Baseline Survey of Forest Resources of West Bengal July, 2017

FINAL REPORT
November 2021

Commissioned by
West Bengal Forest and Biodiversity Conservation Project
Government of West Bengal

Funded by
JICA

By
Forest Survey of India
Ministry of Environment, Forest & Climate Change
Government of India, Kaulagarh Road, Dehradun

CONTENTS

Chapter-I Introduction

1.0 Introduction

The State of West Bengal, located in the eastern part of India, has a geographical area of 88,752 sq km, which is 2.7% of the geographical area of the country. The State lies between 21^0 29' N to 27^0 132' N latitude and 85^0 50' E to 89^0 52' E longitude and shares border with Bangladesh in the east, Assam in the northwest and Bhutan in the northeast. The state is also bordered by Sikkim in the north, Assam in the east, Bihar & Jharkhand in the west and Odisha and Bay of Bengal in the south. The state can be divided into three major regions physio-graphically, the northern mountainous terrain, the southwestern peninsular tract exhibiting rolling topography and low lying alluvial Gangetic plains to the south. West Bengal has a diverse climate, varying from moist tropical in the southeast to dry tropical in the southwest and from subtropical to temperate in the mountains in the north. The average annual rainfall varies from about 900mm to about 5,000mm and the average annual temperature ranges between sub-zeros in the hills during the winters to about 46°C in southern parts during the summer. The state is drained by a number of rivers, which includes Damodar, Hooghly, Mayurakashi, Teesta and Torsa. The state has 23 districts, among which 11 are tribal districts and one is a hill district. As per the 2011 census, West Bengal has a population of 91.28 million accounting to 7.54 percent of India's population. The rural and urban population constitutes 68.13% and 31.87% respectively. The population density of the state is 1028 per sq km, which is higher than the national average of 382 persons per sq km. The 19^{th} Livestock census 2012 has reported a total livestock population of 30.35 million.

The West Bengal Forest and Biodiversity Conservation Project (WBFBCP) which was implemented with the assistance of Government of Japan and Government of India (GOI) under Japan International Cooperation Agency (JICA) from 2012-13 to 2019-20 to improve forest ecosystem and conserve biodiversity by undertaking afforestation, regeneration and wildlife management activities through Joint Forest Management approach in West Bengal. The Project implementation was divided into three phases; Preparatory phase of 2 years (2012-13 to 2013-14) followed by Implementation phase of 4 years (2014-15 to 2017-18) and Consolidation (closing) phase of 2 years (2018-19 to 2019-20).

The Chief Project Director of West Bengal Forest and Biodiversity Conservation Society (WBFBCP) requested FSI to take up baseline survey of forest growing stock raised under the JICA to establish the benchmark for base line survey. FSI agreed to conduct survey under their domain of expertise on a project mode. An MOU between Forest Survey of India and the West Bengal Forest and Biodiversity Conservation Society was signed on 20.03. 2017.

The land use pattern of the state is given below:

Table 1.1: Land Use Pattern

Land Use Types	Area (in 000' ha)	Percentage
Total Geographic Area	8,875	
Reporting area for land utilization	8,683	100
Forests	1,173	13.50
Not available for land cultivation	1853	21.34
Permanent pastures and other grazing lands	2	0.03
Land under misc. tree crops and groves	50	0.57
Culturable wasteland	17	0.20
Fallow land other than current fallows	11	0.13
Current fallows	339	3.90
Net area sown	5,238	60.33

Source: Land Use Statistic, Ministry of Agriculture, GOI, (2014-15)

1.1 Recorded Forest Area

The recorded forest area of the state is 11,879 sq km which is 13.38% of its geographical area. The Reserved, Protected and Unclassed Forests are 59.38%, 31.76% and 8.86% respectively, of recorded forest area. The forest cover in the state is 16,901.51 sq km which is 19.04% of the state geographical area. The state has 3018.52 sq km under Very Dense Forest; 4160.26 sq km under Moderately Dense Forest and 9722.73 sq km under Open Forest.

1.2 Forest Types

The state has 31 forest types belonging to eight forest type groups in the State. The details are given below in the table:

Table 1.2: Forest Type was area

S.No.	Forest type	Area (km^2)	Forest Type (% of Total Forest Cover)
1	2B/2S3 Sub Himalayan Secondary Wet Mixed Forest	334.41	2.68
2	3C/C1a(i) East Himalayan Sal Forest	431.27	3.46
3	3C/C1b(i) East Himalayan Upper *Bhabar* Sal Forest	141.80	1.14
4	3C/C1b(ii) East Himalayan Lower *Bhabar* Sal Forest	117.83	0.94
5	3C/C1c Eastern *Tarai* Sal Forest	305.97	2.45
6	3C/C2d(iii) Eastern Heavy Alluvium Plain Sal Forest	5.07	0.04

S.No.	Forest type	Area (km^2)	Forest Type (% of Total Forest Cover)
7	3C/DS1 Moist Sal Savannah	11.50	0.09
8	3C/C3a West Gangetic Moist Mixed Deciduous Forest	10.98	0.09
9	3C/C3b East Himalayan Moist Mixed Deciduous Forest	465.59	3.73
10	3C/2S2 Secondary Euphorbiaceous Scrub	5.94	0.05
11	3/1S1 Low Alluvial Savanna Woodland	32.12	0.26
12	4B/TS1 Mangrove Scrub	123.12	0.99
13	4B/TS2 Mangrove Forest	1,025.33	8.22
14	4B/TS3 Salt Water Mixed Forest	487.72	3.91
15	4B/TS4 Brackish Water Mixed Forest	313.62	2.51
16	4B/E1 Palm Swamp Forest	151.61	1.21
17	4C/FS2 Submontane Hill-valley Swamp Forest	3.27	0.03
18	4D/SS2 *Barringtonia* Swamp Forest	10.83	0.09
19	4D/2S2 Eastern Wet Alluvial Grassland	4.28	0.03
20	5A/C3 Southern Dry Mixed Deciduous Forest	188.79	1.51
21	5B/C1c Dry Peninsular Sal Forest	2,732.05	21.89
22	5B/C2 Northern Dry Mixed Deciduous Forest	240.62	1.93
23	5/DS1 Dry Deciduous Scrub	84.38	0.68
24	5/E5 *Butea* Forest	109.97	0.88
25	5/1S2 *Khair-Sissu* Forest	208.18	1.67
26	8B/C1 East Himalayan Subtropical Wet Hill Forest	424.82	3.40
27	11B/C1a Lauraceous Forest	164.44	1.32
28	11B/C1b *Buk* Oak Forest	75.18	0.60
29	11B/C1c High Level Oak Forest	27.03	0.22
30	12/C3a East Himalayan Mixed Coniferous Forest	393.74	3.15
31	14/C2 East Himalayan Sub-alpine Birch/Fir Forest	18.88	0.15
32	Plantation/TOF	3,830.67	30.69
	Total	**12,481.00**	**100.00**

Source: Atlas Forest Types of India. 2011

1.3 Objectives of the Survey

The main objectives of the survey were to establish a baseline/benchmark of forest growing stock raised under the JICA assisted project in West Bengal. The specific objectives of the work include:

a. Estimation of district-wise growing stock
    i. Natural forests
        1. Non-Project natural forests under JFMC
        2. Rehabilitated Sal coppice forests
    ii. Old Plantation area
b. Estimation of number of important NTFP resource species as identified by the WBFBCP
    i. Natural forests
        1. Non-Project natural forests under JFMC
        2. Rehabilitated Sal coppice forests
    ii. Old Plantation area
c. Monitoring of old plantation
    i. Growth of plantation by average height
d. Developing GIS database based on digital boundaries provided by WBFBCP.

* *The findings relating to Survival percentage are not presented in the report as the data was inadequate.*

1.4 Responsibility of FSI

The Responsibilities of the FSI were as under:

(i) Selection of sampling units for the survey.
(ii) Preparation of field instruction booklet for collecting relevant data
(iii) Providing technical support and training in field survey to staff of WBFBCP.
(iv) Monitoring of fieldwork carried out by WBFBCP.
(v) Developing application software for data entry
(vi) Developing application for data processing.
(vii) Preparation of Report.

1.5 Responsibility of WBFBCP

Responsibilities of the WBFBCP were as under:

(i) Arranging for logistics, manpower for inventory data collection and general assistance in the fieldwork to staff of FSI
(ii) To provide digital boundaries of Jurisdiction of each JFMC,
(iii) To provide digital boundaries of all the polygons of activity area,
(iv) To provide list of important NTFP resource species.
(v) To provide patch-wise details of plantations raised viz. species, spacing, number of plants, area of patch, year of plantation etc.
(vi) Supervision of fieldwork carried out by WBFBCP staff.
(vii) Carrying out survey by collecting data using GPS on prescribed format suggested by FSI.
(viii) Formation of checking Crew who will check approximately 10% of field work carried out by WBFBCP
(ix) Higher Project authorities will check around 2-5% fieldwork, few points may be concurrent and rest will be from the points completed in the past.
(x) Data entry by using the application software developed by FSI.

1.6 Contents of the Report:

The present report on 'Baseline survey of forest growing stock raised under West Bengal Forest and Biodiversity Conservation project' is framed in four chapters. A brief description of the chapters is given below:

I. Chapter One 'Introduction' provides background of the study, main objective of the study and role and responsibilities of FSI as well as WBFBCP.
II. Chapter Two Covers 'Methodology'. It provides details of the design and methodology along with total number of JFMC under each district and plots surveyed.
III. Chapter Three 'Data collection and estimation' provides information on methodology for survey, layout of sample plot and other attached plots, format for data collection along with data entry and data processing. The methodology for area estimation, Standard error for trees and volume for each district is also given in this chapter.
IV. Chapter Four 'Results' give district wise results of estimated number of trees and volume species wise for each of the type of forest area. It also provides estimated number of NTFPs (Herbs, Shrubs and Climbers) under different types of Forest Area and average height in plantation type of forest area for each district.

