on the environment and society, the project will be expected to be Category FI since sites and activities for some project components, particularly community asset development, can not be specified unless Micro Plans are prepared during the preparatory phase of the project.

(2) Scoping

The project includes components that may affect natural and social environment adversely, which are: afforestation with allied works, biodiversity conservation, community development. From these components, five types of activities were identified further: 1) afforestation and grassland restoration; 2) earthen dams and earthen/rock checks; 3) wells and irrigation channels; 4) roads; and 5) buildings.

Because of a variety of the activities, a range of potentially adverse impacts covers the following aspects: 1) pollution control (air, water, soil, noise, vibration, etc.); 2) natural

environment (protected areas, ecosystem, hydrology, topography, etc.); 3) social environment (resettlement, living/livelihood, ethnic minority/indigenous people, working conditions, etc.). In addition to the direct and immediate impacts, considerations were made for the derivative, secondary and cumulative impacts as well as the associated impact at a rational basis.

To study the potential impacts and mitigation measures, the following environmental checklists were used as the basic format: forestry, dams/reservoirs, agriculture/irrigation, roads and other infrastructure. Information was collected through literature survey, interview with the department officers and field visits to the proposed project sites.

In the case of no project implementation as an alternative plan, it is predicted that the afforestation programme will not proceed with the desirable quality and quantity, which may slow the forest gain rate and further increase deteriorated forests in the state. Conservation and recovery of biodiversity will not be achieved as required due to slow restoration of wildlife habitat in protected areas and increase of man-animal conflict to the critical level. Forest fringe people may not be cooperative for forest and biodiversity conservation because insufficient incentive through community development and livelihood improvement by the Forest Department. Moreover, the project has been planned as ecologically sound, economically viable and socially equitable, being anticipated to have only limited and reversible impacts on the natural and social environment. Therefore, the implementation of the project is much better selection for the forest and wildlife sector in the state than the option of "without the project".

Other alternative plans for the project have not been prepared by the Forest Department nor determined by the Survey Team. The priority regions for the project should be the north, the south-west and Sunderbans and the main project components and activities will not be changed substantially even if alternative plans are prepared. Therefore, it is concluded that the alternative plans are not necessary made for the project at the moment. However, in case that the security assessment planned in two years after the project initiation does not approve the south-west Bengal as the project region, alternative plans should be prepared taking into environmental and social considerations.

9.1.4. Environmental Clearance, Impact and Measures

(1) Required Clearance

As per the Ministry of Environment and Forest (MoEF) Notification (14 September, 2006), this project is not fallen in the development projects of either Category A or B in the Schedule, which means it does not require Environmental Clearance (EC) and thus Environment Impact Assessment report too. The outline of the project has been explained to local stakeholders expected as the main target groups, such as Panchayat institutions and JFMC/EDC members, using several opportunities of meetings with them. Their requirements have been considered in the project planning.

(2) Potential Positive/Adverse Impacts and Mitigation/Avoidance Measures

a) Pollution Control

Afforestation and habitat improvement do not generate pollutants, contaminants and other sources of pollution. All the facilities and structures to be constructed are in small scale to be used for daily life and work and thus, no substantial pollution is anticipated to occur during the operation of such facilities.

b) Natural Environment

Due to the nature of the project, it encompasses ecologically important areas, such as tropical forest, sub-tropical forest, mangrove forest and habitats for threatened species, as well as recorded forest areas and protected areas. It is not anticipated, however, the project will affect these areas adversely since the afforestation and grass management improve the current conditions of environment and biodiversity. Mono-culture plantation (eucalyptus sp.) is made only in degraded areas, not in wildlife habitats for conservation concerns.

c) Social Environment

The project does not have any feature of removing settlements from forest areas, protected areas and villages. As per the Forest Rights Act (2006), the process of eviction of villagers, who are regarded as encroachers, will not been taken place without finalisation of the user right. Tree planting outside forest is executed on areas where no settlements, including squatters, are established.

The project has been planned to alleviate the existing living conditions of local people in the forest fringe by creating job opportunities and reducing dependency to the forest resources. However, in the case of mixed culture in one village (tribe and scheduled caste, or several tribes together), it needs to get consensus carefully among villagers for identifying needs, selecting activities and sharing benefit.

d) Impact during Construction

Most of the project works will be done by a labour intensive mode with manual machine so that there will be little impact anticipated on the natural and social environment. The construction works will be done mainly during the dry season and thus, soil erosion and runoff are not anticipated to occur. However, the construction of larger buildings, namely additional floors of the Headquarters in Kolkata and new offices in Siliguri and Salt Lake, may generate air pollution, noise/vibration, turbid water and solid waste to some extent, which requires mitigation measures and monitoring by the contractors.

