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FOREST SURVEY OF
INDIA DEHRADUN

**GOVERNMENT OF INDIA
MINISTRY OF ENVIRONMENT
AND FORESTS**

(Department of Forests and Wildlife)

81-12

**REPORT
ON
FOREST RESOURCES OF
BANKURA DISTRICT OF WEST BENGAL**

**FOREST SURVEY OF INDIA
EASTERN ZONE**

1985

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P_R_E_F_A_C_E

This report is based on the data collected during inventory of forest resources of Bankura District carried out by the Eastern Zone of Forest Survey of India during the period December, 1981 to March, 1982. The inventory was conducted under the overall supervision of Shri A.B.Chaudhuri, the then Joint Director. The field work was carried out under the direct supervision of Shri J.N.Bhattacharya, Assistant Director. The processing of the data has been done under the supervision of Shri S.K.Sen, Assistant Director (Statistics) and the report has been compiled by Shri J.N.Bhattacharya, Asstt. Director. Subsequent modifications and corrections have been made by Shri S.C.Dey, Joint Director and Shri K.K.Singh, Deputy Director.

This report gives an indication of the depleting status of the forest in Bankura District. It has also been observed that the demand of the local people, specially for firewood, far exceeds the recorded outturn of forest produce. The negative balance existing between this demand and supply has contributed significantly towards depletion of forest. I am sure that the report will be of good use to the State Government and other agencies for planning and management of forests of the district, taking into consideration the local demand.

The hard work put in by all the field staff during this inventory and other staff of the zone during compilation and final preparation of the report is gratefully acknowledged. The help and cooperation extended by the Forest Department of West Bengal and the District Authorities at the time of collection of various data during the inventory is also gratefully acknowledged.

(D.B.Misra)
DIRECTOR.

CHAPTER - I

BACKGROUND INFORMATION

1.0 Need for the survey:

Although the district of Bankura has well spread forest areas covering about 21.5% of the Geographical area, quantitative information on sound statistical footing with regard to its resource potentialities was lacking. The Forest Survey of India in its initial phase of work programme selected this area to assess its varied resources about which comprehensive volume data was not available. The assessment of the changing pattern of forest and its ecology due to biotic factor and large scale afforestation was also an objective of the survey.

The inventory was also undertaken with a view to monitor on a 10 year cycle the changing situation of forest resources, to fulfil the data needs of development planning and as aid to forestry planning in State and Central Government.

1.1 Name of the catchment:

Bankura district falls in the catchment area of rivers like Damodar, Darakeshwar, and Kangsabati.

The river Damodar originates from Chotanagpur hills and enters Bankura near village Shirpuranama in Saltora P.S. and flows in the south eastern direction covering Police Stations of Saltora, Mejia, Bernora, Sonamukhi, Patrasayer and Indus. Important tributaries are Bedai and Sali.

Darakeshwar is the second important river in this district. It originates from Hura P.S. of Purulia district and enters village Dunda of Chatna P.S. and takes a zingzag course through Bankura, Onda, Vishnupur. It separates the P.S. of Patrasayer and Indus in the North of Jaipur and Kotampur in the south. The river divides the district into two halves. The same river is known as Rupnarayan in its lower course which ultimately joins the Bhagirathi. Small streams like Silabati covering P.S. of Mulpur, Taldangra and Simlapal, Arkusa, Borai, Gandheswari, Joypanda feed this river.

Kangsabati originates from hilly terrain of Jhalda P.S. of Purulia district and enters the district near village Bhedua in Khatra P.S. and flows in south easterly direction covering Khatra, Ranibandh and Raipur P.S. The river is fed by Kunari, Bhairabanka, Tarapani etc.

1.2 Situation and boundaries:

The project area is situated in the south west portion of West Bengal with a natural boundary on the North and North-East by the river Damodar. On the east of the district lies the district of Burdwan and Hoogly. Midnapore District lies south of this district while the west is bordered by the District Purulia.

1.3 Location:

The tract dealt with lies between $23^{\circ}38'$ and $22^{\circ}38'$ north latitude and $86^{\circ}36'$ and $87^{\circ}46'$ east longitude and falls entirely under the Bankura Civil District of West Bengal.

1.4 Administrative units:

1.4.1 Geographical area and forested area by district and forest divisions:

Bankura district contains two territorial Forest Divisions. The break up of the geographical area and forested area into respective Forest Divisions as collected from Divisional Forest Officers is as under :

Name of the Forest Division	Total Geographical area (km ²)	Total Forested area (km ²)
1. Bankura (North)	2458	744.8200
2. Bankura (South)	4413	650.7543
Total:	6871	1395.5743 ✓

It may be pointed out that a minor discrepancy is noted with regard to total forest area. As per Working Plan, an area of 1,39,452.56 ha. instead of 139557.43 ha. have been considered as forest area. Again, during preparation of Working Plan from the computed settlement record of 1957, the total forest area was considered as 139452.56 ha. It is, however, possible that some old recorded forest areas have been dereserved for some special Development purpose of other department.

2.0 Locality factor:

2.1 Climate:

The area is basically hot and humid with small period of winter and rainy months.

2.1.1 Temperature:

Temperature is maximum in May and has a tendency to recede from June onwards. A statement showing the maximum and minimum temperature (an average of 25 years) is appended below :-

Month	Minimum - °C.	Maximum - °C.
January	12.24	27.10
February	15.37	30.80
March	20.02	35.05
April	24.24	38.44
May	26.08	38.74
June	26.26	35.32
July	28.52	31.95
August	25.47	31.56
September	25.20	31.71
October	22.59	32.41
November	16.95	31.03
December	12.86	27.66

It is evident from the above table that the highest temperature is attained during the month of March to June. The lowest temperature is met with in the month of December and January and thus the winter prevails during these two months only.

The mean day temperature (Max. and Min. in °C) monthwise for the year 1981 as collected from the Principal, Rice Research Centre, Bankura is appended below for ready reference:

Year	Months											
	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Max.	25.4	29.0	35.3	34.7	34.0	30.5	29.5	33.3	32.5	34.0	31.0	26.3
Min.	12.9	16.0	19.7	22.8	24.0	26.0	25.3	25.5	24.9	21.0	16.0	12.8

2.1.2 Rainfall:

The normal annual rainfall of this district is 1320.1 m.m. The mean annual and monthly distribution of rainfall (Average for a period of 20 years) is furnished below :

Months	No. of rainy days	Amount of rainfall in m.m.	Percentage of the total rainfall in the year	Rainfall per day in m.m.
January	.98	9.48	0.78	9.48
February	1.35	14.66	1.16	11.00
March	1.80	23.98	1.87	13.32
April	2.65	44.71	3.49	16.87
May	4.65	88.38	5.33	14.70
June	10.45	206.38	16.54	19.74
July	16.50	289.12	22.18	17.50
August	16.00	252.40	19.70	11.77
September	11.80	234.42	18.36	19.80
October	6.10	117.60	9.20	19.20
November	1.05	16.25	1.27	15.40
December	3.00	1.56	0.12	0.52

It therefore, transpires from the table that the actual rainy months continues from June to September. In September average rainfall per day is maximum and the probability of having maximum rainfall in a day is 50%, whereas in other months it is not more than 15%.

2.1.3 Relative humidity:

The area is tropical with humid climate and alternates with dry and wet period. It is characterised by hot summer and high humidity spread over long period with well distributed rainfall during monsoon.

The summer heat is oppressive due to high moisture content in the air. The weather is comfortable to pleasant during the winter season.

The monsoon starts from middle of June and lasts upto September. During the period April & May north-western showers are met with. Average humidity percentage figures as collected from Rice Research Sub-station, Bankura are given below :

Month	Percentage of humidity
January	70.82
February	61.08
March	51.55
April	49.55
May	57.36
June	67.03
July	76.76
August	77.63
September	76.41
October	72.64
November	67.66
December	69.68

Further a statement of mean maximum and minimum relative humidity percentage for the year 1977 & 1981 is given below for comparative study:

Year	Months											
	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
<u>1977</u>												
Max.	72	63	67	77.4	82.2	85.7	90.0	90.3	88	88	85	78
Min.	33	30	24	35.5	49.0	62.2	75.7	77.7	68.5	55	49	37.5
<u>1981</u>												
Max.	79.6	74.2	75	77.0	85.7	83.5	90.8	89.0	87.3	72	68	66.3
Min.	50.6	47.7	47	48.6	65.0	66.6	82.0	76.0	70.8	53.3	43.9	47.0

2.2 Topography:

2.2.1 Altitude:

The project area is widespread between alluvial plains on the east and plateau of Chotonagpur on the west. The entire Bishnupur sub-division and a part of Sadar sub-division may be described as plain land. The slope gradually becomes undulating towards the west and in the extreme North-west bordering Purulia and Midnapore District small hills also occur. The altitude here vary between 150 m. to 450 m.

2.2.2 Mountain ranges:

The following isolated peaks are observed on the western part of the District:

- i) Biharinath hill P.S. Saltora - 447.8 m.
- ii) Susunia hill P.S. - 395 m.
- iii) Maskar Pahar - 122 m.
- iv) Kora or Kasa hill - 122 m.
- v) Majio hill - 61 m.