Chapter-II Design & Methodology

2.0 Introduction:

The project was implemented in nine districts of West Bengal i.e Bankura, Birbhum, Burdwan, Cooch Behar, Darjleeng, Jalpaiguri, Jhargram, Paschim Mednipur and Purulia. The Jhargram was earlier part of the Paschim Medinipur district. The number of JFMC identified for the project was 598 JMCs spread in the nine selected districts. The baseline survey had been designed to generate estimates for all the nine districts (and not JFMCs wise). The list of districts along with district wise list of JFMCs had been provided by the WBFBCP. The total area of the Project was approximately 1200 km^2.The list of district wise number of JFMC are given in the table no 2.1.

Table 2.1: Number of JFMC district wise

S. No.	District	No of JFMC
1	Bankura	160
2	Birbhum	14
3	Burdwan	41
4	Cooch Behar	3
5	Darjeeling	25
6	Jalpaiguri	79
7	Jhargram	33
8	Pashchim Medinipur	140
9	Purulia	104
Total		**600**

2.1 Methodology

The project was implemented in nine districts involving 600 identified JFMCs. The baseline survey was designed to generate estimates for all the nine districts (and not JFMCs wise). The list of districts along with list of JFMCs in each district had been provided by the WBFBCP. Considering the availability of budget, time and manpower, it was decided that that the sampling strategy had to be adopted in such a way so as to generate estimates of different parameters at a sampling error of 20%.

To generate the sample size for nine districts at 20% allowable errors, the data collected by FSI earlier from selected FDAs of different districts of West Bengal was used. Thereafter, optimum number of patches in each selected districts were selected in the proportion of sample size of the selected district to total sample size of all the districts. The sample size of the district is then distributed over selected patches systematically by arranging the patches in descending order of their size. In each selected patch, the sample size was randomly distributed in each patch.

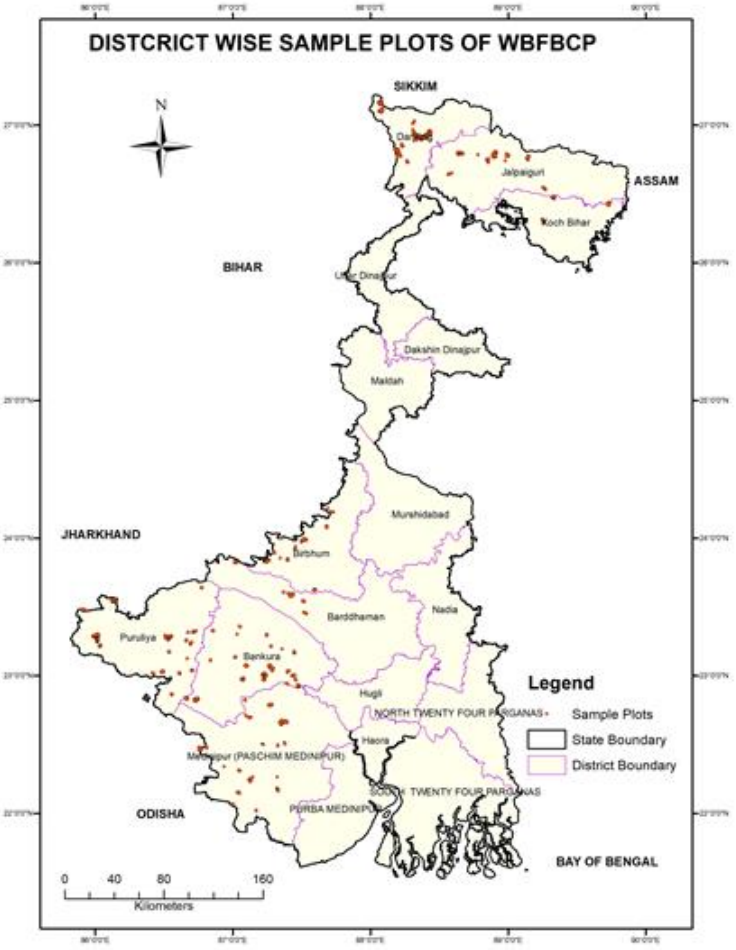
.

For conducting the survey, the required number of patches for *Plantation, Natural Forest and Rehabilitated Sal Coppice Forest* had been selected randomly in each district so that results were within error limits of 20%. The district wise number of plots is given below:

Table 2.2: District wise number of plots

S.No.	District	Number of plots sent from FSI	Number of plots surveyed by WBFBCP
1	Bankura	128	128
2	Birbhum	46	46
3	Burdwan	28	28
4	Cooch Behar	45	45
5	Darjeeling	159	159
6	Jalpaiguri	75	75
7	Jhargram	14	14
8	Pashchim Medinipur	80	80
9	Purulia	187	184
Total		**762**	**759**

Map showing sample plots of WBFBCP



Chapter III: Data Collection and Estimation

3.0 Introduction

According to the objective**,** FSI had to estimate district wise growing stock in Natural Forests which had been further categorized 1 Non project Natural Forest under JFMC 2. Rehabilitated Sal Coppice Forests and Old Plantation area. Besides estimation of important NTFP resource species identified by WBFBCP and monitoring of old plantation by survival percentage and growth of average height in in old plantation area to create a base line survey. This information had to be processed in nine districts selected under JICA by WBFBCP.

3.1 Organization of Fieldwork

3.1.1 How to reach the sample Plot:

After having the list of sample plot with its latitude and longitude, the Crew leaders should decide the plot location and should find a nearest convenient route so that they can reach the plot with minimum traverse by vehicle or foot. After reaching a nearby location of the plot, the next job would be to search a reference point, which can be read on the map as well as locatable on the ground. The GPS should be set using Geographic Projection and WGS 1984 datum as the list of sample points containing Latitude and Longitude of the sample plots sent from Forest Survey of India (FSI) is under degree minutes second (positioning format).

Once the plot centre is reached after covering desired distance with the help of GPS, some qualitative information is to be recorded ocularly within radius of 60m from the plot centre i.e. Sub-plot -1 without actually laying out the plot. The information collected is land use, crop composition, grazing incidence etc.

3.1.2 Layout of Sample Plot:

After reaching the plot centre, put a stout peg of approximately 10cm diameter and 1.5m height, blaze it at the top and fix it firmly on the ground facing the blazed surface towards the direction from which sample point was approached. Write the sample point reference number and the date on the blazed tree surface. Marking of the tree should be done in such a way that tree is not damaged. In a selected sample point, a cluster of four circular sub-plots of eight-meter radius in a fixed pattern will be laid out as sample plot. The central sub-plot is sub-plot-1 and sub-plot-2, will be located at a distance of 40 meters in the north. The sub-plot-3 and 4 will be located at 120^{o} and 240^{o} from north at a distance of 40 meters. After reaching the plot centre, i.e. the centre of sub-plot-1, Azimuth at 360^{0}, 120^{0} and 240^{0}at a distance of 40 meters from the centre of sub-plot-1, centre of sub plots 2, 3 and 4, respectively, will be fixed. All these centres of sub-plots should be marked by thin poles or bamboos of 5 cm diameter and 1.5 meter in height. A red colour cloth may be tied at the top end of these posts for clear visibility from different spots in the plot.

3.1.2.1 Layout of other attached plots: Plot for NTFPs - Herbs (0.6 m radius), Shrubs, Climbers and Regeneration (1.7 m radius)

The data on NTFP (herbs, shrubs & climbers) and regeneration were to be collected from two concentric plots of 0.6 m and 1.7 m radius respectively, from within all the four sub-plots at a distance of 5 meters from its centre towards east. The pictorial diagram for laying out plot is given below:

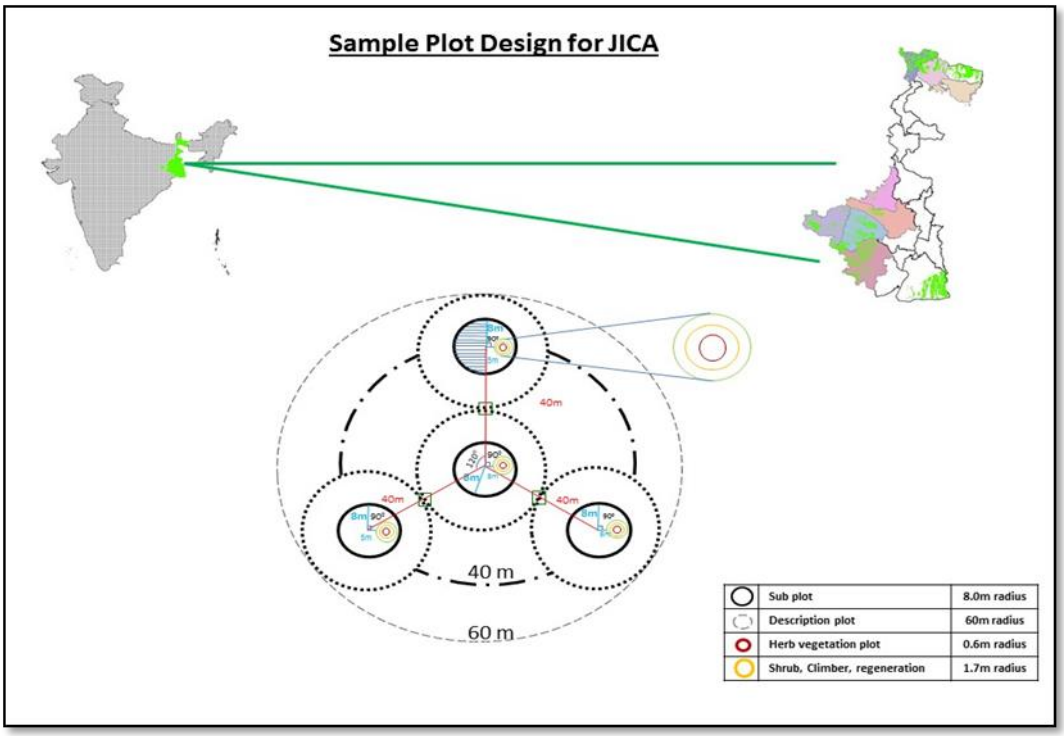


Figure: 3.1 Layout of sample plot design

3.2. Data Collection Forms

The data had been collected by WBFBCP on the pre designed Formats designed by Forest Survey of India. The field data collected were recorded in the following field forms.