e) Potential Impact and Mitigation Measures for Project Activities

Table 9-7 Potential Impacts and Mitigation Measures

Project Activities	Positive Impact	Adverse Impact	Mitigation Measures
Afforesta-tion and grass restoration	a. Reverse degraded forest to regenerated forests. b. Assist in soil and moisture conservation. c. Contribute to ground water recharging and stream flow sustained. d. Improve wildlife habitat. e. Improve micro-climate of the region f. Sequester more carbon.	a. Limited soil disturbance and exposure by mowing and ground preparation for a short period. b. Water pollution and soil contamination by agrochemicals at nurseries and planting on ground, if applied with large amount.	a. As seedlings and grasses grow, soils are covered by them. In the areas prone to soil erosion, vegetative soil conservation work will be done. b. Inorganic fertilisers are not used by the project. c. Limited quantity of insecticides is used following the instruction of each product.
Earthen dams and earthen /rock checks	a. Reduce soil erosion. b. Improve ground water recharging and rain water harvesting. c. Enhance natural regeneration of shrubs and trees. d. Increase and diversify availability of wildlife watering points e. Recover the original topographic features and landscape.	a. Soil disturbance may lead to disturbance to stream bank, stream flows and surface runoff patterns.	a. Embankments are stabilised by vegetative covers.
Wells and irrigation channels	a. Facilitate better agricultural activity for more productivity and income to wean away people from forest resources. b. Facilitate seedling raising and better tree growth for plantation. c. Provide people with easy access to drinking water, which alleviates burden of women.	a. Water pollution and soil contamination by increase of using agrochemicals. However, no substantial impact is anticipated because local farmers use organic fertiliser mainly and only meager amount of agrochemicals. b. Arsenic and fluoride may be found in certain areas, causing health problem among people.	a. The Forest Dept. will guide beneficial farmers to follow Agricultural Dept. guidances for the usage of agrochemicals. b. The Forest Dept. will facilitate beneficial farmers to use organic insecticide. c. Area identified for arsenic and fluoride contamination in ground water* should be avoided from developing tube wells, in consultation with the State Water Investigation Dept. and the Public Health Engineering Dept.
Roads	a. Improve accessibility to markets and public services and make daily work of people easier and productive. b. Contribute to better economy and reduction of forest dependence. c. Improve fire lines for control of forest fire.	a. Soil erosion and drainage impairment if road design is defective. b. Temporary disturbance during construction and maintenance due to influx of labourers	a. Standard design is applied at grade, providing drains on both sides and dry stone stream crossing. b. Shrubs and grasses are planted along roads. c. Traffic controllers will be appointed from villagers if necessary.

Project Activities	Positive Impact	Adverse Impact	Mitigation Measures
Buildings	a. Improving housing facilities will motivate the department staff for better performance of duties. b. Schools in villagers will improve conditions of primary education in remote areas. c. Large office buildings will facilitate acquiring modern tools and equipments and induction of qualified personnel for improving forest management technology and practices.	a. Creation of access and space, causing some vegetation and soil disturbance during construction. b. For the relatively large buildings, air pollution, noise/vibration, turbid water and solid waste will occur to some extent.	a. Location of structures is carefully planned to avoid critical breeding areas, habitats and migratory routes for threatened species. If found during construction, the works will be suspended until the breeding season ends or a new site will be located. b. Areas around the structures are re-vegetated after construction. c. Most of the structures will be completed in dry season, reducing potential for soil erosion. d. During construction of the larger buildings, working time is limited in day time and weekday, noise-reduction panels installed, low-noise/vibration machines used, and watering in the surroundings. e. During construction, site provision and arrangement are made for disposal of turbid water and solid waste.

(Note) * Arsenic reported in 81 blocks in eight districts (concentration > 0.05 mg/l) of 24-Parganas (North), 24-Parganas (South), Nadia, Murshidabad, Malda, Howrah, Burdwan and Hoogly) and fluoride in 49 blocks in seven districts of Bankura, Birbhum, Purulia, Malda, Dakshin Dinajpur, Uttar Dinajpur and South 24-Parganas (State Water Investigation Department: SWID)

(3) Monitoring Plan

Based on the above review of potential environmental and social impact by the project activities and the mitigation measures proposed, the following two areas are considered necessary to carry out monitoring:

a) Water quality of ground water for tube wells

Nature-derived arsenic and fluoride may be found in ground water in some project sites, causing health problem to villagers in a long-term. Before construction of tube wells, water quality for drinking water should be examined to meet the Indian Standard Drinking Water specification set by the Bureau of Indian Standard (BIS 10500 : 2004). The Forest Department will request the panchayats to which beneficiaries from this scheme belong to conduct the water quality examination in contact with West Bengal Pollution Control Board. The monitoring of water quality should be carried out at least in the first year of usage. The results of the examination and monitoring will be reported to the Forest Department by the panchayats.

b) Pollution during construction of larger office buildings

During the construction of larger office buildings in Kolkata, Salt Lake and Siliguri, it is anticipated pollution will occur to some extent. To meet the national standards, monitoring

of ambient air quality and noise level will be conducted with specific instrument before, during and after the construction. If the values exceed the standards, the frequency of monitoring should be increased and other mitigation measures will be considered for adoption. For turbid water and solid waste, it is monitored whether the treatment and disposal are made properly along with the mitigation measures.

The monitoring will be obliged to the contractor through the tender documents. The constructors are instructed to obey the rules of the West Bengal Pollution Control Board and the relevant legislation, such as the Environmental (Protection) Act (1986), the Air (Prevention & Control of Pollution) Act (1981), the Water (Prevention & Control of Pollution) Act (1974) and the Noise Pollution (Regulation & Control) Amendment Act (2002). The contractor is also requested to present the monitoring reports to the Forest Department after each measurement.