Further, there are three hillocks in Khatra, Ranibundh and Raipur. Fine combination of alluvial plains and undulating hilly terrain along with vast stretches of Sal trees in the eastern and southern part, flowering trees of Mahua and Palas in the western part and lofty planted Eucalyptus tree all over the district offers a picturesque scenery, which attracts visitors from industrial areas of Calcutta and neighbouring districts particularly in the winter season.

2.2.3 Aspect:

Main aspect is south-east, but in hilly portion all sorts of aspect occur.

2.2.4 Slope:

The elevation is pronounced in the north-west, and the general slope runs from north-west to south-east, hence most of the rivers also flow towards south-east.

The district can be topographically divided into three regions as below :

- a) Hilly country in the west.
- b) Undulating tract in the middle.
- c) Alluvial plain in the east.

2.2.5 Drainage:

The project area is well drained by a number of rivers. Among the principal rivers, Damodar flows along the northern part of the district and separates Bankura District from Burdwan District while Kangsabati river originates from Jhabar hills of Hazaribagh District and runs through Purulia district entering Bankura district at Ambikanagar where Kangsabati Dam has been constructed. The river Darakeswar, however, runs almost all along the district from west to east.

The list of rivers flowing through the district is given below :

S.No.	Name of river	Total length in the Distt. (km.)	P.S. through which passing.	Source of origin.	Joins at
1.	2.	3.	4.	5.	6.
1.	Damodar	89.6	Saltore, Mejia, Gangajalghatia, Barjora, Sonamukhi, Patralayar.	Hilly country of Chotanagpur 96 km. west of Ramgarh i.e. border of Bankura.	River Hooghly in Howrah District.
2.	Sali	73.6	Gangajalghati, Barjora, Sonamukhi.	Western part of Gangajalghati P.S.	Damodar river at village Somsal in Indpur P.S.

1.	2.	3.	4.	5.	6.
3.	Darakeswar	107.2	Chatna, Bankura, Bishnupur, Joypur, Indus.	North of Hura P.S. Purulia District.	River Bhagirathi near Diamond Harbour.
4.	Gandheswari	33	Saltora, Chatna, Bankura.	Shearbodia, Mourjia, Saltora P.S.	River Darakeswar a few mile down stream from Bankura town.
5.	Berai	30	Onda, Bishnupur.	Ratnapur, Onda P.S.	River Darakeswar at village Chakdah a three mile north of Bishnupur.
6.	Silabati	56	Indpur, Baldangra, Simlapal.	Puncha P.S. Purulia.	Darakeswar in Midnapore District.
7.	Joypalda	43.2	Indpur, Onda, Taldangra, Simlapal.	Village Chaindihi, Indpur P.S.	River Silabari a little sort of village Bhutsapur.
8.	Kangsabati	56	Khatra, Ranibundh, Raipur.	Jhapur hills of Hazaribagh.	River Darakeswar with silai in Chatara Sub-division.
9.	Kumari	8	Ranibundh	Bagmundi, hills in Asha P.S. Purulia.	Kangsabati river near village Baddi, Ranibundh P.S.
10.	Bharanbanki	32	Ranibundh, Raipur.	South-eastern part of Ranibundh.	Kangsabati river in Midnapore.
11.	Baraferin	9	Raipur	Midnapore District.	Kangsabari river in Midnapore District.

2.3 Geology, rock and soil:

2.3.1 General description of rock system and soil:

The area comprises of most diversified rock types belonging to Precambrians and also sedimentaries like Gondwanas and tertiaries. The

Precambrians include various types and grades of mica schists and gneisses, hornblend schists, amphibolites granulites, epidiorites, quartzites dolomitic and younger basic intrusives. The Gondwanas comprise of thick piles of sandstone and shale with coal seams. Towards the end of the sedimentary sequence, extrusions of Rajmahal trap occur with the associated intertrappeans. The tertiaries include sandstone, gravel, clay and semi-consolidated sand. A general stratification of the rocks in this district is indicated below :

Recent	- Newer Alluvium
Sub-Recent to Ploistocene.	- Older Alluvium
Ploistocene to Tertiary	- Laterite
Tertiary-Miocene	- Gritty ferruginous sand stones, ferruginous shales and coarse yellowish sand stone (occasionally) with dicotyledonous fossil wood and usually with a quartz gravelly horizon underlain by clay beds.
Unconformity	-
Rajmahal	- Dolerite (related to the post Gondwana dykes of Ranigunj coal field).
Lower Gondwanas	- Coarse feldspathic (occasionally ferruginous) sandstones, reddish and greyish shales with plant fossil.
Unconformity	-
Archean	- Quartz veins, Pegmatites, Granite-gneiss, Hornblend schist, talc-hornblende-schists, epidiorites, chlorites, norites, anorthosites, Carbon-phyllites, chloritic magnetite schists, dolomites, crystalline limestones, calogranulites, quartzites and associated rock.

Archeans display maximum development in Bankura. The Gondwana rocks extend into the northern part of the district. Similarly older and new alluvium are well developed in the south-eastern parts. The older alluvium are generally found in the higher level and newer alluvium generally occupies lower levels in the vicinity of rivers and rivulets. Laterites occur sporadically in the forms of consolidated blocks as well as in loose assortments as capping on Gondwana or other formations. They are usually red in colour ferruginous and psolitic and the thickness vary from a few inches to 4 metre deep. Dolerites (Rajmahal) are located in the vicinity of Jemua and Deoli villages.

2.3.2 Mineral resources:

Rich deposits of mineral resources occur in the district of Bankura. Commercial exploitations of these minerals are done outside the forest area. The following are the principal mineral resources :

- China clay: A number of good deposits of China clay have been identified from this district. The deposit of China clay occur within the latitudes of 22° 46' and 23° 34' and longitude 86° 29'. Occurrences of China clay is recorded near Jharikocha, also near the fault zone in the hillocks north-east of Bagjabra and south-east of Peripathar.
- Coal: Major part of coal deposit lie in the east of Barakar river within the Budwan District with slight extension to Bankura.
- Dolomite: Crystalline dolomitic limestone occur in the neighbourhood of Harirampur village, Guniada hillocks and Champabani.
- Mineral pigments: Occurrences of carbon phyllite have been recorded in the Kasai river near the Kangsabati dam. They can be probably used in Paint industry.
- Wolframite: In West Bengal, there are two known occurrences of Wolframite both located in the south-western parts of the Bankura District viz. one around Chhendapathar village and the other near Porapahar. At Porapahar tungsten ore is detected as disseminated grains and patches in the two quartz veins but no regular deposit has been found. Detailed investigations have so far failed to prove anything worthwhile.
- Garnet: Crystals of garnet have been reported to occur in the district.
- Magnetite ores: It occurs interlaminated with quartzite and gneise near Biharinath hill and Porapahar.
- Mica: Occurrence of small sheaths of ruby mica or ordinary Mica has been reported from Kaduri and Pirrabani in Bankura District.
- Talc & Steatite: Occurrences of this mineral has been reported from Matgoda, Maula, Kudiha and Punchpathar of this District where they are quarried.
- Vermiculite: Occurrences of this mineral has been reported from Pubayen in Bankura District.

2.3.3 Soil:

Broadly speaking, Bankura has three distinct types of soil - Red soil, Laterites and Alluvial. As one proceed from east to west of the district a regular sequence from flood plains alluvium to pure lateritic soil is noticed. Although the process of laterisation is vivid all over the district the soils cannot be grouped either as true laterite or even lateritic soil. Red soil occur in the margin of hills which differ from lateritic soil in having higher exchangeable calcium and comparatively higher silica alumina ratio. The brown soil which is also of common occurrence is mainly derived from rocks like sandstones, granite and schists of both calcareous and non-calcarious nature.

3.0 Land use pattern and assessment of condition of land, erosion status etc.

The land utilisation pattern of the district is not a constant feature. It changes with years. Waste lands are reclaimed every year. Roads, buildings and new constructions are continuously coming up. More and more areas are being taken up under double cropping.

The average agricultural holding in the district is about 1.5 acres. About 53% of the total areas is under net cropped area. It is estimated that about 7% of the areas is not available for cultivation.

The land utilisation pattern of the district as per latest statistics is depicted below :

Land Utilisation in Bankura District (in thousand hectare)

Total area of the district	: 687.10
Area under forests	: 139.56
Area not available for cultivation	: 41.44
Other uncultivated land excluding current fallow	: 72.58
Current fallows	: 54.66
Net area sown	: 378.86

Serious attempts have been made towards land distribution work and it has indeed gained some momentum in recent years. The following table shows the distribution of vested land for agricultural purpose upto 30th June, 1981 :

District	E.A.Act (in ha.)	L.R.Act (in ha.)	Total (in ha.)	Area of land available for distribution (in ha.)
Bankura	14185.11	1900.92	16086.03	4284.47

The process of flood and wind erosion and the process of deposition of the eroded materials are two distinct aspects of the problem of soil erosion. When erosion takes place in a particular region, the soil robbed of its wealth gradually becomes poorer and poorer. Deposition of eroded materials like silt can enrich lands on lower reaches but the phenomenon is not necessarily beneficial everywhere. Constant silting up of the beds of rivers obstruct their easy flow. The Damodar has been checked up to a great extent by sand aggregation. Such decay of a river system adversely affects agriculture, health, commerce and communication in the riverain tracts. Soil erosion even threatens, to silt up the reservoirs, barrages and channels constructed under various river valley projects which indicate the great importance of soil conservation measures.