1. PAF – 1 Patch Approach Form
2. PDF – 2 Patch Description Form
3. PEF- 3 Patch Enumeration Form
4. NTFP- 4 NTFP (Herbs, Shrubs & Climbers) Form
5. SGF – 5 Survival & Growth Parameter Form

3.3. Data Entry and verification

The online data entry software was developed and hoisted by Forest Survey of India using Microsoft Dot Net Framework with MVC technology. The data entry was done by the staff of WBFBCP**.** After completion of data entry in the inventoried districts, verification of data was also done to remove any inconsistency found in data. The number of records entered in the data entry software were given below:

I. PAF:	759
II. Plot Description Form:	759
III Patch Enumeration Form:	20,751
IV. NTFP (Herbs/Shrubs/climbers) Form:	1,513

3.4 Data Processing

The data processing was carried out using data processing module developed by FSI**.** The data processing software was developed by FSI using Microsoft Dot Net Framework with vb.net. as programming language. First of all, species and diameter class wise volume was calculated using volume equation developed by FSI. The Local Volume equations used to calculate the volume for important species is given in Annexure-I

The data processing was carried out independently for all the nine districts. Estimates of trees per ha and volume per ha were generated according to species and diameter class for each type of forest area i.e. Natural Forest, Sal Coppice Forest and Plantation for each district. The district wise results of nine inventoried district were given in Chapter IV.

3.5 Area Estimation

The district wise SHP. File for 599 JFMC was received from the WBFBCP which were used to compute the area in different land use classes. The classification of area was done by overlaying the polygons of JFMC of selected district over Forest Cover Map (FCM) of FSI. The district wise distribution of area under different land class is given as below:

Table 3.1: District wise distribution of JFMC SHP. File area (in ha) under different land class.

S. No.	District Name	Very Dense Forest	Moderately Dense Forest	Open Forest	Scrub	Non-forest	Water body	Total
1	Bankura	7494	17615	5602	5665	21148	345	57869
2	Birbhumi	0	280	590	67	468	2	1407
3	Burdhaman	2890	2467	3775	225	1324	5	10686
4	Cooch Behar		446	396		321	48	1212
5	Darjeeling	2487	2643	1866	0	381	2	7378
6	Jalpaiguri	7723	6746	4924	492	5514	232	25632
7	Jhargram	552	1113	1611	10	875	6	4167
8	Pashchim Medinipur	5349	8347	10139	377	6726	31	30969
9	Purulia	183	2890	4176	333	4569	23	12174
Total		**26677**	**42548**	**33079**	**7169**	**41326**	**694**	**151493**

3.6 District wise Forest Cover for selected districts of JICA

The forest cover which is based on the interpretation of IRS Resourcesat-2 LISS III satellite data of the period of Nov. 2017 to Feb 2018 given in India State of Forest Report 2019 (ISFR) were used for classification of area of selected district. The forest cover area of Jhargam district was included in Paschim Medinipur district as it was part of Paschim Medinipur district. The district wise forest cover as reported in ISFR 2019 is given as below:

Table 3.2: District wise Forest Cover in selected districts covered under JICA

(in sq km)

S.No.	District	Very Dense Forest	Mod. Dense Forest	Open Forest	Total	Scrub
1	Bankura	222.33	395.27	667.98	1,285.58	28.59
2	Birbhum	1.00	34.14	149.66	184.80	8.90
3	Burdwan	57.53	91.78	190	339.31	7.35
4	Cooch Behar	0.00	27.00	322.06	349.06	0.00
5	Darjeeling	720.76	654.52	992.52	2,367.80	9.21
6	Jalpaiguri	724.22	434.92	1,703.26	2,862.40	39.65
7	Pashchim Medinipur including Jhargram	256.21	591.64	1,313.69	2,161.54	20.24
8	Purulia	37.36	306.94	571.58	915.88	28.68

3.7 Standard Error

The precision of estimates generated through sampling method is very necessary for any estimation procedure to be complete. It helps in understanding the error contained in the generated estimates. The standard error serves this purpose, which was calculated by using the formulae as given in estimation procedure. As the trees/ha and volume/ha are directly related to estimated trees and volume respectively, the standard error calculated for trees/ha and vol/ha hold equally good for estimated trees and volume also. This is why the standard error was calculated for trees/ha and volume/ha only. From the table it can be observed that SE% for trees/ha varies between 6.4% to 24.7% and for volume/ha, it varies between 11.0% to 25.3%. The SE% was within permissible limit of 20% as per project proposal except Jhargram district where SE % is higher than the permissible limit. The reason was less number of sample plot laid out in the district as it was carried out from Paschim Medinipur district later on as a separate district and results were generated separately. The district wise standard error for trees/ha and volume/ha are given below:

Table 3.3: District wise standard error for trees and volume

S. No.	District	SE Percent (Trees/ha)	SE Percent (Volume/ha)
1	Bankura	8.5	11.0
2	Birbhum	13.3	13.0
3	Burdwan	14.0	15.6
4	Cooch Behar	11.1	16.9
5	Darjeeling	8.6	15.1
6	Jalpaiguri	13.5	15.2
7	Jhargram*	24.7	25.3
8	Paschim Medinipur	13.1	13.7
9	Purulia	6.4	16.1

Chapter IV: District wise Results

4.0 Introduction

The present chapter provides findings of the survey for each of the districts separately. The data records of 759 plots laid in the Joint Forest Management Committee (JFMCs) in the nine districts of West Bengal have been analyzed/processed to generate estimates for each district.

The chapter provides district wise results of estimated number of trees and volume for major species for each of the type of forest area namely natural forest, Sal coppice forests and plantations. Further, the estimates of number of NTFPs (Herbs, Shrubs and Climbers) under different types of Forest Area and average height in plantation type of forest area for each district have also been presented for each district. It may be noted that the findings relating to survival percentage for plantation have not been given, due to the insufficient data. The district wise findings are given below:

4.1 District-wise estimated number of trees and volume by species and diameter for each Type of Forest Area

This section provides district wise results of estimated number of trees and volume for major species for each of the type of forest area namely natural forest, sal coppice forests and plantations.

District: Bankura

Type of Forest Area: Natural Forest

Table 4.1.1: Estimated number of trees by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Acacia auriculiformis	103525	0	0	103525
Anacardium occidentale	55059	0	0	55059
Buchanania latifolia	66858	0	0	66858
Eucalyptus species	106068	12434	0	118502
Madhuca latifolia	55060	0	0	55060
Shorea robusta	460143	3933	0	464076
Terminalia bellirica	15732	0	0	15732
Rest of Species	43898	3933	12434	60265
Total	**906343**	**20300**	**12434**	**939077**

Type of Forest Area: Natural Forest

Table 4.1.2: Estimated volume (cum) by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Acacia auriculiformis	13648	0	0	13648
Anacardium occidentale	5216	0	0	5216
Buchanania latifolia	3246	0	0	3246
Eucalyptus species	27951	8509	0	36460
Madhuca latifolia	2983	0	0	2983

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Shorea robusta	39217	2533	0	41750
Terminalia bellirica	2278	0	0	2278
Rest of Species	4148	1821	58094	64063
Total	**98687**	**12863**	**58094**	**169644**

Type of Forest Area: Sal Coppice Forest

Table 4.1.3: Estimated number of trees by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Adina oligocephala	3728	0	3728	7456
Albizzia odoratissima	27894	3728	0	31622
Anogeissus latifolia	89472	3728	0	93200
Bridelia retusa	188198	7456	0	195654
Buchanania latifolia	264689	7456	0	272145
Diospyros melanoxylon	11184	14912	0	26096
Lannea coromandelica	137804	0	0	137804
Madhuca latifolia	322406	18640	9254	350300
Phoenix sylvestris	22105	11053	0	33158
Semecarpus anacardium	130480	0	0	130480
Shorea robusta	2306717	18640	3728	2329085
Soymida febrifuga	104384	0	0	104384
Rest of Species	504683	5526	0	510209
Total	**4113744**	**91139**	**16710**	**4221593**

Type of Forest Area: Sal Coppice Forest

Table 4.1.4: Estimated volume (cum) by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Adina oligocephala	193	0	9098	9291
Albizzia odoratissima	1488	5199	0	6687
Anogeissus latifolia	7228	3249	0	10477
Bridelia retusa	14934	4001	0	18935
Buchanania latifolia	13158	3695	0	16853
Diospyros melanoxylon	1005	11119	0	12124
Lannea coromandelica	19251	0	0	19251
Madhuca latifolia	39912	10721	50419	101052
Phoenix sylvestris	8054	13042	0	21096
Semecarpus anacardium	5367	0	0	5367
Shorea robusta	168288	10086	18696	197070

Soymida febrifuga	6648	0	0	6648
Rest of Species	27527	7011	0	34538
Total	**313053**	**68123**	**78213**	**459389**

Type of Forest Area: Plantation

Table 4.1.5 Estimated number of trees by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Acacia auriculiformis	1597213	45469	0	1642682
Anacardium occidentale	68250	8259	0	76509
Eucalyptus species	1012272	26863	4129	1043264
Shorea robusta	503798	8258	4129	516185
Terminalia arjuna	491409	0	0	491409
Rest of Species	155101	0	4129	159230
Total	**3828043**	**88849**	**12387**	**3929279**

Type of Forest Area: Plantation

Table 4.1.6: Estimated volume (cum) by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Acacia auriculiformis	176401	27482	0	203883
Anacardium occidentale	5068	2904	0	7972
Eucalyptus species	149261	20093	25983	195337
Shorea robusta	56312	4475	22663	83450
Terminalia arjuna	32649	0	0	32649
Rest of Species	11691	0	19783	31474
Total	**431382**	**54954**	**68429**	**554765**

District: Birbhum

Type of Forest Area: Natural Forest

Table 4.1.7: Estimated number of trees by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Acacia auriculiformis	2146	0	0	2146
Madhuca latifolia	6467	417	0	6884
Shorea robusta	53743	833	0	54576
Terminalia bellirica	833	0	417	1250
Rest of Species	268	417	0	685
Total	**63457**	**1667**	**417**	**65541**