Table 9-8 Outlines of Monitoring Plan

Monitoring	Item	Executant (Examinant)	Period	Frequency
Construction of tube wells				
Water quality of ground water	Turbidity, PH, Coliform, Viable bacteria, Arsenic, Fluoride, Pesticide, etc.	Panchayat (West Bengal Pollution Control Board)	a) Before construction b) 1st year of usage	a) Once b) Twice per year (before/during monsoon)
Construction of larger buildings				
Air quality	PM, SPM, SOx, NOx, CO	Forest Dept. (Contractor)	a) Before construction b) During construction	a) Once b) Three times per year (before/during/after monsoon)
Noise/vibration	Noise/vibration			
Waste (water/solid)	Disposal site Disposal arrangement			

Social and environmental considerations shall be carried out based on subproject in order to avoid any adverse effect, and the timing of the consideration is on designing of subproject scope of work in the preparation phase and subproject completion in the evaluation phase. The monitoring form (Annexure) shows the timing of the consideration on the communities based activities. The consideration shall be conducted using the Environmental Checklist which may be prepared based on Annexure 7.

9.1.5. Consideration for the Socially Vulnerable

(1) Scheduled Tribe/Caste:

On the outset it is imperative to refer "The Schedule Tribes and other Forest Dwellers Act, (ST & FD) 2006" and its rules and regulations notified in January 2008, provides an enabling environment to address conflicts related to rights, tenure, decentralised resource management and lays down responsibilities to protect and conserve biodiversity, ecological sensitive areas, wildlife and to prohibit activities that adversely affect conservation efforts. Broadly the project may consider two pronged approach to support activities to achieve its

development objective, which are (a) implement existing provisions under laws/policies that are not in conflict with the interest of the community; and (b) policy level initiatives on settlement of rights to land, usufruct rights, develop progressive incentive systems, opportunities to de-regulate the regime to support NTFP livelihood based activities and for grazing purpose.

The project envisages the components relating the development of forest and the dwellers who will be willing partners in protecting forest and biodiversity resources. Forest fringe areas are inhabited by the Scheduled Tribe, Scheduled Caste and the economically weaker sections of the society. Forest Department has been working with these communities in Forest through the Joint Forests Management System and organised FPCs, EDCs and SHGs currently have a large presence in most of the areas under forest cover. The project execution therefore has to focus on participation of the SC & ST communities. The Forest Dwellers Development Plan (FDDP) also ensures a fair flow of funds to the areas having concentration of SC/ST. This flow of funds may create a situation of synergy with the funds made available under the project components benefiting the targeted poor in ST/SC communities.

To highlight the high priority given by the project to tribal inclusion, the District Facilitation Unit will initiate the project processes and strengthen the FPCs, EDCs and SHGs having sizeable members belonging SC & ST groups first. This means that any village with SC & ST households, regardless of the number of households, will be able to access benefits of programme execution faster than the other communities. The entry level project interventions will put special attention to building awareness and understanding of the objectives and the SC & ST development and inclusion strategy of the project through the FPCs, EDCs and SHGs level meeting, and dissemination of information on project components.

With the SC & ST and primitive tribe (Santhal, Oraon, Munda, Lepcha etc), some additional measures that could be taken are:

- Information Education and Communication (IEC) campaign to highlight the tribal inclusion strategy in all villages with 10% or more tribal households
- Monthly Review meeting of all FPCs, EDCs and SHGs in tribal areas in the first two years
- Convergence with the tribal development department to enhance utilisation of the financial allocation for tribal areas.

(2) Gender Issue:

Gender discrimination started, sharpened and women have become its victim's decades after decades with the progress of socioeconomic production system, development of agriculture system, industrial revolution, patriarchal society etc. This situation can only improve with sustained efforts directed towards eradication through creating an environment of empowerment, recognition, economic self-reliance and active participation

of women in the social development, and the project can cover the improvement through JFM approach.

The project recognises the rural women who don't have job opportunities in the target areas as its most important stakeholder. It draws that the project is focused on forest fringe and forest dwellers households belonging to the FPCs, EDCs and SHGs which should be made women participation.

- There shall be normally a joint-membership for each house hold (i.e. if husband is a member, wife automatically becomes a member and vice versa).
- Three number of members of the JFMC subject to the condition that at least one member will be women and a tribal.

Reaching out and mobilising forest dwelling women and empowering them with skills and capacity for an improved livelihood is an integral part of the overall project. The implementation of each component may have the following activities for women participation.

Table 9-9 Activities for Women Participation on Each Component

Component	Potential
Afforestation and Allied Works	Nursery raising activities can be done by the women. Plantation can be also done by women. Cleaning of weeds can be done by women. Collection of minor forest produce can be done by women. Maintenance of forests can be done by women, etc
Biodiversity Conservation	Nursery raising activities can be done by the women. Plantation can be also done by women. Cleaning of weeds can be done by women. Maintenance of forest with pasture for wild animal
Community Development	Labour work activities for various subprojects can be done by the women Operation and maintenance work in the community And etc. depending on the subproject type

Gender actions are envisaged at two levels. First, at the level of the project to ensure that the frontline staff of the Forest department has the necessary capacity to identify and integrate gender issues in the project cycle and create a gender sensitive environment to ensure safety and leadership by women and described below.