The problem of soil erosion in Bankura district is being tackled jointly by the Department of Forests, Agriculture and Community Development. Contour bunds have been set up in different areas and many more are scheduled to be constructed in the near future. Detailed programme of afforestation is in the process of execution by the Forest Department. But the problem is so vast that coordinated soil conservation scheme is necessary to tackle the problem adequately. Total area affected by severe soil erosion in Bankura District is estimated to be 70,400 ha. It is gratifying to note that the State Forest Department has already taken up a massive soil conservation programme in the area under various schemes and these are being taken up in increased scale from year to year. The soil

conservation measures include contour trenching, disiltation dams, gully plugging, construction of check dams, and afforestation of blank areas.

Land of Bankura, particularly in the western and northern parts, are mostly lateritic and undulating in nature. Accordingly, a good portion of the uplands is cultivable waste, land is subject to erosion hazards because of absence of adequate vegetative cover and low moisture holding capacity of the soil. The river, streams and even the tanks and other water reservoirs are also getting silted up. Even the cultivated lands are often damaged due to the deposition of sand and gravels. Eating away of the cultivated land by the expanding gullies are very common. The State Agriculture Department is now taking a multi directional approach described below to combat this menace.

- a) The waste lands, particularly in the catchment areas of the Kangsabati, Silabati and Gandheswari rivers are being surveyed (i) for assessment of land suitable for agricultural purposes (ii) to indicate the soil conservation measures required to be taken in these lands before bringing them under cultivation and (iii) to determine the types of crops that could be raised best considering technical and economic aspect.
- b) Soil conservation measures, namely contour bunding and terracing are being undertaken at Government cost in the cultivable waste lands and also in the cultivable lands which are subject to erosion hazards. In addition, the cultivators are also being given extra incentive in the form of free supply of manures and fertilizers for reclamation of these lands.
- c) The gully control work has also made some progress in these areas. This will help to achieve better moisture conservation and at the same time prevent the gullies from scouring away the adjoining lands.
- d) Social forestry is also being taken up in large scale in the private land through the agency of Forest Department.

4.0 People and their socio-economic condition:

The population of the project area is about 23,74,000 according to 1981 census. The density of population per km² is 345 as against West Bengal average of 615 persons per km². Literacy is only 26% which is also less than the general literacy position of West Bengal. Persons with advanced education are few in rural areas but in the urban area the position is much better. About 91.84% of the population are workers including agriculturists working for themselves.

The socio-economic structure of the area is rather poor. Employment opportunities are erratic and is not uniform throughout the year. The months of September, October, April and May are the months when employment opportunity is very less there being virtually no agricultural work during these months. People in general live on day to day earning and therefore during these four months of lean agricultural season a number of people remain unemployed. A percentage of this category resort to illicit practice during this period to earn their livelihood. About 30 % of the population of the district live below the poverty line.

There is high concentration of Scheduled Caste population in this district which comprises of about 28.89% of the total population as per 1981 census. There is also a fair amount of tribal population in the district which forms 10.55% of the total population as per 1981 census. Most of the tribals are largely dependent on forests for their livelihood and their religion as well as culture are largely associated with the forests in the area.

The district of Bankura has essentially an agrarian economy as about 82% of the population depend on agriculture. The average agricultural holding is in the order of 1.5 acre. Nearly 55% of the total area of the district falls under net cropped area, and cultivable waste aggregate to as much as 11% of the total land area. Rice is the main crop and occupy about 90% of the net cropped field. A large portion of the district is undulating and falls under drought prone areas where double cropping is not possible without artificial irrigation which is yet to cover a large portion of the district.

In spite of the presence of rich mineral resources, the district is industrially backward. No major industrial complex is there in the district. Only some wood based industries in the form of Saw Mills are in existence. However, a good quantity of forest produce, particularly from plantations finds its way out to Paper Mills at Ranigunj and Calcutta.

During the course of inventory, it was estimated that about 20 Saw Mills with total annual capacity of 11836 m³ is there in the district. The forests having covered approximately 21.5% of the land area and being fairly well distributed all over the district has a reasonable role to play in the matter of upliftment of the economic status of the people by offering employment in the form of development work and in building up of cottage industries based on various minor forest produce.

The main tribal communities of the district consist of Santhals, Oraon, Munda, Bhumiya, Kaora, Mahali, Kheria and Malpahariyas. Of these communities, Santhals have got specific attachment to forests. They regard certain category of trees in the forests as their own property and try to resist any action organised to cut, remove and replace the same by different types of species in the area. Fruits and flowers of trees like Mohul, Karanj, Kusum etc. are collected by the local population for eating and extraction of edible oil etc. and hence they have got natural tendency to protect these seedlings wherever these are found.

Linkages between peripheral rural areas and town centres are not adequate. The limited access of rural people to productive resources, social services, public facilities, markets for agricultural commodities as well as consumer goods perpetuates rural poverty. The frail linkage among settlements in the interior areas makes the spread of development from urbanised centre slow and uncertain.

5.0 Forests:

5.1 Classification by types & vegetation:

The inventory results of the district have shown that the present vegetation of the area consists of the following types:

1. Area containing predominantly Sal Forest. Here Shorea robusta contains almost 86% of the crop. Other important associates have been found to be Madhuca latifolia, Diospyros melanoxylon, Buchanania latifolia, Terminalia tomentosa, Terminalia belerica, Terminalia chebula, Syzgium cumini, Alstonia scholaris, Aegle marmelos, Lagerstroemia parviflora, Butea frondosa etc. This Sal forest can be classified as Northern Tropical Dry Deciduous Forests under Champion & Seth's classification.
2. Area containing mainly miscellaneous species with scattered Sal or Sal being totally absent. The miscellaneous species found mainly in the area are Terminalia tomentosa, Madhuca latifolia, Diospyros melanoxylon, Buchanania latifolia, Aegle marmelos, Azadirachta indica, Syzgium cumini, Terminalia belerica, Terminalia chebula, Semecarpus anacardium, Hollarrhena antidysenterica etc.
3. Area raised by plantation and containing species like Eucalyptus, Acacia auriculiformis, Alstonia scholaris etc. along with miscellaneous species like Madhuca latifolia, Diospyros melanoxylon etc. which exist as unfelled trees of original forest stand.
4. Areas containing scrubs and blanks with thorny and bushy vegetation like Eupatrium, Combretum, Zizyphus etc. with or without small and scattered trees of stunted growth.

5.2 Stratification:

Three distinct strata namely Sal, Miscellaneous and Plantation can be identified in the project area. From the scrub and blank areas, no outturn can be expected in near future. As such, it has not been considered as a distinct strata and has been excluded from growing stock estimation.

5.3 Legal status:

The forest areas belonged to old Zamindars in the past but with the introduction of Estate Acquisition Act and fixation of land ceiling, a remarkable change took place leading to abolition of intermediary rights. Accordingly, practically all the big holdings were transferred to the Forest Department in several stages by way of taking over of the same under section 10(2) of EA 1953. Gradually steps were taken to declare these forests as protected and reserved. The statement showing the present Division-wise legal position is given below :

Name of the Division.	Total reserved forest(in ha.)	Total protected forests(in ha.)	Total other forests(in ha.)	Total forests of the Division (in ha.)
Bankura North	5490.92	60,213.53	8777.55	74,482.00
Bankura South	700.77	58,965.15	5409.51	65,075.43
Total :	6191.64	1,19,178.68	14,187.06	1,39,557.43

Forests are scattered over about 2000 numbers of Moujas. Declaration of the entire forests as reserve is taking time due to various local rights and demands as well as various cases filed in the matter in various Courts. Further, classification of forest land is still to be finally decided in certain areas by the settlement authorities.

5.4 Demarcation and forest settlement:

Most of the areas of forests where P.S. maps were available have been demarcated and cattle proof trench or external boundary trench dug along the border. The forests of this district being in innumerable small pockets, the length of external boundary is extremely long. Most of the external boundary is artificial hence annual checking, maintenance and repairs of external boundary is essential.

The total length of external boundary surveyed has been demarcated by boundary trench with boundary pillars at important points. Boundaries are also demarcated by placing sowings of Akashmoni, Cashew and cuttings of Agave and Ipomoea on the heaped soil of trenches.

5.5 Rights and privileges:

As the forests have vested in the State free from all encumbrances the rights and concessions so long enjoyed by private individuals in the forests have been extinguished. However, as per the new directive of forest management in tribal areas issued by Land Revenue Department of the Government of West Bengal in July 1980, certain privileges and concessions of the tribals living in the vicinity of forests have been admitted.

The tribals have been allowed to collect free of charge the following forest produces, from the forests :

1. i) Brush-wood/Jhanti for domestic use-headload per individual and cart-load per group;
ii) Leaves, flowers, fruits and seeds of tree like Mahua, Peasal, Kendu, Sal etc.
iii) One pole per tribal house-hold per annum to be used as plough and three poles per tribal house-hold for house construction every 3 years; and
iv) To assign any tree in the forest as Jaherthan for the purpose of offering prayer and worship by tribals.
2. Such free permits are to be issued to two persons per tribal house-hold situated in or around the forest area.
3. The Scheduled Tribe and Scheduled Caste families occupying the reserve and protected forest land for a pretty long time before August, 1977, would be assigned pattas upto an area not exceeding one acre per house-hold, after screening by a duly appointed committee.