Type of Forest Area: Natural Forest

Table 4.1.8: Estimated volume (cum) by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Acacia auriculiformis	336	0	0	336
Madhuca latifolia	742	257	0	999
Shorea robusta	4726	572	0	5298
Terminalia bellirica	239	0	827	1066
Rest of Species	26	386	0	412
Total	**6069**	**1215**	**827**	**8111**

Type of Forest Area: Sal Coppice Forest

Table 4.1.9: Estimated number of trees by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Acacia auriculiformis	1578	0	0	1578
Buchanania latifolia	2951	0	0	2951
Eucalyptus hybrid	328	0	0	328
Eucalyptus species	6250	0	0	6250
Madhuca latifolia	2712	0	0	2712
Shorea robusta	19764	417	0	20181
Terminalia chebula	0	0	417	417
Rest of Species	3280	0	0	3280
Total	**36863**	**417**	**417**	**37697**

Type of Forest Area: Sal Coppice Forest

Table 4.1.10: Estimated volume (cum) by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Acacia auriculiformis	111	0	0	111
Buchanania latifolia	171	0	0	171
Eucalyptus hybrid	50	0	0	50
Eucalyptus species	413	0	0	413
Madhuca latifolia	218	0	0	218
Shorea robusta	1771	225	0	1996
Terminalia chebula	0	0	688	688
Rest of Species	157	0	0	157
Total	**2891**	**225**	**688**	**3804**

Type of Forest Area: Plantation

Table 4.1.11: Estimated number of trees by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Acacia auriculiformis	44428	411	822	45661
Anacardium occidentale	1234	0	0	1234

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Cassia siamea	5759	0	0	5759
Eucalyptus species	29618	823	0	30441
Madhuca latifolia	3702	411	411	4524
Shorea robusta	9050	0	0	9050
Rest of Species	4111	0	0	4111
Total	**97902**	**1645**	**1233**	**100780**

Type of Forest Area: Plantation

Table 4.1.12: Estimated volume (cum) by species and diameter class

Species	Diameter Class (CM)			Total
	10-30	30-50	50+	
Acacia auriculiformis	3759	243	2014	6016
Anacardium occidentale	180	0	0	180
Cassia siamea	708	0	0	708
Eucalyptus species	3104	570	0	3674
Madhuca latifolia	700	329	950	1979
Shorea robusta	1361	0	0	1361
Rest of Species	333	0	0	333
Total	**10145**	**1142**	**2964**	**14251**

District: Burdwan

Type of Forest Area: Natural Forest

Table 4.1.13: Estimated numbers of trees by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Acacia auriculiformis	145988	0	0	145988
Bauhinia vahlii	0	0	5560	5560
Bombax ceiba	16679	0	0	16679
Butea monosperma	27798	0	5560	33358
Madhuca latifolia	16679	0	0	16679
Shorea robusta	239066	11119	5560	255745
Sideroxylon grandifolium	5560	0	0	5560
Terminalia bellirica	66716	0	0	66716
Terminalia chebula	27798	0	0	27798
Rest of Species	137670	0	0	137670
Total	**683954**	**11119**	**16680**	**711753**

Type of Forest Area: Natural Forest

Table 4.1.14: Estimated volume (cum) by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Acacia auriculiformis	9055	0	0	9055

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Bauhinia vahlii	0	0	8114	8114
Bombax ceiba	1388	0	0	1388
Butea monosperma	1169	0	7090	8259
Madhuca latifolia	1264	0	0	1264
Shorea robusta	10358	14550	53434	78342
Sideroxylon grandifolium	1544	0	0	1544
Terminalia bellirica	4616	0	0	4616
Terminalia chebula	1499	0	0	1499
Rest of Species	6554	0	0	6554
Total	**37447**	**14550**	**68638**	**120635**

Type of Forest Area: Sal Coppice Forest

Table 4.1.15: Estimated number of trees by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Albizzia odoratissima	13557	0	0	13557
Buchanania latifolia	40671	0	0	40671
Madhuca latifolia	131049	0	0	131049
Shorea robusta	1292421	18076	4519	1315016
Terminalia bellirica	13557	4519	0	18076
Rest of Species	85861		4519	90380
Total	**1577116**	**22595**	**9038**	**1608749**

Type of Forest Area: Sal Coppice Forest

Table 4.1.16: Estimated volume (cum) by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Albizzia odoratissima	2337	0	0	2337
Buchanania latifolia	3298	0	0	3298
Madhuca latifolia	10139	0	0	10139
Shorea robusta	106446	13245	43432	163123
Terminalia bellirica	1151	5544	0	6695
Rest of Species	6452	0	29850	36302
Total	**129823**	**18789**	**73282**	**221894**

Type of Forest Area: Plantation

Table 4.1.17: Estimated number of trees by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Acacia auriculiformis	19969	0	4992	24961
Quercus dilatata	0	0	4992	4992

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Shorea robusta	195912	0	9984	205896
Rest of Species	96718	0	0	96718
Total	**312599**	**0**	**19968**	**332567**

Type of Forest Area: Plantation

Table 4.1.18: Estimated volume (cum) by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Acacia auriculiformis	972	0	23510	24482
Quercus dilatata	0	0	11763	11763
Shorea robusta	11035	0	47434	58469
Rest of Species	5504	0	0	5504
Total	**17511**	**0**	**82707**	**100218**

District: Cooch Behar

Type of Forest Area: Plantation

Table 4.1.19: Estimated numbers of trees by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Acer acuminatum	11775	1472	0	13247
Albizzia odoratissima	2208	490	0	2698
Albizzia procera	3190	1962	736	5888
Anthocephalus cadamba	3680	1717	0	5397
Bombax ceiba	491	1227	0	1718
Bruguiera species	23060	245	1227	24532
Chukrassia velutina	11039	0	0	11039
Gmelina arborea	13001	245	0	13246
Tectona grandis	1963	1963	491	4417
Terminalia arjuna	3434	0	245	3679
Terminalia crenulata	8096	1472	0	9568
Terminalia myriocarpa	13493	245	0	13738
Trewia nudiflora	15455	4171	0	19626
Rest of Species	52498	4415	490	57403
Total	**163383**	**19624**	**3189**	**186196**

Type of Forest Area: Plantation

Table 4.1.20: Estimated volume (cum) by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Acer acuminatum	969	944	0	1913
Albizzia odoratissima	508	395	0	903
Albizzia procera	730	1924	3841	6495
Anthocephalus cadamba	845	1069	0	1914
Bombax ceiba	94	1184	0	1278
Bruguiera species	1436	146	5394	6976
Chukrassia velutina	2419	0	0	2419
Gmelina arborea	1763	97	0	1860
Tectona grandis	448	1696	976	3120
Terminalia arjuna	252	0	1018	1270
Terminalia crenulata	806	1402	0	2208
Terminalia myriocarpa	1520	125	0	1645
Trewia nudiflora	3470	3399	0	6869
Rest of Species	5286	2925	1215	9426
Total	**20546**	**15306**	**12444**	**48296**

District: Darjeeling

Type of Forest Area: Natural Forest

Table 4.1.21: Estimated number of trees by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Cryptomeria japonica	42300	11844	6768	60912
Pinus pectula	5076	9306	846	15228
Quercus lamellosa	12690	0	10152	22842
Quercus lineata	10998	2538	7614	21150
Quercus pachyphylla	2538	0	20304	22842
Quercus species	11844	2538	3384	17766
Rhododendron arboreum	21150	5076	5922	32148
Rhododendron griffithianum	7614	0	7614	15228
Schima wallichii	56682	4230	1692	62604
Tectona grandis	104058	10998	1692	116748
Tsuga dumosa	13536	21150	21996	56682
Rest of Species	368009	87138	99828	554975
Total	**656495**	**154818**	**187812**	**999125**

Type of Forest Area: Natural Forest

Table 4.1.22: Estimated volume (cum) by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Cryptomeria japonica	7262	8047	12808	28117
Pinus patula	1455	7099	1529	10083
Quercus lamellosa	1203	0	37236	38439
Quercus lineata	1270	1926	35159	38355
Quercus pachyphylla	316	0	95673	95989
Quercus species	2428	1702	8521	12651
Rhododendron arboreum	1833	1781	9945	13559
Rhododendron griffithianum	545	0	12055	12600
Schima wallichii	7390	2217	6712	16319
Tectona grandis	18138	8442	5822	32402
Tsuga dumosa	3464	20375	100402	124241
Rest of Species	45274	63035	431486	539795
Total	**90578**	**114624**	**757348**	**962550**

Type of Forest Area: Sal Coppice Forest

Table 4.1.23: Estimated number of trees by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Alnus nepalensis	2388	0	0	2388
Michelia species	11939	0	0	11939
Quercus lineata	4776	0	0	4776
Schima wallichii	62084	2388	0	64472
Shorea assamica	4776	0	0	4776
Shorea robusta	47756	0	0	47756
Terminalia crenulata	19103	0	0	19103
Rest of Species	9552	0	0	9552
Total	**162374**	**2388**	**0**	**164762**

Type of Forest Area: Sal Coppice Forest

Table 4.1.24: Estimated volume (cum) by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Alnus nepalensis	190	0	0	190
Michelia species	911	0	0	911
Quercus lineata	385	0	0	385
Schima wallichii	6983	1089	0	8072
Shorea assamica	555	0	0	555
Shorea robusta	5352	0	0	5352
Terminalia crenulata	1167	0	0	1167

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Rest of Species	295	0	0	295
Total	**15838**	**1089**	**0**	**16927**

Type of Forest Area: Plantation

Table 4.1.25: Estimated number of trees by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Cryptomeria japonica	33095	0	0	33095
Lithocarpus spicatus	1839	1839	0	3678
Macaranga species	9193	0	0	9193
Myrica sapida	0	0	1839	1839
Quercus lineata	5517	1839	0	7356
Sarcocalinium longifolium	0	0	1839	1839
Symplocos theaefolia	5516	0	0	5516
Viburnum species	1839	0	0	1839
Rest of Species	27581	0	0	27581
Total	**84580**	**3678**	**3678**	**91936**