- In the mobilisation phase for the introduction to community people and stakeholder, women's leader in the communities should be involved the meeting.
- In the micro-planning phase, the women shall be invited PRA activities in community wide due to catch the actual situation and needs under the women view points.
- In the preparation phase for development of scope of work such as detailed subproject design, women groups such as SHGs shall be formed newly or reactivated to involve the subprojects as implementation actor.
- In the implementation phase, the women groups identified in the preparation phase participate in the implementation activities.

Second at the community level women's livelihoods have to improve along with their social and power relations within and outside the households. Towards this end, some of the specific gender actions are proposed and described below.

- Increase the women participation, especially those from the very poor and poor families, in the Community Institutions like FPCs, EDCs, SHGs, and Producer Organisations
- Enhance capacity of women in decision making process, especially those from poor and vulnerable families.
- Increase voice and representation of women in the local community institutions, FPCs, EDCs and SHGs;
- Enhance poor women's asset base, livelihood security and economic opportunities
- Reduce gender specific risks and vulnerabilities of poor women from SC/ST and poorest households.

Due to realise above actions, the project shall use not only participatory approach among male and female, but also discussion among women or women group to make their voices out, and the project shall provide the following consideration.

- Dissemination of Gender policy for the project & society
- Improved gender balance in project staffing and community resource persons;
- Gender sensitisation of project staff, partners and PRIs;
- Women focused community mobilisation and institution building;
- Gender sensitisation of men within the project as well as PRI processes;
- Training on livelihoods and value chains; supporting innovative projects on gender equity and expansion of women's rights and freedom;
- Supporting young women in skill development and employment;
- Comprehensive capacity building of women's institutions around social development, accountability and empowerment issues.

Building the capacity and sensitivity of the staff to understand and deal with gender issues; promote gender sensitivity working environment for women in the Project may be achieved through organising workshops with the help of reputed NGOs working in the field.

9.1.6. Criteria and Procedure for Selecting Sub-projects

Although the types of development are indicated in DPR, the sub-projects have not been specified yet for the component of community asset development in particular; they can be only determined after selection of the target areas by PMU and through preparation of Micro Plans by JFMC/EDC members. Similarly, the sites for afforestation and most of the department infrastructure have not been located yet, which will be also determined by PMU during the preparatory phase of the project.

In this section, it is proposed how environmental and social considerations be made to select sub-projects for these components by setting up criteria and procedure. It should be

noted that bio-physical parameters and social criteria have been set up in this project plan. Moreover, the project itself has been planned for promoting forest and biodiversity conservation though improving local people's livelihoods. However, most of the development activities will be conducted in/near recorded forest areas and protected areas and involve the ST/SC communities, it should not be underestimated the importance to ensure the sub-projects to be planned and implemented without significant adverse impact on the natural and social environment.

(1) Criteria

The principle of selecting the sites and activities is to avoid those likely to cause serious and irreversible adverse impact on the natural and social environment; that is, to avoid large-scale development and critically important areas for conservation. Although the community assets and the department facilities usually do not have such nature, the following criteria are proposed for selecting the sub-projects:

- Avoid a site/activity that requires involuntary re-settlement and land acquisition.
- Avoid a site/activity that requires felling a number of trees.
- Avoid a site of critical habitats, breeding areas and corridors for threatened species.
- Avoid a site with unique archeological, historical or cultural values.
- Select a site/activity to contribute to mitigating man-animal conflict.
- Select an activity to improve the status of socially vulnerable including gender.
- Select an activity to enhance the culture and tradition of local communities.

(2) Procedure

The above criteria will be taken into consideration together with the general criteria for selecting the sub-projects in two processes: 1) through meetings of PMU; and 2) preparation of Micro Plans with JFMC/EDC members. In reference to the relevant environment checklists filled by the Survey Team, the proposed activities and/or sites will be reviewed by PMU and Micro Planning teams and only those assessed with no significant adverse impact on the environment and society will be adopted finally.

9.1.7. Implementation System and Capacity Building

(1) Current System and Capacity

Currently there is no arrangement in the Forest Department for considering environmental and social impacts of ongoing forestry activities under different sections. This is due to facts that forestry field practices generally produces beneficial environmental impacts by improving productivity of forests and forest resources and reducing pressure on protected areas. Moreover, potential adverse impacts by the activities are limited in scope and significance since they are mostly small scale and localised. All the earlier project activities were labour intensive and required little mechanisations and construction work. Therefore, no special cadre of staff is maintained by the department for planning and implementing

environmental and social considerations and thus no particular budget and equipment secured.

(2) Needs for Improving Capacity

It is necessary that the executive staff of different ranks have exposure to broad considerations on environmental and social effects for their accountability of the project implementation. This should be inculcated right from the planning stage, where such considerations should receive priority attention in respect of prescribing any activity, to the implementation stage in which the considerations should be monitored and verified. It is also important to provide training opportunity for the frontline staff who facilitate preparing Micro Plans with communities. While they could obtain knowledge and experience through actual work, it is recommended to have training for environmental and social considerations, including lecture, exposure and workshop. The Forest Department is requested to seek support from consultants, institutions or NGOs for the capacity development.