Where such persons have settled deep inside forests, attempt would be made to persuade them to move to the periphery where they would be assigned land upto aforesaid limit.

In addition to the uses of forest produce free of charge for domestic consumption, the tribals have also been allowed some concession in the matter of trade of forest produce. Monopoly rights of collection of Kendu leaves, Sal seeds and their primary processing have been given to Tribal Co-operative Societies. In certain areas they have also been allowed coupe operation, Cashew nuts collection etc. in fixed rate. Apart from those, tribals have also been given priority in casual employments in forest areas.

Government expects that these privileges and concessions would go a long way in allaying the misunderstanding that had developed in certain areas and would bring about harmonious relationships between the forest administration and the local tribals, which in turn would help in protecting and developing the forest wealth of the region.

5.6 Present system of management:

5.6.1 Area covered under Working Plan management:

The first Working Plan of Bankura forest Division covering both existing north and south divisions proposed for the period 1978-79 to 1987-88, covers almost the entire forest area of the district. The estimated area of Working Circle as per the first Working Plan is given below :

<u>Name of the Working Circle</u>	<u>Area in hectare</u>
Sal	69,226.65
Pulpwood	49,374.55
Sal high forests	8,436.31
Timber conversion	6,610.35
Total :-	1,33,647.86

The total forest area of the district as per record of Working Plan is 1,39,452.56 ha. out of which 1,33,647.86 ha. is covered by Working Plan prescription. The area, therefore, not covered by Working Plan is 5,804.70 ha. which represents mostly encroached forest land and forest land diverted for other purposes.

5.6.2 Short details of management:

The objects of the management as per this Working Plan are :-

- i) To convert the existing irregular forests to regular forests so that sustained yield from it can be ensured.
- ii) To follow a balanced and complementary land use system in which a particular type of land is put to that form of use to produce most and deteriorate least.
- iii) To utilise the full potential capacity of the forest to the best advantage of the people within the framework of scientific forestry.
- iv) To meet the demand of wood based industries and Sal poles and local demand in respect of timber and firewood.
- v) To create natural habitat for wild life for maintaining ecological balance of flora-fauna.

The object of management is covered by putting the forest areas under four working circle as mentioned above. Short details of each of the Working Circle is given below :

1. Sal Coppice Working Circle:

All Sal coppice areas not included in any other Working Circle of this plan have been brought under this Working Circle. This also includes degraded Sal areas which have got coppice potential and adequate stock which by protection and cultural operation is capable of producing good Sal coppice. The object of this Working Circle is to produce Sal poles for meeting the local demand of house construction and firewood.

2. Pulpwood Working Circle:

This Working Circle covers mostly blank areas, miscellaneous scrub forests and extremely degraded Sal forests where the number of stumps per ha. is less than 200 and which even on proper treatment and protection is unable to produce good Sal poles. This Working Circle also includes older plantations excepting those included in Sal high forests working circles and timber conversion working circle. The object of this Working Circle is to convert the unproductive areas by plantation of quicker growing species in order to meet the industrial demand of wood as well as local demand.

3. Sal High forests Working Circle:

This working Circle includes well growing patches of Sal coppice on better sites with the object of meeting the demand of big sized trees and small wood. This also includes some better quality old plantations which can be protected and can grow to commercial sizes. The intention of this Working circle is also to create good natural stock of different important species which may serve as habitat for wild life and other ecological conservation.

4. Timber Working Circle:

This Working Circle is created primarily to provide quality timber for various industries and other domestic users. The tract selected for this Working Circle consist mostly of open hill terrain of Khatra, Ranibundh and Saltora Ranges and char plantation at Metzia in Gangajalghati Range. In addition to the production of large sized timber and poles, the other objects of this Working Circle are also to reduce soil erosion in the area to bring soil water equilibrium and to create suitable abode for wild life.

5.6.3 Exploitation:

In Sal coppice Working Circle since the aim is to produce poles for domestic and other consumption and poles of 10 cm. diameter are considered adequate for such purposes, the rotation is fixed on 15 years by which time the average crop of the coupe is expected to reach 10 cm. diameter. The actual coupes are sold in auction or departmentally operated in which the existing coppice shoots are cut almost flush to the ground and exploited to meet the local demand of both poles and firewood.

In Pulpwood Working Circle the inferior forest crop is cut flushed to the ground and undesired stumps uprooted and sold to local people by permit. Thereafter the areas are planted with quick growing species of Eucalyptus and Akashmoni mixed with cashew and cassia in some cases. The produce of this Working Circle where Eucalyptus is dominant species is worked in 10 years rotation by allotting the pulpwood plantation to Paper Mills of Calcutta and Raniganj. Mixed plantations are also felled in 10 years cycle. Good areas of Akashmoni should however, be attempted to be retained for 15 years where affording protection is possible. The lops and tops of tree after pulpwood working are sold on permit system to local people.

In Sal high forests Working Circle in absence of adequate data no conversion or rotation period has been fixed now and these are proposed to be determined in the next plan after analysing development and results of this management.

In Timber Conversion Working Circle, the system prescribed is clear-felling followed by artificial regeneration of the area by valuable timber species like Teak, Sal, Sissoo, Akashmoni, Khair, Simul, Haldu, Sonalu and Gamar etc. Bamboos should also be grown where original forest contained bamboo. In upper ridges where soil depth is shallow Alstonia, Cassia and Mangifera may also be planted. Rotation fixed is 60 years for most of the areas. The produce coming out of this Working Circle is expected to meet the demand of furniture and quality wood for house construction etc.

The Bankura forests yield primarily Sal poles having 5 to 15 cm. diameter at butt end which have a high export potential. These poles are locally used as house posts, as props for drawing water from wells, for erecting sheds for betel leaf crops etc. and are exported as props in collieries or as posts for scaffolding or for building construction purposes. A large percentage of poles find their market outside districts and States. Timber production is, however, low as large trees are now rare. The fuel yield is high and a fair quantity of firewood is exported outside the district. A few minor forest products like Bidi leaves, Sal leaves, Mahua flowers, Simul cotton, grasses etc. are also collected.

6. Forest Resources information:

Though the forest area of Bankura district is more or less uniformly spread all over the area of the district but quantum of forest capital per unit area varies considerably from area to area. In general good forest areas having both reasonable number of stems and volume per ha. is found to occur in the Bankura North forest Division covering ranges Joypur, Sonamukhi, part of Beliatora and Bishnupur.

Forest areas in the north-west and central-west part of the district are largely derelict and consist primarily of regeneration crop. In Bankura South Division good forest is found to occur only in Ranibundh Range and part of Sarenga and Taldangra ranges.

As per inventory results, maximum volume per ha. has been found to be 132.4 m³ in selected forest areas of Sonamukhi range. In Ranibundh range volume of 102.5 m³/ha. has been found. In Joypur range in a sizeable portion volume of 50 to 70 m³ per ha. has been found. In Bishnupur, the highest volume recorded per ha. has been 30 m³. In Taldangra range volume upto 35.44 m³ per ha. has been noted. In general the ranges Saltora, Jatipahari, Baddiha, Indpur and Khatra consist of poor forest areas.

∟ In Beliatora range volume upto 39 m³/ha. has been found.

Number of stems per ha. has also been found to be high in certain plots of Sonamukhi, Beliatore, Joypur and Ranibundh ranges. The analysis of the felling coupe data indicate that maximum number of exploitable poles from the coupe is found to be as high as 2000 stems per ha. Maximum value of coupes per ha. has been found to be as high as Rs. 16,000/- per ha.

Maps & Photographs:

There are about 12 toposheets covering the project area as below :

S.No.	Toposheet No.	S.No.	Toposheet No.
1.	73/ M/1	7.	73 M/8
2.	73 M/2	8.	73 J
3.	73 M/3	9.	73 1/16
4.	73 M/4	10.	73 1/14
5.	73 M/5	11.	73 1/15
6.	73 M/7		

Infrastructure:

A good net work of metalled roads traverse the forests of this division. These roads help in movement of forest produce to and from its railhead depots, stationed in Bishnupur, Sonamukhi, Peardoba and Bankura.

Name of important roads are given below :

State Highway (S.H.) - Total 354 km.

Major District Road (M.D.R.) - Total 70.5 km.

P.W.D. Road under Bankura Division:

S.No.	Name of Road	Km.
1.	S.H. Raniganj - Midnapore Road S.H. 6th to 92 H.D.Mile.	86
2.	Bishnupur - Kotalpur - Arambagh Road	37
3.	M.D.R. Bishnupur - Loop Road	7
4.	S.H. Bankura - Beliatore - Durgapur Road	38
5.	S.H. Beliatore - Sonamukhi - Patrasayer - Rasulpur Road	44
6.	S.H. Bankura - Saltora Road	44
7.	S.H. Saltora - Murulia Road	13
8.	M.D.R. Bankura - Taldangra Road	22
9.	M.D.R. Taldangra - Simlapal Road	19
10.	S.H. Bankura - Ranibundh Road	55
11.	S.H. Taldangra - Bansa Road	37
12.	M.D.R. Bankura - Feeder Road	2.5
13.	M.D.R. Rajgram - Suppanagar Road	10
14.	M.D.R. Bankura - Saltora link Road	5
15.	M.D.R. Gobindanagar link Road	5

No river route is in existence. Kharagpur - Purulia section of the south-eastern railway passes through the district. So far as goods traffic is concerned, this is one of the most important section of the South-eastern railway. Bankura - Damodar river Railway runs for 32.2 km. in the district in a north-eastern direction. It serves mainly as a feeder line to the South-eastern railway. This feeder road passes through the forest areas of Beliatore and Sonamukhi Ranges.