Type of Forest Area: Plantation

Table 4.1.26: Estimated volume (cum) by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Crypomeria japonica	3752	0	0	3752
Lithecarpus spicatus	176	809	0	985
Macaranga species	478	0	0	478
Myrica sapida	0	0	28429	28429
Quercus lineata	525	782	0	1307
Sarcocalinium longifolium	0	0	5649	5649
Symplocos theaefolia	720	0	0	720
Viburnum species	511	0	0	511
Rest of Species	1824	0	0	1824
Total	**7986**	**1591**	**34078**	**43655**

District: Jalpaiguri

Type of Forest Area: Natural Forest

Table 4.1.27: Estimated number of trees by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Acacia species	0	0	9621	9621

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Albizzia odoratissima	0	4811	14432	19243
Aphanamixis polystachya karagie	62539	19243	19242	101024
Bischofia javanica	4811	4811	43296	52919
Bombax ceiba	4811	38485	139508	182804
Lagerstroemia species	43296	24053	0	67350
Talauma phellocarpa	0	0	4811	4811
Terminalia crenulata	91403	4811	4811	101025
Terminalia paniculata	0	0	4811	4811
Trewia nudiflora	124347	52917	57728	234992
Rest of Species	298262	138055	38486	474804
Total	**629470**	**287187**	**336747**	**1253403**

Type of Forest Area: Natural Forest

Table 4.1.28: Estimated volume (cum) by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Acacia species	0	0	72867	72867
Albizzia odoratissima	0	3357	14219	17576
Aphanamixis polystachya karagie	5065	10569	24023	39657
Bischofia javanica	1260	4664	108893	114817
Bombax ceiba	375	27222	572014	599611
Lagerstroemia species	5184	16018	0	21202
Talauma phellocarpa	0	0	32742	32742
Terminalia crenulata	8763	2274	5220	16257
Terminalia paniculata	0	0	20462	20462
Trewia nudiflora	13833	30983	132006	176822
Rest of Species	21441	78095	54340	153876
Total	**55920**	**173181**	**1036787**	**1265887**

Type of Forest Area: Sal Coppice Forest

Table 4.1.29: Estimated number of trees by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Shorea robusta	170705	0	0	170705
Total	**170705**	**0**	**0**	**170705**

Type of Forest Area: Sal Coppice Forest

Table 4.1.30: Estimated volume (cum) by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Shorea robusta	5475	0	0	5475
Total	**5475**	**0**	**0**	**5475**

Type of Forest Area: Plantation

Table 4.1.31: Estimated number of trees by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Aglaia spectobilis	6563	0	13125	19688
Anthocephalus cadamba	0	6563	19687	26250
Bombax ceiba	0	0	19687	19687
Castanopsis hystrix	0	0	19687	19687
Lagerstroemia species	98437	118126	91875	308438
Lawsonia inermis	0	0	19687	19687
Magnolia campbellii	0	0	26250	26250
Oroxylum indicum	0	0	19687	19687
Psidium guyava	6563	0	32812	39375
Schima wallichii	0	6563	85313	91876
Shorea robusta	0	13125	183751	196877
Tectona grandis	26250	39375	26250	91875
Terminalia paniculata	0	0	13125	13125
Trewia nudiflora	72188	26250	6563	105000
Rest of Species	301877	72189	52501	426566
Total	**511877**	**282190**	**630001**	**1424068**

Type of Forest Area: Plantation

Table 4.1.32: Estimated volume (cum) by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Aglaia spectobilis	380	0	71739	72119
Anthocephalus cadamba	0	1281	76796	78076
Bombax ceiba	0	0	62957	62957
Castanopsis hystrix	0	0	45970	45970
Lagerstroemia species	8494	42375	259177	310046
Lawsonia inermis	0	0	65037	65037
Magnolia campbellii	0	0	79269	79269
Oroxylum indicum	0	0	30156	30156
Psidium guyava	380	0	60141	60521

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Schima wallichii	0	1050	192036	193087
Shorea robusta	0	2449	938916	941365
Tectona grandis	3378	17941	69293	90612
Terminalia paniculata	0	0	61825	61825
Trewia nudiflora	3143	9886	10039	23068
Rest of Species	20476	19776	128426	168678
Total	**36251**	**94758**	**2151777**	**2282786**

Note: There is a lot of big tree having big dbh which cannot be a plantation origin of recent years. The data suggest that they must be more than 60 to 70 years old.

District: Jhargram

Type of Forest Area: Natural Forest

Table 4.1.33: Estimated number of trees by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Buchanania latifolia	9706	0	0	9706
Lannea coromandelica	9706	0	0	9706
Madhuca latifolia	100299	0	0	100299
Semecarpus anacardium	9706	0	0	9706
Shorea robusta	326779	0	0	326779
Rest of Species	10451	3235	0	13686
Total	**466647**	**3235**	**0**	**469882**

Type of Forest Area: Natural Forest

Table 4.1.34: Estimated volume (cum) by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Buchanania latifolia	414	0	0	414
Lannea coromandelica	933	0	0	933
Madhuca latifolia	5705	0	0	5705
Semecarpus anacardium	365	0	0	365
Shorea robusta	13888	0	0	13888
Rest of Species	495	4105	0	4600
Total	**21800**	**4105**	**0**	**25905**

Type of Forest Area: Sal Coppice Forest

Table 4.1.35: Estimated number of trees by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Buchanania latifolia	6269	0	0	6269
Madhuca latifolia	12537	0	0	12537
Shorea robusta	56418	0	0	56418
Total	**75224**	**0**	**0**	**75224**

Type of Forest Area: Sal Coppice Forest

Table 4.1.36: Estimated volume (cum) by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Buchanania latifolia	444	0	0	444
Madhuca latifolia	426	0	0	426
Shorea robusta	5209	0	0	5209
Total	**6079**	**0**	**0**	**6079**

Type of Forest Area: Plantation

Table 4.1.37: Estimated number of trees by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Acacia auriculiformis	12537	0	0	12537
Eucalyptus citriodora	28209	0	0	28209
Madhuca latifolia	9403	0	0	9403
Shorea robusta	210000	0	0	210000
Rest of Species	3134	0	0	3134
Total	**263283**	**0**	**0**	**263283**

Type of Forest Area: Plantation

Table 4.1.38: Estimated volume (cum) by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Acacia auriculiformis	133	0	0	133
Eucalyptus citriodora	1816	0	0	1816
Madhuca latifolia	481	0	0	481
Shorea robusta	8585	0	0	8585
Rest of Species	44	0	0	44
Total	**11059**	**0**	**0**	**11059**

District: Paschim Medinipur

Type of Forest Area: Natural Forest

Table 4.1.39: Estimated number of trees by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Diospyros species	13413	1137	0	14550
Eugenia cymosa	24551	0	0	24551
Madhuca latifolia	261197	1137	0	262334
Shorea robusta	2031390	6138	3410	2040938
Terminalia bellirica	2274	6138	0	8412
Terminalia chebula	25688	0	0	25688
Rest of Species	154814	6138	12276	173228
Total	**2513327**	**20688**	**15686**	**2549701**

Type of Forest Area: Natural Forest

Table 4.1.40: Estimated volume (cum) by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Diospyros species	4494	1417	0	5911
Eugenia cymosa	5927	0	0	5927
Madhuca latifolia	30474	1082	0	31556
Shorea robusta	155470	3318	20520	179308
Terminalia bellirica	260	3993	0	4253
Terminalia chebula	4570	0	0	4570
Rest of Species	11135	4195	41364	56694
Total	**212330**	**14005**	**61884**	**288219**

Type of Forest Area: Sal Coppice Forest

Table 4.1.41: Estimated number of trees by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Aegle marmelos	9895	0	4947	14842
Buchanania latifolia	227581	0	0	227581
Diospyros species	35394	4947	0	40341
Madhuca latifolia	157711	2131	4262	164104
Shorea robusta	989564	44526	14842	1048932
Rest of Species	276363	0	4947	281310
Total	**1696508**	**51604**	**28998**	**1777110**

Type of Forest Area: Sal Coppice Forest

Table 4.1.42: Estimated volume (cum) by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Aegle marmelos	498	0	23115	23613
Buchanania latifolia	11933	0	0	11933
Diospyros species	1560	3476	0	5036
Madhuca latifolia	17732	1601	14233	33566
Shorea robusta	96542	35606	79866	212014
Rest of Species	17917	0	56768	74685
Total	**146182**	**40683**	**173982**	**360847**

Type of Forest Area: Plantation

Table 4.1.43: Estimated number of trees by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Albizzia lebbek	72709	0	0	72709
Azadirachta indica	14542	0	0	14542
Buchanania latifolia	58167	0	0	58167
Shorea robusta	159960	0	0	159960
Terminalia arjuna	14542	14542	0	29084
Total	**319920**	**14542**	**0**	**334462**

Type of Forest Area: Plantation

Table 4.1.44: Estimated volume (cum) by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Albizzia lebbek	1986	0	0	1986
Azadirachta indica	265	0	0	265
Buchanania latifolia	2516	0	0	2516
Shorea robusta	5014	0	0	5014
Terminalia arjuna	384	8596	0	8980
Total	**10165**	**8596**	**0**	**18761**

District: Purulia

Type of Forest Area: Natural Forest

Table 4.1.45: Estimated number of trees by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Acacia auriculiformis	61647	448	224	62319
Bergenia ciliata	3656	0	1462	5118
Buchanania latifolia	238546	731	0	239277
Butea monosperma	48493	8147	13979	70619

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Diploknema butyracea	21206	731	1462	23399
Eugenia cymosa	10176	1462	0	11638
Lannea coromandelica	21206	731	0	21937
Madhuca latifolia	61812	1909	0	63721
Phoenix sylvestris	894	224	671	1789
Pongamia pinnata	224	0	731	955
Pterocarpus marsupium	16311	2194	0	18505
Semecarpus anacardium	38024	0	0	38024
Shorea robusta	540319	7312	2194	549825
Terminalia crenulata	28517	0	0	28517
Rest of Species	339112	15518	6683	361313
Total	**1430143**	**39407**	**27406**	**1496956**