9.2 Forest Dwellers Development Framework

In West Bengal the connotation forest dwellers lived in the Project target area will mean the forest villagers who have resident in forest areas of Paschim Medinipur, Bankura, Purulia in the South West Bengal and Cooch Behar, Jalpaiguri and Darjeeling in the North Bengal. This is reality that where there is concentration of Forests, there are concentrations of SC and ST population in West Bengal. This fact definitely gives a direction that in any programme the matter of targeting such communities has to be attached due priority.

Such Forest Dwellers[1] signified who have been dwelling in the forest and in the forest fringes will be considered as the forest dwellers have enjoyed certain privileges like collection of firewood, fodder, grazing etc. All such villagers have been included in FPC/EDC and now they enjoy usufractuary rights to get a share of the revenue as per the State Govt. resolution .Their association has helped the Forest department to undertake regeneration of forests in this tract since the early part of twentieth century. These forest villages were the source of labor for all activities of the department including Afforestation/ reforestation

Thus, the framework of the consideration of Indigenous people in the project preparation period is called the Forest Dwellers Development Framework (FDDF), and the further output of FDDF is called Forest Dwellers Development Plan (FDDP) corresponding Indigenous People Plan in World Bank Operation Manual 4.10.

[1] i.e. People lives within 2 km from forests under the Forest Right Act

9.2.1. Objectives, Target Area and People

(1) Objective

To avoid potentially adverse effects on the indigenous people and the community, or when avoidance is not feasible, minimise, mitigate or compensate for such effects, the subprojects of each components should be develop the FDDP under JICA Guideline, thus this article show FDDF for developing FDDP with smooth running the actual stage of preparation and implementation of the project.

The further objective of FDDF seeks to ensure that indigenous people and tribal communities are informed, consulted and mobilised to participate in the different stages of project implementation through the FDDP. The Framework is intended to guide selection and preparation of additional subprojects under the Project where impacts on tribal people are identified to ensure better distribution of the Project benefits and promote development of the indigenous peoples in the Project areas.

(2) Target Area and People

The project triggers on Indigenous Peoples, since most of area will have tribal population, and the South West Bengal, North Bengal and Sunderbans are significantly populated by the tribal.

The main tribal races in the target area are Oraon, Munda, Santhal, Kharia, Bhumij, Ho, Rabha, Toto, Lodha, Mech etc. The tribal communities are basically nature loving and resides mostly in forests or adjoining to forests with peace, security and harmony, maintaining their rich socio-cultural heritage since time immemorial. This mass is also known as Forest Dependent Population, as they depend on forest flora and Fauna for their subsistence and livelihood.

Different projects with the concept of Globalisation and Patent Laws has been continuously hampering the Pre-historic rich socio-cultural heritage and the socio-economic institutions of different tribal communities, by making them displaced from their original Hamlets and are being compelled to shift to the urban area for their subsistence and livelihood, leaving behind their pre-historic socio-cultural heritage and the economic institutions. The tribal communities are even not in a position to adjust in the new urban culture. The demographic data of the tribal communities for the past 30-40 years also clearly shows continuous reduction in their population

Of course, the forest sector is no exception, Forest Village as one of the target communities as was established in the reserved forest with resettlement of indigenous people in northern parts of West Bengal on British colonial era, due to protect and maintain the reserved forest. The villagers are mixed tribal people; the Forest Department has continued support for forest conservation with economical improvement of forest villagers. Now there are 170 forest villages across the 3 districts covering 11 divisions of forest department in North Bengal. The following table gives locations and number of Forest Villages.

Table 9-10 List of Forest Villages in districts/divisions
as per frame of Forest Directorate and as observed during evaluation study

District	Division	Forest Villages as per the frame of the Forest Directorate	Villages Populated by the tribal only	Population
Cooch Behar	1. Cooch Behar Social Forestry	3	14	4560
Darjeeling	1. Darjeeling	27	3	2061
	2. Kurseong	22	5	4090
	3. Kalimpong	29	8	9425
	4. Wild life I	14	5	520
Jalpaiguri	1. Jalpaiguri	21	9	5076
	2. Baikunthapur	4	5	3030
	3. Wild Life II	2	1	5885
	4. Wild Life III	12	1	3712
	5. Buxa Tiger Reserve (E)	16	1	3245
	6. Buxa Tiger Reserve (W)	20	3	550
Total		170	55	42154

Source: The study conducted by Society for Socioeconomic Studies & Services

As above mentioned, there are various participants in this project under the policy of Forest Department covered local peoples (habitants) for to realise the forest development and biodiversity conservation successfully, and the consideration of indigenous peoples may not only cover forest dwellers but also consider the participation of local people whose activities have impact to Forest and Biodiversity Conservation.