9. Forest based industries:

Saw Mills are observed to be the main wood based industry of the district. During the course of inventory it was estimated that there are about 20 Saw Mills in the area. The largest Saw Mill being Sarenga Saw Mill with an annual installed capacity of 1273.93 m³ and the smallest Saw Mill has an annual installed capacity of only 42 m³. The average capacity of the Saw Mill is estimated to be 500 m³/annum.

Common species used are Shorea robusta, Mangifera indica, Bombax ceiba, Ficus bengalensis, Terminalia arjuna. Among these species again Sal is most commonly used. A good percentage of Sal logs come from outside state like Bihar and Orissa.

CHAPTER - II

INVESTIGATION & METHODOLOGY

2.1 Objectives:

The broad objectives of the present inventory are as follows :

- i) To estimate the total growing stock of the area.
- ii) To examine the extent and composition of the forest crop and its distribution according to size classes and density.
- iii) To estimate the quantity of domestic and industrial wood consumption.
- iv) To arrive at the net wood balance of the area.
- v) To monitor periodically (10 years cycle) the changing pattern of the forest resources.

2.2 Aerial reconnaissance:

No aerial reconnaissance was carried out for the area.

2.3 Mapping:

Photo-interpretation maps for the area was not available. Ground inventory was carried out on the basis of Survey of India toposheets of 1 : 50,000 scale as indicated in para 7 of Chapter-I.

2.4 Inventory Design:

The standard design for ground inventory work prepared by Forest Survey of India was adopted.

2.4.1 Sampling Design:

Each topographical map sheet of Bankura in the scale of 1 : 50,000 was divided into $2\frac{1}{2} \times 2\frac{1}{2}$ grids, which formed the basic sampling unit. Two square plots of an area of 0.1 ha. were laid out in each such grid for collection of field data in prescribed field forms.

The methodology for marking the plot centres of these sample plots on the map in each grid of $2\frac{1}{2} \times 2\frac{1}{2}$ is as under :

The selected random numbers from random number table gives the co-ordinate of the longitude (Y - axis) and latitude (X - axis) of the sample plot. The S - W corner of $2\frac{1}{2} \times 2\frac{1}{2}$ grid is taken as the origin and the distance on X - axis and Y - axis is read and the point is marked on the cross section which gives the plot centre of the first plot.

To locate the second plot centre the first plot centre is joined with the grid centre and the line is extended in the opposite direction. A point is marked at an equal distance in the opposite direction of the grid centre, which will be the second plot centre.

2.5 Field instructions:

For guidance of the field staff, a field manual has been drawn up on listing there-in the nature of the field work to be carried out, details required to be filled in the various columns of the prescribed forms and the code numbers to indicate various details of the area under sampling.

Strict observance of these instructions was ensured during the course of inventory. The data collected was to be filled in the following forms :

S.No.	Type of field form	Description
1.	Plot Approach Form (Form - I)	Details of journey upto reference point and conspicuous feature observed during the journey.
2.	Plot Description Form (Form - II)	General observation on an area 2 ha. around the plot centre.
3.	Plot Enumeration Form (Form - III)	Measurement of all trees from 5 cm. d.b.h. & above in a plot of 0.1 ha.
4.	Sample Tree Form (Form - IV)	An area of 0.025 ha. (1/4th of the plot) is choosen in N - W quadrant for measurement of sample trees.
5.	Herbs and Shrubs Form	Details of herbs and shrubs.

CHAPTER - III

DATA ANALYSIS

3.1 General:

The data processing operation can be broadly divided into three components :

- (a) Manual processing
- (b) Processing on unit record machine
- (c) Processing on computer.

3.2 Manual Processing:

It involve the following steps :-

- (i) Proper documentation of the field informations received.
- (ii) Coding the information in the field forms.
- (iii) Manual checking for validity of codes used.
- (iv) Reconciliation of the discrepancies if any.

3.3. Processing on Unit record machines:

It involves the following steps :-

- (i) Punching of the data on cards.
- (ii) Verification of the cards.
- (iii) Sorting and collating the cards.
- (iv) Listing the punched data for detecting any omission or duplication etc.

3.4 Processing on Electronic Computer:

The steps comprise of the followings:-

- (i) Loading the data on tape/disc.
- (ii) Consistency checking on computer.
- (iii) Corrections of data.
- (iv) Calculation of tree and plot volume.
- (v) Preparation of stand/stock tables.
- (vi) Preparation of growing stock tables.

Suitable computer programmes were prepared to attain the aforesaid items of work on the Electronic Computer.

3.5 Calculation of area:

As thematic maps of the district were not available, the area of the forest, the various strata and other classified groups could not be demarcated and estimated accurately.

The total forest area of the district was obtained from the Divisional Forest Officers of North and south Divisions. The estimations of areas of ~~Bunkura~~ different strata and other classified groups have been calculated proportionately from the total forest area on the basis of number of sample

plots falling in each stratum or classified group. These areas have been shown in various tables given in the subsequent chapters. These areawise break-ups are approximate and have more of indicative value. They do not claim statistical precision.

The areas of different types of forest growth found in the district as per method explained above are given below :

S.No.	Type of forest	No. of sample plots.	Area in ha.
1.	Sal stratum	80	78,564.81
2.	Miscellaneous stratum	11	10,802.66
3.	Plantation	28	27,497.69
4.	Scrub forest and blank areas	23	22,587.00
Total :		142	1,39,452.16

3.6 Tree Volume:

The under bark volume of each section was calculated by Smalicon's formula using a suitable computer programme.

$$V = \frac{\pi}{4} \left(\frac{d_1^2 + d_2^2}{2} \right) L$$

Where, V is volume, d_1 , d_2 the average dia. at the butt ends of a section and L is the length of the section.

3.7 Bark Volume:

No study was conducted.

3.8 Cull Volume:

As the measurement in respect of defective part was not included in the survey the cull study was not done.

3.9 Utility Volume:

The utility study was not included in the objective.

3.10 Volume Study:

Tree Volume study:

No trees were felled for construction of volume equations. The volume equation for Shorea robusta (the major growing species of the area) was developed based on the data collected from the State Forest Department. Regarding other species it was decided that the volume equation constructed for Ranchi District would be used in the present inventory in view of the fact that the vegetation of both the areas exhibit very little variation.

3.10.1 General volume equations:

The following are the general volume equations used in the present inventory :

Species	Equation
✓ <u>Anogeissus latifolia</u>	$V/D^2H = 0.45110 + 0.00161/D^2H$
✓ <u>Syzygium cuminii</u>	$V/D^2H = 0.3750 - 0.001154/D^2 + 0.0077689/D^2H$
✓ <u>Adina cordifolia</u>	$V/D^2H = 0.55615 - 0.0052355/D^2H$
✓ <u>Shorea robusta</u>	$V/D^2H = 0.36701 - 0.0040134/D^2H$
✓ <u>Boswellia serrata</u>	$V/D^2H = 0.43527 - 0.0018469/D^2 + 0.0057489/D^2H$
✓ <u>Terminalia tomentosa</u>	$V/D^2H = 0.42823 - 0.002149/D^2H$
✓ Rest of the species	$V/D^2H = 0.50894 - 0.0019764/D + 0.0078117/D^2H$

V = Volume under bark in (m³)

D = Over bark diameter (m) at breast height

H = Height of the tree in (m)

3.10.2 Local volume equations:

The following local volume equations have been used for calculation of the volume of the growing stock.

Species	Equation
✓ <u>Anogeissus latifolia</u>	$V = 0.28653 - 0.97687D + 11.024 D^2$
✓ <u>Syzygium cuminii</u>	$V/D^2 = 6.2214 - 0.49649/D + 0.016042/D^2$
✓ <u>Adina cordifolia</u>	$V/D^2 = 13.437 - 1.3527/D + 0.04472/D^2$
✓ <u>Shorea robusta</u>	$V/D^2 = 6.90733 + 0.00389/D^2 - 0.27516/D$
✓ <u>Boswellia serrata</u>	$V/D^2 = 10.306 - 1.124/D + 0.03356/D^2$
✓ <u>Terminalia tomentosa</u>	$V/D^2 = 9.4721 - 0.84158/D + 0.022389/D^2$
✓ Rest of the species	$V/D^2 = 9.5879 - 0.89224/D + 0.025584/D^2$

V = Total volume under bark in metre

D = Over bark diameter (m) at breast height

H = Height of the tree in (m)

3.10.3 Volume of trees enumerated:

With the help of the local volume equations and diameter of enumerated trees, the total volume (U.B.) of a tree is computed.

3.10.4 Plot Volume:

Tree volumes of all trees occurring in a plot is added to obtain the plot volume.