Type of Forest Area: Natural Forest

Table 4.1.46: Estimated volume (cum) by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Acacia auriculiformis	3695	276	633	4604
Bergenia ciliata	195	0	3232	3427
Buchanania latifolia	18573	374	0	18947
Butea monosperma	5001	5940	33059	44000
Diploknema butyracea	2279	406	3413	6098
Eugenia cymosa	1432	1136	0	2568
Lannea coromandelica	2199	428	0	2627
Madhuca latifolia	6672	1037	0	7709
Phoenix sylvestris	191	133	3608	3932
Pongamia pinnata	18	0	2999	3017
Pterocarpus marsupium	2532	1537	0	4069
Semecarpus anacardium	3113	0	0	3113
Shorea robusta	37187	5302	19174	61663
Terminalia crenulata	2573	0	0	2573
Rest of Species	26445	10165	23486	60096
Total	**112105**	**26734**	**89604**	**228443**

Type of Forest Area: Sal Coppice Forest

Table 4.1.47: Estimated number of trees by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Acacia auriculiformis	14025	0	0	14025
Albizzia odoratissima	2214	0	0	2214
Bombax ceiba	2953	0	0	2953
Buchanania latifolia	42812	0	0	42812
Butea monosperma	5706	0	738	6444
Madhuca latifolia	13286	0	0	13286
Shorea robusta	119580	0	0	119580
Terminalia bellirica	8858	0	0	8858
Terminalia chebula	3691	0	0	3691
Terminalia crenulata	5905	0	0	5905
Rest of Species	18586	0	0	18586
Total	**237616**	**0**	**738**	**238354**

Type of Forest Area: Sal Coppice Forest

Table 4.1.48: Estimated volume (cum) by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Acacia auriculiformis	661	0	0	661
Albizzia odoratissima	382	0	0	382
Bombax ceiba	300	0	0	300
Buchanania latifolia	2699	0	0	2699
Butea monosperma	339	0	4442	4781
Madhuca latifolia	957	0	0	957
Shorea robusta	6844	0	0	6844
Terminalia bellirica	622	0	0	622
Terminalia chebula	307	0	0	307
Terminalia crenulata	278	0	0	278
Rest of Species	734	0	0	734
Total	**14123**	**0**	**4442**	**18565**

Type of Forest Area: Plantation

Table 4.1.49: Estimated number of trees by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Acacia auriculiformis	152463	867	867	154197
Anacardium occidentale	12137	0	0	12137
Butea monosperma	9478	867	867	11212
Cassia siamea	16472	0	867	17339

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Dalbergia sissoo	2601	0	0	2601
Eucalyptus citriodora	8669	0	0	8669
Eucalyptus species	11270	0	0	11270
Phoenix humilis	6355	404	0	6759
Shorea robusta	22541	0	0	22541
Rest of Species	17744	1734	0	19478
Total	**259730**	**3872**	**2601**	**266203**

Type of Forest Area: Plantation

Table 4.1.50: Estimated volume (cum) by species and diameter class

Species	Diameter Class (cm)			Total
	10-30	30-50	50+	
Acacia auriculiformis	6740	417	2977	10134
Anacardium occidentale	517	0	0	517
Butea monosperma	1106	572	1878	3556
Cassia siamea	1117	0	7978	9095
Dalbergia sissoo	593	0	0	593
Eucalyptus citriodora	526	0	0	526
Eucalyptus species	719	0	0	719
Phoenix humilis	1494	208	0	1702
Shorea robusta	2257	0	0	2257
Rest of Species	2145	1377	0	3522
Total	**17214**	**2574**	**12833**	**32621**

4.2 District wise estimated number of NTFP under different Type of Forest Area

District: Bankura

Table 4.2.1: Estimated number of NTFP (Herbs, Shrubs & Climbers) in '000 'by habit in different type of forest area

Type of Forest Area	NTFP Habit	Estimated NTFP by habit in '000'
Natural Forest	Shrubs	7739
	Climber	28034
Sal Coppice Forest	Herbs	5024
	Shrubs	52858
	Climber	31508
Plantation	Herbs	45212
	Shrubs	17313
	Climber	72520
Total		**260207**

District: Birbhum

Table 4.2.2: Estimated number of NTFP (Herbs, Shrubs & Climbers) in '000 'by habit in different type of forest area

Type of Forest Area	NTFP Habit	Estimated NTFP by habit in '000'
Natural Forest	Herbs	0
	Shrubs	15
	Climber	153
Sal Coppice Forest	Shrubs	56
	Climber	389
Plantation	Climber	134
Total		**746**

District: Burdwan

Table 4.2.3: Estimated number of NTFP (Herbs,Shrubs & Climbers) in '000 'by habit in different type of forest area

Type of Forest Area	NTFP Habit	Estimated NTFP by habit in '000'
Natural Forest	Herbs	312718
	Shrubs	0
	Climber	8155
Sal Coppice Forest	Herbs	0
	Shrubs	16372
	Climber	46231
Plantation	Shrubs	4292
	Climber	3679
Total		**391447**

District: Cooch Behar

Table 4.2.4: Estimated number of NTFP (Herbs, Shrubs & Climbers) in '000 'by habit in different type of forest area

Type of Forest Area	NTFP Habit	Estimated NTFP by habit in '000'
Natural Forest	Shrubs	216
	Climber	324
Plantation	Herbs	5195
	Shrubs	16205
	Climber	8826
Total		**30766**

District: Darjeeling

Table 4.2.5: Estimated number of NTFP (Herbs, Shrubs & Climbers) in '000 'by habit in different type of forest area

Type of Forest Area	NTFP Habit	Estimated NTFP by habit in '000'
Natural Forest	Herbs	10539
	Shrubs	436
	Climber	2809
Total		**13784**

District: Jalpaiguri

Table 4.2.6: Estimated number of NTFP (Herbs,Shrubs & Climbers) in '000 'by habit in different type of forest area

Type of Forest Area	NTFP Habit	Estimated NTFP by habit in '000'
Natural Forest	Climber	876
Plantation	Herbs	667754
	Shrubs	6032
	Climber	1167
Total		**689613**

District: Jhargram

Table 4.2.7: Estimated number of NTFP (Herbs,Shrubs & Climbers) in '000 'by habit in different type of forest area

Type of Forest Area	NTFP Habit	Estimated NTFP by habit in '000'
Natural Forest	Climber	6233
Sal Coppice Forest	Climber	1357
Plantation	Climber	1018
Total		**8607**

District: Paschim Madinipur

Table 4.2.8: Estimated number of NTFP (Herbs, Shrubs & Climbers) in '000 'by habit in different type of forest area

Type of Forest Area	NTFP Habit	Estimated NTFP by habit in '000'
Natural Forest	Herbs	10701
	Shrubs	20983
	Climber	3618
Sal Coppice Forest	Herbs	48154
	Shrubs	22031
	Climber	20365
Plantation	Shrubs	0
Total		**125852**

District: Puruliya

Table 4.2.9: Estimated number of NTFP (Herbs, Shrubs & Climbers) in '000 'by habit in different type of forest area

Type of Forest Area	NTFP Habit	Estimated NTFP by habit in '000'
Natural Forest	Herbs	14715
	Shrubs	9004
	Climber	29154
Sal Coppice Forest	Herbs	1668
	Shrubs	1422
	Climber	2491
Plantation	Shrubs	2986
	Climber	2346
Total		**63785**

4.3 District wise NTFP by Habit(Herbs/Shrubs/Climbers) under different Type of Forest Area

District: Bankura

Table 4.3.1: Estimated NTFP species per/ha by habit under different Type of Forest Area

Type Of Forest Area	Type of NTFP	Botanical Name	Per ha
Natural Forest	Climber	*Asparagus racemosus*	1651.46
		Aristolochia indica	2477.19
		Hemidesmus indicus	5081.42
		Andrographis paniculata	6605.85
		Ichnocarpus frutescens	10256.45
	Shrubs	*Holarrhena antidysenteria*	2422.15
		Cymbopogon winterianus	11009.75
Plantation	Climber	*Aristolochia indica*	1100.98
		Ichnocarpus fruitescens	3002.66
		Hemidesmus indicus	3655.24
		Andrographis paniculata	9372.40
	Herbs	*Hemidesmus indicus*	8838.38
		Andrographis paniculata	26515.15
		Centella asistica	88383.84
	Shrubs	*Holarrhena antidysenteria*	2752.44
		Eulaliopsis binata	3669.92
		Hemidesmus indicus	5504.88
		Ocimum sanctum	8367.41
		Andrographis paniculata	16514.63
Sal Coppice Forest	Climber	*Asparagus racemosus*	1513.84
		Hemidesmus indicus	1805.60
		Aristolochia indica	1926.71
		Ichnocarpus frutescens	2584.90

Type Of Forest Area	Type of NTFP	Botanical Name	Per ha
		Andrographis paniculata	2667.15
	Herbs	*Aristolochia indica*	17676.77
	Shrubs	*Holarrhena antidysenteria*	1887.39
		Andrographis paniculata	3302.93
		Eulaliopsis binata	13624.57

District: Birbhum

Table 4.3.2: Estimated NTFP species per/ha by habit under different Type of Forest Area

Type Of Forest Area	Type of NTFP	Botanical Name	Per ha
Natural Forest	Climber	*Ichnocarpus frutescens*	1887.39
	Shrubs	*Holarrhena antidysenteria*	*366.99*
Plantation	Climber	*Ichnocarpus frutescens*	3302.93
Sal Coppice Forest	Climber	*Aristolochia indica*	1100.98
		Ichnocarpus frutescens	3774.77
	Shrubs	*Holarrhena antidysenteria*	2752.44
Natural Forest	Climber	*Ichnocarpus frutescens*	1887.39

District: Burdwan

Table 4.3.3: Estimated NTFP species per/ha by habit under different Type of Forest Area