9.2.2. Components of Project and Sub Project

The Project has various subprojects under the components, "Afforestation and Allied Works", "Community Asset Development Activities in Forest Fringe Areas & Forest Villages" and "Wildlife Management & Habitat Improvement". Although especially afforestation activities are targeted the SC and ST as beneficiaries under the National Forest Policy, other subprojects have impact not only FPC/EDC members, but also local people in the village and forest fringe area. The area and targeted beneficiaries of assumed subproject are shown in below

Table 9-11 Area and Beneficiaries of Sub Projects

Component / Subprojects	Area	Targeted Beneficiaries
Afforestation and Allied Works		
Afforestation and allied works	North & South of West Bengal	Members of JFMCs & EDCs and the people living in adjoining areas.
Tree planting outside forests	North & South of West Bengal	Panchayat, Members of Beneficiary Group and the people living in adjoining areas.
Soil and moisture conservation works	North & South of West Bengal	Members of JFMCs & EDCs and the people living in adjoining areas.
Production of QPM	North & South of West Bengal	Members of JFMCs & EDCs and the people living in adjoining areas.
Biodiversity Conservation		
Grass and fodder tree plantation	North & South of West Bengal	Members of JFMCs & EDCs and the people living in adjoining areas.
Bamboo under-planting	South West of West Bengal	Members of JFMCs & EDCs and the people living in adjoining areas.
Fodder tree plantation after bamboo removal	North, and South West of West Bengal	Members of JFMCs & EDCs and the people living in adjoining areas.

Component / Subprojects	Area	Targeted Beneficiaries
Community Development		
- Social Infrastructure Development		
Construction / Extension of roads in forest fringe areas for improving access for forest dwellers and forest fringe communities	North & South of West Bengal	Members of JFMCs & EDCs and the people dwelling in the areas. Sites will be selected on the basis of social/bio physical criteria during micro planning
Construction of School Bldg for North Bengal and south Bengal JFMCs with toilets, water supply etc	North & South of West Bengal	School going children of the communities
Rock Checks/Earthen checks, gully treatment measures and earthen dams for water harvesting	North & South of West Bengal	Members of JFMCs & EDCs and the people dwelling in the areas. Sites will be selected on the basis of social/bio physical criteria during micro planning
Boring and installation of shallow tube well and MDTWs duty including cost of kutcha/ pucca conveyor channels	North & South of West Bengal	Members of JFMCs & EDCs and the people in adjoining areas. Sites to be selected in consultation with WRIDD and the communities.
Boring and installation of deep tube well--300 tp 500 ft. depth--including cost of pucca conveyor channels	South of West Bengal	Members of JFMCs & EDCs and the people dwelling in the areas
Construction of sanitary toilets for JFMCS/ EDC members	North & South of West Bengal	JFMCs/ EDC members
- Livelihood Improvement Activities		
Supply of Sal leaf plate making machine to the JFMCs/SHGs/EDCs --manual operation	North & South of West Bengal	Members of JFMCs, EDCs & SHGs
Supply of sewing machine to the JFMCs/SHGs/EDCs --manual operation	North & South of West Bengal	Members of JFMCs, EDCs & SHGs
Supply and installation of oil distillation plant + grinder and accessories for processing of NTFP collected by the JFMCs-- electrical operation	North & South of West Bengal	To add value to NTFPs produced by JFMCS/EDC
Supply of handloom machines to the JFMCS/EDC beneficiary	North & South of West Bengal	SHGs after their identification through micro planning
Provision of poultry, duckery & piggery units	North & South of West Bengal	JFMCS/EDC beneficiaries
Promoting home gardens for medicinal plants and orchard	North & South of West Bengal	JFMCS/EDC beneficiaries and people of adjoining areas

9.2.3. Potential Positive / Adverse Effect of Components

(1) Potential Positive Effects

In few wards it can be said that through this project the forest fringe and forest dwellers will be benefited in term of their livelihood improvement as the project components have been devised in such manner. The details have been laid down in the table follows:

Table 9-12 Positive Effects on each Component

Proposed Components	Positive Effects
Afforestation and Allied Works	Afforestation and social forestry will economically create benefit to ST and SC directly and local people in directly, through increasing opportunity of labour works for plantation which will be provided to local people in the target village. And the components shall provide friendly atmosphere surrounding situation of target villages.
Community Asset Development Activities in Forest Fringe Areas &	The Forest Department has organised and has been organising the Joint Forest Management program and organised FPCs, EDCs among the forest dwellers and forest fringe dwellers. Their livelihood improvement is being taken into considerations. There are

Proposed Components	Positive Effects
Forest Villages	some community developments initiatives already have been incorporated in the detailed project report. Though there is an infrastructural facility with the Forest Department. Despite this project would reinforce the exiting infrastructure and man power would be in place in an incremental basis for FD staff.
Wildlife management and habitat improvement	The effort for wild life management and habitat improvement will have positive effect for local people, since it brings economic benefit through increasing labour work and reduction of man-animal conflict by mitigation measure and habitat improvement in protected area.

(2) Adverse Effects

There is a possibility of having conflict between the forest and forest fringe dwellers who have become members of the FPCs and EDCs and those who have not been member of the FPCs and EDCs. The members of FPCs and EDCs will be reaping benefits through the project and forest resources and the non-members will not have access to the benefits though they are residing nearby. These contradictions among the two types of people have to be handled with due care and sincerity, as well as involvement of two types of people in the process of Micro Plan using JFM approach.

Improper targeting of beneficiaries may lead to deepening of socio-economic stratification amongst the fringe population thereby creating a situation of social conflict.