3.10.5 Volume per hectare by strata:

Three distinct strata namely Sal, Miscellaneous and Plantation were identified in the area. Volume per hectare by strata is given as under :

Stratum	Volume per ha.(m ³)
Sal	14.636
Miscellaneous	22.209
Plantation	4.335

3.10.6 Standard error:

Standard error for the estimate of volume per hectare for the three strata is given as below :

Stratum	Vol/ha (m ³)	S.E.%
Sal	14.636	14.87
Miscellaneous	22.209	29.18
Plantation	4.335	26.63

3.11 Tree density study:

From the enumeration results, the estimate of stem/ha. by species and diameter classes were derived for each stratum. These are given in table numbers 1.1 to 1.3.

From a close study of the tables, the following inference may be drawn for each stratum :-

3.11.1 Sal stratum:

The density of stems/ha. is observed to be 402.270.

Regarding the pattern of distribution of the crop it is seen that the stem percentage in diameter class (5-9) cm. is 83.9, for diameter class (10-19) cm. it is 14.2, for diameter class (20-29) it is 1.5.

The percentage occurrence of diameter classes higher than 30 cm. is rather insignificant. It is observed that Shorea robusta accounts for 86.2% of the total stems in the stratum. Other important species are Madhuca latifolia (2.8%) & Diospyros melanoxylon (2.5%).

3.11.2 Miscellaneous stratum:

The density of stems per hectare is 429.957. It is observed that about 89.2% of the stems occur in diameter class (5-9) cm., 5.5% in diameter class (10-19) cm. and 2.8% in diameter class (20-29) cm. while only 2.1 occurs in diameter class (30 - 39) cm. The main species in the stratum and their percentage of occurrence is given as below :-

Sl.No.	Species	% occurrence
1.	Buchnanian latifolia	3.6
2.	Diospyros melanoxylon	5.1
3.	Madhuca latifolia	6.6
4.	Shorea robusta	63.4
5.	Terminalia tomentosa	7.8

3.11.3 Plantation stratum:

The density of stem per hectare is 155.505. This indicate a degenerated status of the crop in general. However, it is observed that in certain areas the density of crop is as high as 680 stems/ha. This variation is mostly due to biotic interference whose degree vary from area to area.

Regarding the percentage occurrence of various diameter classes it is seen that 80.5% of the stems are in diameter class (5-9) cm. and 18.0% in (10-19) cm. and rest falls in diameter class (20-29) cm.

The main plantation species are - Eucalyptus (81.4%) followed by Acacia auriculiformia (11.1%) and Alstonia scholaris (2.9%).

3.12. Volume Studies:

The estimate of volume for Sal, Miscellaneous and Plantations strata were separately derived as given in table No. 2.1 to 2.3.

A close study of the table leads to the following deductions :

3.12.1 Sal stratum:

The volume per hectare is 14.636 m^3 . This poor status of the crop is due to adverse biotic factor and demands an immediate attention for protection.

Regarding the distribution of volume in various diameter classes, it is seen that about 39.0% of the volume belongs to diameter class (5-9) cm. and 30.9% of the volume belongs to (10-19) cm. while 30.1% of the volume pertains to higher diameter class.

It is observed that Shorea robusta is the main volume contributing species and contribute about 68.4% of the total volume.

3.12.2 Miscellaneous stratum:

The volume per hectare in the stratum is 22.209 m^3 . Thus the status of the crop in the stratum is better than that of Sal stratum. Regarding the distribution of volume in various diameter classes, it is seen that 24.7% of the volume belongs to the diameter class (5-9) cm. and 12.1% of the volume for diameter class (10-19) cm. while 63.2% of the volume falls in higher diameter class.

Further, it is observed that Terminalia tomentosa is the main volume contributing species and contribute about 27.8% of the total volume.

3.12.3 Plantation stratum

The volume per hectare in the stratum is 4.335 m^3 .

Regarding the distribution of volume in various diameter classes, it is observed that 32.2% of the volume belongs to diameter classes (5-9) cm. and 45.4% of the volume belongs to diameter class (10-19) cm. while 22.4% of the volume falls in higher diameter class.

3.13 Local volume tables

The local volume table for important commercial species occurring in the project area was prepared as shown in Table No.1.

Table No.1

Dia. Class	<i>Alseodaphne</i> <i>latifolia</i>	<i>Syzygium</i> <i>cuminii</i>	<i>Adina</i> <i>cordi-</i> <i>folia.</i>	<i>Shorea</i> <i>robusta</i>	<i>Boswellia</i> <i>serrata</i>	<i>Terminalia</i> <i>tomentosa</i>	Other species
5-9	0.014	0.011	0.110	0.016	0.005	0.009	0.010
10-19	0.118	0.074	0.131	0.104	0.087	0.099	0.097
20-29	0.451	0.267	0.519	0.373	0.376	0.384	0.382
30-39	1.003	0.585	1.177	0.817	0.872	0.859	0.858
40-49	1.776	1.027	2.103	1.435	1.574	1.523	1.527
50-59	2.770	1.593	3.298	2.228	2.481	2.377	2.387
60-69	3.984	2.284	4.762	3.195	3.595	3.420	3.438
70-79	5.419	3.099	6.494	4.336	4.916	4.652	4.682
80-89	7.074	4.038	8.496	5.651	6.442	6.074	6.117
90 +	8.950	5.102	10.765	7.141	8.174	7.685	7.744

CHAPTER - IV

GROWING STOCK AND YIELD

4.1 General:

The inventory results have shown that approximately 22587 ha. of forest area which constitute 16.2% of the forest area contain no growing stock and have become scrub and blank (Para 3.5). The balance area of forest contains growing stock of various densities and sizes. Density of crop less than .3 has been taken as poor from .3 to .7 as medium, and more than .7 as good. The distribution of the area according to these size classes and stock densities have been found to be as follows :-

Predominant d.b.h.	Area in ha. occupied by crop of density			Area occu- pied by young crop.	Total area in ha.	Percen- tage of total
	Poor ($<.3$)	Medium (.3 to .7)	Good ($>.7$)			
10 cms.	22587.39	27497.69	1964.12	20623.27	72672.47	52.18
10-19 cms.	3928.24	19641.21	3928.24	-	27497.69	23.53
20-29 cms.	3928.24	10802.65	-	-	14730.89	12.61
30 cms. and above	1964.12	-	-	-	1964.12	1.68
Total :	32407.99	57941.55	5892.36	20623.27	116865.17	100.00
% of total area.	27.73	49.58	5.04	17.65	-	100.00

In coppice forest it is often difficult to separate the maltreated and damaged crop from the crop of young regeneration. Due to continuous and frequent cutting the coppice shoots are not allowed to grow and are maintained at regeneration state. A scrutiny of the extent of area felled under coppice regeneration for the last three years shows that an area of approximately 1423 ha. is felled annually. It can thus be reasonably expected that an area of 5692 ha. can be taken as maltreated and damaged crop which has been maintained at regeneration stage due to perpetual and frequent cutting of coppice regrowth. Also an extent of approximately 5892 ha. of plantation has been found to contain young plantation crop. Thus the extent of damaged crop of Sal, within the young crop shown in the above table, would be approximately 9039 ha. Thus the extent of damaged and poor density crop is approximately 41447 ha.

Thus the total area of approximately 64034 ha. of forest has become damaged and scrub. This covers almost 46% of the total forest area.

Sustained yield can be expected only from the crop with medium to good density and the young crop with proper protection. The balance area with poor density and damaged young crop is not expected to provide any yield in near future and appropriate protection, rehabilitation and improvement of stocking is required in this area through plantation activities and appropriate silvicultural operations.

4.2 Inventory result stratawise:

4.2.1 Sal stratum:

The distribution of the area of this stratum according to predominant size classes and density of stocking was found to be as follows :-

Predominant d.b.h.	Area occupied by crop of density			Area occu- pied by young crop	Total area	Percentage of total
	Poor ($<.3$)	Medium ($.3 - .7$)	Good ($>.7$)			
10 cms.	16695.02	15712.96	1964.12	14730.90	49103.00	62.50
10-19 cms.	3928.24	11784.72	2946.18	-	18659.14	23.75
20-29 cms.	2946.18	6874.42	-	-	9820.60	12.50
30 cms. & above.	982.07	-	-	-	982.07	1.25
Total :-	24551.51	34372.10	4910.30	14730.90	78564.81	100.00
Percentage of total area.	31.25	43.75	6.25	18.75	100.00	

Thus approximately 31 % of the stratum contains crop of poor density. Only about 50% of the crop contains density ranging from medium to good. Almost 63% of the area contains crop of predominant diameter less than 10 cms. As explained in para 4.1 approximately 9039 ha. of young crop is in a perpetual state of regeneration due to continuous maltreatment. This crop cannot be subjected to exploitation immediately. Thus a total area of 33590.51 ha. cannot be exploited in near future which constitute 42.76% of the existing Sal crop.

Average volume per ha. in this stratum has been found to be 14.636 m^3 (3.12). The total growing stock is thus $11,49,874.5 \text{ m}^3$ in the Sal stratum.