Type Of Forest Area	Type of NTFP	Botanical Name	Stem Per Ha
Natural Forest	Climber	*Hemidesmus indicus*	3669.92
		Asparagus racemosus	10275.77
	Herbs	*Holarrhena antidysenteria*	353535.35
		Andrographis paniculata	441919.19
Plantation	Climber	*Piper Longum*	2201.95
		Asparagus racemosus	5137.88
		Hemidesmus indicus	7706.83
	Shrubs	*Holarrhena antidysenteria*	12844.71
Sal Coppice Forest	Climber	*Rauwolfia serpentina*	2752.44
		Asparagus racemosus	3669.92
		Hemidesmus indicus	4533.43
		Ichnocarpus frutescens	7311.60
	Shrubs	*Rauwolfia serpentina*	3302.93
		Andrographis paniculata	4403.90
		Hemidesmus indicus	4770.89
		Holarrhena antidysenteria	12385.97
		Withania somnifera	35781.69

District: Cooch Behar

Table 4.3.4: Estimated NTFP species per/ha by habit under different Type of Forest Area

Type Of Forest Area	Type of NTFP	Botanical Name	Stem Per Ha
Natural Forest	Climber	*Withania somnifera*	16514.63
	Shrubs	*Withania somnifera*	11009.75
Plantation	Climber	*Ocimum sanctum*	2201.95
		Calamus spp	5504.88
		Holarrhena antidysenteria	5504.88
		Asparagus racemosus	6238.86
		Aloe vera	7156.34
		Andrographis paniculata	13924.10
		Withania somnifera	16586.43
		Phyllanthus niruri	22019.50
	Herbs	*Andrographis paniculata*	8838.38
		Calamus spp	8838.38
		Holarrhena antidysenteria	8838.38
		Swertia chirata	8838.38
		Piper longum	132575.76
	Shrubs	*Ichnocarpus frutescens*	1100.98
		Andrographis paniculata	2752.44
		Ocimum sanctum	4403.90
		Phyllanthus niruri	5190.31
		Holarrhena antidysenteria	10223.34
		Withania somnifera	13895.07
		Asparagus racemosus	15138.41
		Rubia cordifolia	19267.07
		Cymbopogon winterianus	23120.48
		Calamus spp	30927.39

District: Darjeeling

Table 4.3.5: Estimated NTFP species per/ha by habit under different Type of Forest Area

Type Of Forest Area	Type of NTFP	Botanical Name	Stem Per Ha
Natural Forest	Climber	*Asparagus racemosus*	21285.52
	Herbs	*Andrographis paniculata*	5199.05
		Asparagus racemosus	11931.82
		Hemidesmus indicus	21756.02
	Shrubs	*Asparagus racemosus*	366.99

Type Of Forest Area	Type of NTFP	Botanical Name	Stem Per Ha
		Andrographis paniculata	1981.76

District: Jalpaiguri

Table 4.3.6: Estimated NTFP species per/ha by habit under different Type of Forest Area

Type Of Forest Area	Type of NTFP	Botanical Name	Stem Per Ha
Natural Forest	Climber	*Ichnocarpus frutescens*	3302.93
Plantation	Climber	*Ichnocarpus frutescens*	4403.90
	Herbs	*Rubia cordifolia*	132575.76
		Cymbopogon winterianus	2386363.64
	Shrubs	*Eulaliopsis binata*	1100.98
		Ocimum Sanctum	16514.63

District: Jhargram

Table 4.3.7: Estimated NTFP species per/ha by habit under different Type of Forest Area

Type Of Forest Area	Type of NTFP	Botanical Name	Stem Per Ha
Natural Forest	Climber	*Andrographis paniculata*	1100.98
		Aristolochia indica	1100.98
		Ichnocarpus frutescens	4704.17
Plantation	Climber	*Ichnocarpus frutescens*	4403.90
Sal Coppice Forest	Climber	*Hemidesmus indicus*	2752.44
		Ichnocarpus frutescens	6055.36

District: Pashchim Medinipur

Table 4.3.8: Estimated NTFP species per/ha by habit under different Type of Forest Area

Type Of Forest Area	Type of NTFP	Botanical Name	Stem Per Ha
Natural Forest	Climber	*Ichnocarpus frutescens*	1100.98
		Aristolochia indica	1834.96
		Hemidesmus indicus	2201.95
		Holarrhena antidysenteria	2201.95

Type Of Forest Area	Type of NTFP	Botanical Name	Stem Per Ha
		Andrographis paniculata	7706.83
	Herbs	*Eulaliopsis binata*	5892.26
		Andrographis paniculata	13257.58
	Shrubs	*Eulaliopsis binata*	6302.13
Sal Coppice Forest	Climber	*Eulaliopsis binata*	4403.90
		Hemidesmus indicus	4495.65
		Andrographis paniculata	10349.17
	Herbs	*Andrographis paniculata*	79545.45
	Shrubs	*Asparagus racemosus*	1100.98
		Hollerhena antidysenteria	1651.46
		Eulaliopsis binata	7844.45

District: Puruliya

Table 4.3.9: Estimated NTFP species per/ha by habit under different Type of Forest Area

Type Of Forest Area Desc	Type of NTFP	Botanical Name	Stem Per Ha
Natural Forest	Climber	*Aristolochia indica*	1100.98
		Ocimum sanctum	2201.95
		Hemidesmus indicus	3685.87
		Holarrhena antidysenteria	4403.90
		Ichnocarpus frutescens	4865.60
		Piper longum	5504.88
		Asparagus racemosus	6422.36
		Andrographis paniculata	9861.42
	Herbs	*Rauwolfia serpentina*	17676.77
		Ichnocarpus frutescens	24305.56
		Phyllanthus niruri	37563.13
		Centella asistica	88383.84
	Shrubs	*Asparagus racemosus*	4403.90
		Holarrhena antidysenteria	7844.45
		Ocimum aanctum	11156.55
		Eulaliopsis binata	12294.22
		Rauwolfia serpentina	28625.35
Plantation	Climber	*Hemidesmus indicus*	2446.61
		Rauwolfia serpentina	2752.44
		Ichnocarpus frutescens	4804.26
		Andrographis paniculata	14312.68
	Shrubs	*Rauwolfia serpentina*	3302.93
		Andrographis paniculata	5504.88
		Holarrhena antidysenteria	11009.75
		Ocimum sanctum	40736.08

Type Of Forest Area Desc	Type of NTFP	Botanical Name	Stem Per Ha
Sal Coppice Forest	Climber	*Asparagus racemosus*	1467.97
		Holarrhena antidysenteria	2201.95
		Hemidesmus indicus	4073.61
		Ichnocarpus frutescens	4246.62
		Andrographis paniculata	5780.12
	Herbs	*Ichnocarpus frutescens*	2209.60
		Hemidesmus indicus	6313.13
		Swertia chirata	17676.77
		Holarrhena antidysenteria	20622.90
	Shrubs	*Asparagus racemosus*	550.49
		Ichnocarpus frutescens	660.59
		Andrographis paniculata	2752.44
		Hemidesmus indicus	3302.93
		Holarrhena antidysenteria	6097.71
		Withania somnifera	11009.75

4.4 District wise Species wise average height (in meter) in Type of Forest Area- Plantation

District: Bankura

Table 4.4.1: Species wise average height

Species Name	Avg_height (in meter)
Acacia auriculiformis	5.8
Acacia ferruginea	3.0
Aegle marmelos	4.5
Albizzia lebbeck	1.0
Alstonia scholaris	7.0
Azadirachta indica	5.0
Bombax ceiba	1.0
Cassia fistula	3.7
Cassia siamea	6.3
Dalbergia sissoo	1.0
Eucalyptus species	9.0
Eugenia cymosa	4.5
Eugenia hemispherica	8.0
Gmelina arborea	1.0
Madhuca latifolia	2.5
Pterocarpus marsupium	4.5
Shorea robusta	3.8
Sterculia villosa	8.5
Syzygium cumini	1.0
Syzygium jambos	1.0
Terminalia arjuna	1.0

Terminalia bellirica	1.0
Misc spp	4.0

District: Birbhum

Table 4.4.2: Species wise average height

Species name	Avg_height (in meter)
Acacia arabica	1.0
Acacia auriculiformis	5.3
Albizzia lucida	8.0
Albizzia mollis	1.0
Albizzia odoratissima	8.8
Beilschmiedia assamica	1.0
Mahonia napaulensis	1.0
Dalbergia sissoo	1.0
Diospyros melanoxylon	1.0
Eucalyptus species	2.0
Eugenia cymosa	1.0
Shorea robusta	1.0
Misc spp	1.0

District: Burdwan

Table 4.4.3: Species wise average height

Species name	Avg_height in meter
Acacia auriculiformis	₹ 2.88
Eucalyptus species	2.5

District: Cooch Behar

Table 4.4.4: Species wise average height

Species name	Avg_height (in meter)
Acacia catechu	8.0
Acer acuminatum	9.2
Albizzia odoratissima	10.4
Albizzia procera	7.5
Anthocephalus cadamba	12.3
Artocarpus chaplasha	18.3
Bombax ceiba	21.3
Bruguiera species	10.0

Species name	Avg_height (in meter)
Cassia siamea	12.0
Chickrassia velutina	10.7
Dalbergia sissoo	18.0
Diospyros assimilis	4.0
Gmelina arborea	10.9
Tabernaemontana spp	8.0
Tectona grandis	16.0
Terminalia arjuna	7.4
Terminalia bellirica	5.0
Terminalia crenulata	11.8
Terminalia myriocarpa	7.1
Trewia nudiflora	5.1
Misc spp	10.7

District: Darjeeling

Table 4.4.5: Species wise average height

Species name	Avg_height (in meter)
Acer campbellii	4.0
Alnus nepalensis	4.0
Eriobotrya petiolata	2.7
Michelia species	2.0
Myrica sapida	2.7
Quercus lamellosa	2.0
Schima wallichii	2.0
Symingtoria populnea	2.7
Misc spp	4.0

District: Jalpaiguri

Table 4.4.6: Species wise average height

Species name	Avg_height (in meter)
Abies pindrow	2.0
Acacia catechu	4.0
Aglaia spectobilis	6.6
Anthocephalus cadamba	7.0
Artocarpus chaplasha	2.0
Bombax ceiba	10.0
Cedrela toona	3.0
Chukrassia velutina	5.8
Emblica officinalis	1.0

Gmelina arborea	7.0
Lagerstroemia parviflora	5.3
Lagerstroemia spaciosa	7.0
Lagerstroemia species	4.0
Salvadora species	10.0
Tectona grandis	7.2
Terminalia bellirica	15.0
Terminalia crenulata	3.4
Terminalia myriocarpa	5.7
Terminalia paniculata	7.0
Trewia nudiflora	7.8