9.2.4. Planning for Social Assessment

(1) Procedure of Social Assessment

As part of preparation of each component with various subprojects, a detailed Social Assessment (SA) in the project area shall be conducted based on the results of baseline survey and PRA, and is for the development of Micro Plan with any consideration. Due to verify between the actual condition and baseline survey results and work out the actual Micro Plan, the PRA implemented in the preparation phase of Micro Plan shall be carried out in the Project areas, including consultation among Forest Department personnel, tribal communities, government departments and NGOs. The social assessment has involved the following activities.

i) Identification of the social perspectives, impacts, benefits and issues relevant to the objectives and interventions of project based on results of the Base Line Survey and PRA.
ii) Holding informed consultations with the primary and secondary stakeholders like FPCs, EDCs & the PRI representatives of the project areas, particularly the STs and the SCs for FDDP.
iii) Identifying mechanisms and processes to promote the participation and inclusion of SCs and ST communities.
iv) Preparing a forest dwellers development. The SA builds on the studies, findings, consultations and community interaction processes initiated by the project

consultants. The SA methodology included household survey of existing statistical data and PRA results, public consultations and focus group discussions in villages, and interviews and consultations with government, relevant NGOs and Panchayati Raj Institutions (PRIs) staff and representatives. The SA laid particular focus to consult the STs.

(2) Stakeholder Consultations.

The SA involves Focused Group Discussions (FGDs) and consultations with the stakeholders in the Project areas including the members of FPCs, EDCs having representations from tribal communities. These included households Below Poverty Line (BPL) and the SCs, the STs, other backward castes, and primitive tribal groups for developing the FDDP, as well as women headed households, persons with disabilities, and youth for other social consideration on the same time. FGDs and consultations in the Micro Plan are also held with other stakeholders, including officials of the Forest Department, elected representatives and officials of the PRIs, and other government departments dealing with related schemes for project components with SCs and STs such as rural livelihood, poverty reduction, and social welfare.

(3) Key Social Issues

The key issues for developing FDDP in Micro Plan are levels of health and education, incidence of poverty and vulnerability, social capital and social cohesion, caste hierarchies and social discrimination, tribal marginalisation and exclusion, marginalisation of the poor from local self governance processes, it is necessary to design the questionnaire and PRA contents in Micro Plan.

Caste based discrimination has been caused by exclusion and subjugation which are the most important social constraints for inclusion and empowerment of the poorest. The extent of poverty among the scheduled population groups continues to be higher than among the non-scheduled groups. The SA shall confirm whether the major vulnerable groups are the SCs, STs, and certain other traditional forest dwellers in the target village.

9.2.5. Procedure for Obtaining Broad Community Support for the Project through Prior and Informed Consultation

(1) FDDP in Micro Plan

The Project has two approach of planning forest development and biodiversity conservation; one is Working Plan for Afforestation component developed by Forest Department initiative with participatory approach among the Department and Forest Protection Committee (FPC) on behalf of forest conservation, the other is Micro Plan for the components of Infrastructure Improvement and Community Asset Development in community / village level, such as Entry Point Activities of Forest and Biodiversity

Conservation Project promoting initiative local people as well as motivation of participation to the Project.

Working Plan: Forest Department develops the state wide plan for forest conservation and protection according to National Forest Policy, and provides the financial and technical support to villager using JFM approach.

Micro Plan: FPC/EDC should develop the plan for their development covering multi-spectral needs, and this plan has influence to surrounding area of not only target group and also out of target group, and shall be developed on community / village-wise. Regarding of Forestry and Biodiversity sector, The Plan should include the afforestation activities under the Working Plan with JFM approach.

According to this two planning approach, it is necessary to consider FDDF with FDDP in each stage of the project, site selection have been considered ST and SC who lived close to forest area under the National Forest Policy, and Micro Plan is prepared the FDDP based on the FDDF, therefore the FDDP is one part of the Micro Plan.

The FDDF seeks to ensure ST and SC are informed, consulted and mobilised to participate in the planning process of Micro Plan, the Framework is intended to guide selection and preparation of subprojects where impacts on ST and SC are identified to ensure better distribution of the Project benefits and promote development of the ST and SC in the Project areas.

(2) Procedure for Obtaining Broad Community Support

The FDDP is developed as one parts of Micro Plan developed by the JFM approach using Participatory Rural Appraisal. According to the PRA exercise incorporating the knowledge and opinions of target people in the planning and management of development projects and programmes, the Micro Plan is developed by beneficiaries with village people and related stakeholders jointly, and action plan is selected based on needs under consensus among target village and people through the participatory process of Micro Plan.

In case of developing new Working Plans, a JFM overlapping working circle should be provided to incorporate broad provisions for Micro Plans. To achieve this flexible guideline should be prepared local need based on consensus among target people and stakeholder in the Micro Plans. For this purpose, the officer engaged in Working Plan will work in tandem with the territorial DFO and CF for finalisation of the prescriptions of the JFM overlapping working circle.