4.2.2 Miscellaneous stratum

The distribution of the area of this stratum according to predominant size classes and density of stocking was found to be as follows :-

Predominant d.b.h.	Area occupied by crop of density			Area occu- pied by young crop	Total area	Percentage of total area.
	Poor ($\leq .3$)	Medium stock ($.3 - .7$)	Good stock ($> .7$)			
10 cms.	-	Enumeration not done below 10 cms. d.b.h.				
10-19 cms.	-	3928-24	982-06	-	4910.30	45.45
20-29 cms.	982.06	3928.24	-	-	4910.30	45.45
30 cms. & above.	982.06	-	-	-	982.06	9.10
Total :	1964.12	7856.48	982.06	-	10802-66	100.00
Percentage of total area.	18.18	72.73	9.09	-	100.00	

Thus approximately 18% of the area contains crop of poor density and approximately 82% of the area contain medium to good density with the predominant d.b.h. ranging from 10 cms. to 30 cms.

The average volume/ha. in this stratum has been found to be 24.4323 m^3 . Thus the total growing stock in this stratum is $2,63,930.58 \text{ m}^3$.

4.2.3 Plantation stratum:

The distribution of area of this stratum according to predominant size classes and density of stocking was found to be as follows :-

Predominant d.b.h.	Area occupied by crop of density			Area occupied by young crop	Total area	Percent- age of total
	Poor ($<.3$)	Medium ($.3 - .7$)	Good ($>.7$)			
10 cms.	5892.36	11784.73	-	5892.36	23569.45	85.71
10-19 cms.	-	3928.24	-	-	3928.24	14.29
20-29 cms.	-	-	-	-	-	-
Total area	5892.36	15712.97	-	5892.36	27497.69	-
Percentage of total	21.43	57.14	-	21.43		

Thus approximately 21% of the plantation area contains crop with poor density and only 57% of the crop has medium density. There is no crop with good density.

The average volume per ha. in this stratum has been found to be 3.699 m³. Thus the total growing stock would be 119202.48 m³.

The trees in the diameter class 10-20 cm. have been found to be Eucalyptus, Acacia auriculiformis and Alstonia scholaris.

4.3 Annual yield:

4.3.1 Area under present management:

The forest area of the district is managed under a prescribed working plan. Out of the total forest area of 139452.56 ha. (as recorded in W.P.) an area of 133647.86 ha. has been covered by Working Plan prescription. The balance area of 5804.70 has been shown as mostly encroached forest land and land diverted for other purposes.

4.3.2 Area considered exploitable as per this survey:

As stated in para 4.1. 22587 ha. of forest area has been found to be blank and containing scrub growth where the growing stock is almost absent. This area cannot be exploited immediately on a sustained yield basis. Also approximately 41447 ha. of forest areas contains at present damaged crop and crops of poor density. This will also not be available immediately for regular exploitation. Thus only about 75418 ha. of forest area which constitute approximately 54 % of total forest area contain crop of medium to good density including the young and healthy crop and this can be exploited to get a regular and sustained yield.

4.3.3 Future management model:

In Sal stratum the total area of 39282.40 ha. containing crop of medium to good density can be worked under coppice system in order to supply a sustained yield of poles, firewood and smaller timber. The regeneration crop covering an area of 5692 ha. can also be worked on a sustained yield basis under coppice system. The balance area of 33590.51 ha. containing Sal crop has become severely damaged and the crop requires rest, recuperation and improvement of stock. Rehabilitation of this crop is required through appropriate cultural operations. Out of this area, an area of 7856.49 ha. containing crops of predominant d.b.h. 10 cms. & above and density of the crop less than .3 the stocking has to be improved through plantation preferably with miscellaneous species and this may be done in a period of ten years.

In Miscellaneous stratum 8738.54 ha. of the area containing crop of density more than .3 can be exploited on a sustained yield basis in future. This area can be worked under a larger rotation to yield small timber and for minor forest produce. The balance area of 1964.12 ha. containing crop of density less than .3 requires to be planted up immediately.

The scrub and blank area of 22587.39 ha. can be planted up with quick growing species. A portion of the area under plantation stratum containing poor density crop can also be exploited in shorter rotation of five years immediately for improvement of the density of the crop. The remaining area of plantation be exploited on a cycle of ten years.

Thus area available for plantation annually can be as follows :-

Item	Stratum				Scrub forest	Total
	Sal	Misc.	Plantation			
			Poor stock	Good stock		
Total area available for plantation in hectare.	7856.49	1964.12	5592.36	21605.33	22587.39	59905.69
Conversion period in years.	10	10	5 (cutting cycle)	10	10	
Annual target of plantation	785.65	196.41	1175.47	2160.53	2258.74	6576.80

The plantation areas of 9820.61 ha. raised in areas of Sal and Miscellaneous stratum will be worked for smaller timber on longer rotation and the species to be planted will be plants with potential of Minor Forest Produce value.

4.3.4 Estimation of annual yield from different stratum:

The annual yield expected from different stratum as indicated through the present inventory is as follows :-

4.3.4.1 Sal stratum:

The following is the area available for exploitation in a sustained yield basis in the Sal stratum.

Predominant d.b.h.	Item	Medium (.3 to .7)	Good (7)	Young crop
10 cms.	Area	15712.96	1964.12	5692.00
	Vol./ha.	17.02	17.8	
10-19 cms.	Area	11784.72	2946.18	-
	Vol./ha.	38.87	41.12	
20-30 cms.	Area	6874.42	-	
	Vol./ha.	41.80	-	
		34372.10	4910.30	5692.00

If the rotation is fixed at 15 years which is expected to produce a d.b.h. of 10 cms., the annual cut area in the various types of area would be as follows :-

Item	Medium density	Good density	Young crop	Total area
Area of annual cut in ha.	2291.47	327.35	379.47	2998.29

Thus the annual cut area of 2998.29 ha. will include area which will contain predominant d.b.h. varying from below 10 cms. to 30 cms. and above. Thus while calculating expected yield weighted average volume have been calculated for areas of medium density and good density from the volume/ha. given above, for different d.b.h. classes. It is presumed that the young crop will, on maturity, contain good density. Then the yield from the annual cut area will be as follows :-

Type of crop density	Area of annual cut	Volume/ha. in m ³	Yield in m ³
Medium	2291.47	29.47	67529.621
Good	706.82	31.792	22471.221
Total :-	2998.29		90000.842

4.3.4.2 Miscellaneous stratum:

The areas of medium and good stock existing in the stratum is as follows :-

Predominant d.b.h.	Area in ha. with crop density (medium stock)	Good stock
10 cms. - 20 cms.	3928.24	982.06
20 cms. - 30 cms.	3928.24	-
Total :-	7856.48	982.06

It is seen that the majority of the area contain pole crops of 10-20 cms. and the species composition shows that the predominant species are Aegle marmelos, Diospyros melanoxylon, Madhuca latifolia, Terminalia tomentosa, Terminalia chebula, Terminalia belerica besides Anogeissus latifolia, Holarhena antidysenterica etc. which are species having local importance because of their value as producers of minor forest produce. Thus yield will not be available in the immediate future. They should be worked on a longer rotation for timber and minor forest produce.

4.3.4.3 Plantation stratum:

Bulk of the plantation area contains crop of predominant diameter less than 10 cms. The area containing crop of medium density and young crop can be exploited on a sustained yield basis on a rotation of 10 years.

The area of density requires to be restocked as quickly as possible which will require felling. If this area is restocked in a span of five years the annual cut in the plantation area and the yield expected will be as follows :-

Total area of Plantation.	Area with medium stock and young crop			Area with poor stock		
	Area in hectare	Rotation in years	Annual cut in hectare	Area in hectare	Cut back cycle in years.	Annual cut
27497.69	21605.33	10	2160.53	5892.36	5	1178.47
Total annual cut	Average volume per ha.		Yield in m ³			
3,339.	3.699		12350.96			

4.3.5 Total Yield:

Thus the total expected yield according to stratum would be as follows :-

Name of strata	Stocking of the area	Annual cut in ha.	Total yield in m ³
Sal	Medium to Good	2998.29	90,000.84
Plantation	Poor to Medium	3339.00	12,350.96
Total :-		6337.29	1,02,351.80

4.3.6 Total outturn:

However, an examination of past records of the forest division in Bankura District has revealed the following average outturn per annum figures :-

Item	Timber & pole (m ³)	Firewood (m ³)	Total timber & pole (m ³)	Pulpwood (m ³)
Average outturn	58429.66	81439.00	139868.66	11682.77

Besides the above outturn of firewood local people also collect firewood from the forest in the form of drysticks, Kukat jhati, stumps, tops and branches of trees, barks etc. These produce are generally collected on the basis of head loads and cart loads. Although all the records of such permit were not available in all the Ranges, available records indicate that approximately 17772 m³ of firewood in the above mentioned categories are removed from the forest annually by the local people. Thus the total outturn will be as follows :-

Timber & pole	Firewood			Pulpwood (m ³)	Total (m ³)
	From coupe (m ³)	Removed by headload etc.	Total (m ³)		
Average outturn per annum.	58429.66	81439.00	17772.00	99211.00	11682.77 169323.43

4.3.7 Future Yields

It has already been stated in para 4.1 that an area of approximately 64,034 ha. of forest has become damaged and degraded. While calculating the present yield expected from the forest, it was maintained that yield from such an area, on a sustained manner, is not possible, immediately. Improvement of stocking, rest and rehabilitation have been advocated for such crop. Also it was expected that the general condition of the forest crop will improve with better management and adequate protection. Under these conditions, the yield from the forest is expected to come in the following manner :

Scrub and blank area of 22587.39 ha. after planting with appropriate quick growing species is expected to yield a volume of about 90349.56 m³ at the rate of 4 m³/ha. per annum which is the M.A.I. of well grown and good stocked crop in the area.