District: Jhargram

Table 4.4.7: Species wise average height

Species name	Avg_height (in meter)
Abies smithiana	2.0
Acacia auriculiformis	2.4

District: Paschim Medinipur

Table 4.4.8: Species wise average height

Species name	Avg_height (in meter)
Buchanania latifolia	3.8
Eucalyptus species	7.5
Shorea robusta	7.0
Terminalia bellirica	3.0

District: Purulia

Table 4.4.9: Species wise average height

Species name	Avg_height (in meter)
Acacia auriculiformis	3.8
Adina cordifolia	2.0
Alstonia scholaris	1.0
Anthocephalus cadamba	1.5
Azadirachta indica	3.8
Aconitum ferox	7.0
Bombax ceiba	1.0
Bridelia retusa	5.5
Chukrassia velutina	1.5

Species name	**Avg_height (in meter)**
Dalbergia latifolia	1.5
Dalbergia sissoo	2.0
Emblica officinalis	1.0
Eucalyptus rostrata	6.0
Eucalyptus species	4.0
Eugenia cymosa	3.5
Eugenia gardneri	6.0
Ficus religiosa	1.0
Madhuca latifolia	1.0
Pongamia pinnata	1.6
Scolopia crenata	1.0
Shorea robusta	2.5
Syzygium cumini	1.0
Tecomella undulata	1.0
Terminalia arjuna	1.0
Terminalia bellirica	1.0
Misc spp	6.3

Annexure-I

Local Volume Equations

Volume equations used to compute volume of wood for dominant trees

Species Name	Volume Equation
Acacia auriculiformis	$V=(-0.048108+5.873169*D^2)$
Acacia catechu	$V=(-0.048108+5.873169*D^2)$
Albizzia odoratissima	$\sqrt{V}=(-0.07109+2.99732*D-0.26953*\sqrt{D})$
Albizzia procera	$V=(0.13817-2.16947*D+11.40870*D^2+1.11636*D^3)$
Anacardium occidentale	$V=(0.0148-0.422*D+4.5899*D^2)$
Anogeissus latifolia	$V=(0.045731-1.020606*D+9.656667*D^2)$
Areca catechu	$V=(0.0239-0.6266*D+5.4067*D^2)$
Azadirachta indica	$V=(-0.03510+5.32981*D^2)$
Bischofia javanica	$\sqrt{V}=(-0.00273+2.56199*D)$
Bombax ceiba	$V=(-0.032-0.0619*D+7.208*D^2)$
Bridelia retusa	$V=(0.36432-1.32768*\sqrt{D}+9.48471*D^2)$
Buchanania latifolia	$V=(0.031-0.64087*D+6.04066*D^2)$
Butea monosperma	$V=(0.031-0.64087*D+6.04066*D^2)$
Cassia fistula	$V=(0.05159-0.53331*D+3.46016*D^2+10.18473*D^3)$
Cassia siamea	$V=(0.05159-0.53331*D+3.46016*D^2+10.18473*D^3)$
Chukrassia velutina	$V=(-0.07559+9.23051*D^2)$
Cryptomeria japonica	$V=(-0.01097+5.30991*D^2)$
Diospyros species	$V=(-0.009124-0.494103*D+7.610416*D^2)$
Eucalyptus citriodora	$V=(0.02894-0.89284*D+8.72416*D^2)$
Eucalyptus species	$V=(0.02894-0.89284*D+8.72416*D^2)$
Eugenia grandis	$\sqrt{V}=(-0.08008+2.39257*D)$
Gmelina arborea	$\sqrt{V}=(-0.00189+2.10033*D)$
Lagerstroemia parviflora	$\sqrt{V}=(-0.153687+2.975938*D)$
Lagerstroemia species	$\sqrt{V}=(-0.153687+2.975938*D)$
Lannea coromandelica	$\sqrt{V}=(-0.32985+2.21152*D+0.78769*\sqrt{D})$
Macaranga species	$V=(0.13333-2.18825*D+13.12678*D^2)$
Machilus species	$V=(4.84009*D^2-0.02402)$
Madhuca latifolia	$V=(-0.00092-0.55547*D+7.34460*D^2)$
Michelia species	$V=(4.84009*D^2-0.02402)$
Pterocarpus marsupium	$V=(0.058424-1.233468*D+9.433633*D^2)$
Quercus lamellosa	$V=(0.04430-0.84266*D+6.36239*D^2+2.27556*D^3)$

Species Name	**Volume Equation**
Quercus lineata	$V=(0.04430-0.84266*D+6.36239*D^2+2.27556*D^3)$
Quercus pachyphylla	$V=(0.04430-0.84266*D+6.36239*D^2+2.27556*D^3)$
Quercus species	$V=(0.04430-0.84266*D+6.36239*D^2+2.27556*D^3)$
Rhododendron arboreum	$V=(0.06007-0.21874*\sqrt{D}+3.63428*D^2)$
Rhododendron griffithianum	$V=(0.06007-0.21874*\sqrt{D}+3.63428*D^2)$
Saurauia nepaulensis	$V=(0.03006-0.77786*D+6.72270*D^2)$
Schima wallichii	$\sqrt{V}=(-0.11242+2.54133*D)$
Semecarpus anacardium	$\sqrt{V}=(1.67477+14.83747*D-9.43386*\sqrt{D})$
Shorea robusta	$V=(0.1563-2.45104*D+11.90581*D^2)$
Symplocos laurina	$\sqrt{V}=(-0.2433+2.44627*D+0.48232*\sqrt{D})$
Symplocos theifolia	$\sqrt{V}=(-0.2433+2.44627*D+0.48232*\sqrt{D})$
Tectona grandis	$V=(0.00341-0.65623*D+7.881*D^2)$
Terminalia arjuna	$V=(0.05061-1.11994*D+8.77839*D^2)$
Terminalia bellirica	$\sqrt{V}=(-0.15683+3.01055*D)$
Terminalia chebula	$V=(-0.05004-0.03440*D+6.35715*D^2)$
Terminalia crenulata	$V=(0.05061-1.11994*D+8.77839*D^2)$
Terminalia myriocarpa	$\sqrt{V}=(0.30858+4.35664*D-1.64694*\sqrt{D})$
Trewia nudiflora	$V=(0.0549-1.31*D+10.0*D^2)$
Tsuga dumosa	$V=EXP(2.32244)*(D^{2.37411})$
Rest of species	$\sqrt{V}=(-0.153973+2.724109*D)$

Annexure-II

Field Forms for Inventory

Field Form No. 1

Plot Approach Form (JICA)

1). Patch approach Form must be filled in while approaching the field
2) While recording date please record month and year also.

1. Form Code: 1(1)

2. District Code: 2(2)

3. Forest Division Code: 3(2)

4. Forest Range Code: 4(3)

5. Forest Beat Code: 5(3)

6. Location of the place up to which journey was Performed by vehicle:

Latitude	**Longitude**
(dd.mm.ss ss)	(dd.mm.ss ss)

(Remark: The Latitude & Longitude of the location of the place up to which journey was performed by vehicle are to be recorded here.)

7. Total time taken to reach patch periphery from camp:

8. Distance covered on foot Upto Patch periphery:
(in km upto one decimal place)

Remarks:

Name & Signature of the Crew Leader

Date:DD MM YYYY

Field Form No. 2

Plot Description Form(JICA)

Form Code	Plo_ID No.	District Code	Forest Division Code	Forest Range Code	Forest Beat Code	Type of forest area	Lat.of the centre of the Sub-plot-1	Long. Of the centre of the Sub-plot-1	Category of JFMC	Name of JFMC code	Type of Plantation
1 (1)	2(3)	3 (2)	4 (2)	5(2)	6(2)	7(1)	8(8)	9(8)	10(2)	11(2)	12(1)

Land use	Crop composition	Grazing incidence	Fire Incidence	Presence of undergrowth vegetation	Presence of grass	Injuries to crop due to girdling	Injuries to crop due to illicit felling	Lopping for fodder etc.	Area of platch as per record (ha)	Area of patch as observed (in ha.)	***Month & year of plantation (if applicable)***						Age of plantation (if applicable)
13 (2)	14 (2)	15 (1)	16 (1)	17 (1)	18 (1)	19 (1)	20 (1)	21 (1)	22 (4)	23 (4)	24 (6)						25 (1)
											M	M	Y	Y	Y	Y	

Signature of the WBFBCP officials……

Signature of the Crew Leader……

Date of survey:DD MM YYYY

Field Form No. 3

Plot Enumeration Form(JICA)

Form Code	Plot_ID No.	Sub-plot No.	Sub-plot status
1 (1)	2(3)	3(1)	4(1)

Total no of Bamboo Clumps	Total no of Trees
10(3)	11(3)

Sl.No.	Species Name	Species code	Species spacing (in case of block plantation only)	Diameter(cms)	Height in meter
	5	6(4)	7(1)	8(3)	9(2)

Signature of the WBFBCP official: Name & Signature of the Crew Leader:
Date of survey: DD MM YYYY

Field Form No. 4

NTFP (TREES, HERBS, SHRUBS and CLIMBERS) AND REGENERATION FORM

Form Code	Plot_ID No.
1(1)	2(3)

Herbs Plot size: 0.6 meter radius
Shrubs, Climbers & Regeneration Plot size: 1.7 meter radius

Sub-Plot No.	NTFP (Herbs, Shrubs and Climbers)							Regeneration (Trees)					
	Species			No. of plants				Species			No. of plants		
	Name	Code	Habit (Herbs/Shrubs/Climbers)	Collar diameter class (mm for herbs /cm for shrubs & climbers)				Sub-plot no.	Name	Code	Category of regeneration		
				0-2	2-5	5-8	8+				1	2	3
3(1)	4	5 (2)	6(1)	7 (3)	8 (3)	9 (3)	10 (3)	11(1)	12	13 (4)	14 (2)	15 (2)	16 (2)

Signature of the WBFBCP official
Date of survey: DD MM YYYY

Signature of the Crew Leader