9.2.6. Action Plan or Capacity Building to Ensure for Forest Dwellers that They Received Culturally Appropriate Benefit

Currently there is no forest dwellers development plan in the Department for considering STs and STs such as forest dwellers lived in the forest and forest fringe area, because the target people in the forest and forest fringe area generally is rural area like remote area, and

is living area of STs and SCs. Thus by the same token in "9.1.7 Implementation System and Capacity Building", it is necessary that the executive staff of different ranks have exposure to broad considerations for their accountability of the project implementation. The capacity building for FDDP based on FDDF shall be carried out to the frontline staff who facilitate preparing Micro Plans in tandem with Capacity building for Environmental and Social Consideration, therefore the Forest Department is requested to seek support from consultants, institutions or NGOs for the capacity development as one package of Environmental and Social Consideration.

9.2.7. An Appropriate Action Plan of Measurement to Avoid, Minimise, Mitigate or Compensate for Adverse Effects

In order to resolve conflicts in the functioning of FPC/EDC and to maintain harmony among different groups participating in the JFM, the Forest Department have constituted range and beat level representative committee, and the committee hold the regular meetings to share the problem, needs, process, performance of activities and include representatives from all the FPC, Panchayat, Forest Department as well as stakeholders including NGOs well as additional meetings whenever needs arise. This kind of committees should be oriented and guided the FPC/EDC with group participating in the JFM and Panchayat Gram for their accountability to participants in the JFM.

In the process of Micro Plan and the implementation in village level, It is necessary to involve the participants of JFM to any process, and the process should be open the community, as well as information shall be disclosed to participants of JFM in the village and neighbours.

Due to avoid, minimise, mitigate or compensate for adverse negative effects, the key action are shown in below;

Recognition of Self-initiated groups: The community groups are performing the essential functions of forest protection and regeneration. These groups need to be identified, recognised and registered as JFM Committees after proper verification of records and enquiry. The period of their existence and duties performed for protection and regeneration should be suitable assessed and proper weightage given to them for deriving benefits under the JFM approach.

Contribution for Regeneration of Resources: For long term sustainability of resources, it is essential that a mechanism is created for ploughing back a certain percentage of the revenue earned from final harvest. For this purpose, village should be deposited in the village development fund for meeting the conservation and development from its share of such sales. There should be transparent mechanisms for computation of income for sharing the benefits between different stakeholders.

In addition, the following action for FDDP shall be provided;

- Prioritised targeting of designated tribal areas
- Engagement of dedicated staff for the FDDP preparation based on FDDF
- Community disclosure of the FDDP
- Pre-mobilisation consultations with tribal communities and leaders
- Tribal representation and participation in all community institutions and their executive positions and committees
- Intensive technical assistance and handholding support in preparation of FDDP in the Micro Plan
- Accessible information dissemination and grievance redressed mechanisms by engagement with PRIs and tribal development department
- Periodic community feedback and consultations, reservation for tribal in project structures, and sensitisation of project staff and partners on engaging with the society and culture of tribal
- In addition, periodic external monitoring on the implementation phase of Micro Plan including FDDP

9.2.8. Mechanism for Monitoring

Monitoring specialist for Micro Plan with FDDF shall be appointed Range Office with Beat Officers and Forest Guards in village level, and the District Facilitation Unit along with Divisional Forest Officer will compile all result of monitoring activities in association of the front line project staff. Evaluation specialist for Micro Plan with FDDF shall be appointed Conservator of Forest in the circle level supporting with the frontline staff. Monitoring and Evaluation shall be conducted all the project activities of the various components. If required, some NGO may be involved in the process for social aspect.

The monitoring has the following outputs:

Table 9-13 The Monitoring Outputs

Outputs	Description
Reporting:	Monthly/periodical reporting system has to be introduced before the staff members who will execute the project. On the basis of the project components schedule has to be framed for reporting. The officer-in-charge will study the report and meet with the staff and discuss with them about the observations. She/he will then discuss about what action is required to be taken for the next period/month Half Yearly Report: FD will furnish half yearly report on the progress of the project to submit the JICA.
Publicity:	In regard to the community development and livelihood improvement components the information has to be disseminated to the beneficiaries for their understanding. That might be in the form of periodical distribution of leaflets or citing information on the boards in the range/beat level office.

Since FDDP is formed on the subprojects based in a Microplanning, the monitoring shall be carried out in line with the subproject implementation as a part of monitoring for microplan. According to all monitoring result, FDDP shall be evaluated in the completion phase. The monitoring form (Annexure) shows the timing of the development, monitoring & evaluation of FDDP on the communities based activities.

Chapter 10 Project Risks / Important Assumptions

In the Jangal Mahal comprising of the districts Paschim Medinipur, Bankura and Purulia the political scenario is little bit different. Political turmoil and unrest have been prevailing there for last couple of years. The present situation is better and is likely to improve further in future. Any flare up in this area during project period may dislocate physical targets set against some components of afforestation/reforestation.

Local conflicts arising out of political rivalries in the project catchments may also derail execution in limited areas. But with the support from local communities, it will be possible to resolve such conflicts.

There is a possibility of having conflict between the forest and forest fringe dwellers who have become members of the FPCs and EDCs and those who have not been member of the FPCs and EDCs. The members of FPCs and EDCs will be reaping benefits through the project and forest resources and the non-members will not have access to the benefits though they are residing near by. These contradictions among the two types of people have to be handled with due care and sincerity.

Improper targeting of beneficiaries may lead to deepening of socio-economic stratification amongst the fringe population thereby creating a situation of social conflict.