Also with the improvement of stocking of plantation, the yield per annum from the plantation area will be 109990.80 m³ from an annual cut 2749.77 ha. with a yield of 40 m³/ha.

9039 ha. of damaged Sal crop with predominant d.b.h. 10 cms. will give a yield of 19157.86 m³ for an annual cut of 602.60 ha. at the rate of 31.792 m³/ha. which is the yield from a well stocked area.

Also, if the existing medium density crop are all converted to good density crop, the yield from the Sal stratum will be 95321.64 m³ at the present rate of felling.

The total yield would thus be :

Item	Scrub and blank area	Damaged Sal area with d.b.h.10 cm.	Existing plantation	Present explo- -itable area of Sal	Total
Yield in m ³	90349.56	19157.86	109990.80	45321.64	215819.86

This yield is expected in the near ~~about~~ future, on improvement of condition of the forest crop. The yield from the areas of miscellaneous stratum, and in Sal stratum with poor stocking and d.b.h. 10 cms. - 30 cms. will also be expected on attaining the appropriate age of maturity. This will further increase the above calculated yield.

CHAPTER - V

LOGGING AND ACCESSIBILITY STUDIES

5.1 Objectives:

Detailed analysis of the terrain was not done and the present study was made with the limited objectives to determine the followings :-

- 1) Cost involved in the various steps of harvesting of various categories of forest produce.
- 2). Comparison of the cost prices of various categories of produce.
- 3) To examine the present logging practices and suggestions, if any.

5.2 Extraction routes:

The main Railway line runs through the middle of the district touching a sizeable portion of the forest belt. There are a number of stations with yards connected with selling centres and forests by metalled and non-metalled road. In addition to the P.W.D., Zilla Parishad and Municipality roads which, forms all weather communications throughout the year, there are a number of canal roads which also facilitate the movement of forest produce from forests to marketing or trading centre. In recent years a number of forest roads have also been constructed in big blocks of valuable forest patches particularly in Ranibundh, Sonamukhi, Motgodo, Sarenga and Beliatore ranges. Construction of these interior roads have extended the facility of extraction and have enhanced the marketability of forest products.

The length of various P.W.D., Zilla Parishad and Municipality roads are given below :-

1) Metalled road (P.W.D.)	-	764.75 Kms.
2) Metalled road (Zilla Parishad)	-	507.40 "
3) Non-metalled road (Zilla Parishad)	-	866.30 "
4) Metalled road (Bankura Municipality)	-	75.40 "
5) Non-metalled road (Bankura Municipality)	-	55.70 "
Total		- 2269.55 Kms.

In addition to above, a number of village roads have also been constructed in recent years through the schemes of Test Relief, C.S.R.E., S.E.P., N.R.E.P. etc. which cover a large portion of the district and is fit for carriage of forest produce at least during the dry months of the year (November to May).

5.3 Existing logging practices:

The logging operations practiced in general consist of felling, logging and debarking of the produce, carriage of produce from coupe to road side and carriage by trucks to nearest Rail head depot or selling centres. Felling and logging is done by traditional method of axe and

saws by local labourers with orthodox implements. Cross cut saws are sometimes used for felling of trees to minimise the wastage. Modern scientific method of felling and logging is practically absent in the area.

Power Chain Saws were introduced in some areas by West Bengal Forest Development Corporation through trained loggers at the time of departmental working of poles for supply to flood affected people in the year 1978 and subsequently for supply of poles to the Eastern Coalfield. This, however, did not make much difference in work output as the time required for felling of these small sized poles by orthodox method was not much, and most of the poles being extracted in one piece, there was hardly any scope for detailed logging. Apart from this in the total process of conversion, the felling and logging component was quite small and main time is required in debarking and sorting of the poles for which modern machinery could not be used and this had to be done manually.

Except for some local merchants of lesser financial footing practically all the timber, poles and 'Khadi' fire wood are extracted from the coupe directly by trucks. Only from some interior areas where road communication is absent or poor, extraction is done by carts. In peak season, some small local merchants who cannot procure trucks also extracted a portion of their purchased produce through carts.

As already mentioned better portion of fire wood extracted as 'Khadi' are transported by trucks as it finds its market mainly in the town areas within and outside the district. The smaller diameter firewood which is locally known as 'Jharai' is extracted through carts and this is the main firewood which is utilised by the local population for their domestic consumption. In addition to this, the lops and tops of left out produce twigs and leaves are also extracted from forests by local people on cart load and head load basis for domestic consumption in the villages near-about.

Minimum labour wage rate fixed for unskilled forest worker is Rs.8.58 per day, but experienced and seasoned hand when employed on daily wage basis demand a wage varying from Rs. 10/- to 14/- a day. It has, however, been seen that when the works are done on contract basis, a good worker can easily earn Rs. 15/- a day.

The average comparative rate of conversion and exploitation etc. of various types of forest produce spread over last thirty years is summarised below. It is, however, mentioned here that there is some seasonal variation of the rate of carriage of forest produce both by carts and trucks which becomes highest in the month of February.

Timber - Rate per m³

Year	Felling, logging & debarking (m ³) Rs.	Carriage upto road side by cart m ³ /km. Rs.	Sawing on the basis of finished sawn timber/m ³ Rs.
1950	6.25	6.00	25.00
1955	10.00	7.00	27.00
1960	14.00	10.00	35.00
1965	17.50	15.00	35.00
1970	27.00	20.00	40.00
1975	35.00	25.00	50.00
1976	35.00	25.00	50.00
1982	70.00	85.00	105.00

Sal Poles - Rate per 100 Nos.

Year	Felling & debarking Rs.	Carriage upto roadside by cart Rs.	Carriage by trucks to nearest Rail head depot - Rate %		
			Lead 6 Km. Rs.	Lead 6-15 Km. Rs.	Lead 15-25 km. Rs.
1950	3.00	3.00	8.00	12.00	15.00
1955	5.00	5.00	12.00	17.00	20.00
1960	8.00	8.00	27.00	22.00	25.00
1965	12.00	9.00	19.00	25.00	28.00
1970	18.00	10.00	20.00	26.00	30.00
1975	20.00	14.00	22.00	28.00	35.00
1976	20.00	15.00	25.00	30.00	35.00
1982	60.00	40.00	60.00	75.00	90.00

Firewood - Rate per stack of 1.12 m³/40.5 c.f.t.

Year	Felling, cutting & stacking Rs.	Carriage by cart by km. Rs.	Carriage by truck to nearest Rail head depot. capacity 480 cft.		
			Upto 5 km. Rs.	Upto 15 km. Rs.	Upto 25 km. Rs.
1950	1.50	1.75	3.50	4.00	5.25
1955	1.75	2.00	4.50	5.00	6.00
1960	2.00	2.50	5.00	6.00	7.00
1965	2.30	2.75	5.50	6.50	7.50
1970	2.40	3.00	6.00	7.00	8.00
1975	2.50	3.75	6.25	7.75	8.75
1976	2.60	4.00	6.25	8.00	9.00
1982	10.00	10.00	12.00	15.00	17.50

N.B. The sharp increase in the rate of all forest working between the period 1976 to 1982 is due to steep rise in the labour wage rate and accelerated increase in the cost of petroleum products.

The following tables given below will depict the past and current market prices of poles and different diameter classes:

Sal poles - Rate %

Year	Diameter in cm.						
	2.5	3	4	5	6	8	10
1950	15/-	35/-	60/-	125/-	300/-	450/-	875/-
1955	30/-	75/-	125/-	200/-	500/-	800/-	1200/-
1960	60/-	125/-	200/-	300/-	600/-	900/-	1500/-
1965	80/-	175/-	300/-	450/-	800/-	1200/-	2000/-
1970	100/-	225/-	400/-	550/-	1000/-	1600/-	2400/-
1975	200/-	400/-	600/-	800/-	1400/-	2200/-	3000/-
1976	225/-	500/-	700/-	1050/-	1600/-	2400/-	3100/-
1982	350/-	700/-	900/-	1300/-	1900/-	2900/-	3500/-

Firewood - Rate per wagon f.c.r. Bankura - Railhead Depot

Year	Sal	Miscellaneous
1950	Rs. 150/-	Rs. 100/-
1955	Rs. 300/-	Rs. 200/-
1960	Rs. 700/-	Rs. 400/-
1965	Rs. 1200/-	Rs. 800/-
1970	Rs. 2000/-	Rs. 1500/-
1975	Rs. 2000/-	Rs. 1500/-
1976	Rs. 2200/-	Rs. 1600/-
1982	Rs. 5500/-	Rs. 3500/-

Sal log - Rate per m³

Year	Girth below 1.2 m.	Girth over 1.20 m.
1950	Rs. 140/-	Rs. 175/-
1955	Rs. 180/-	Rs. 220/-
1960	Rs. 300/-	Rs. 400/-
1965	Rs. 375/-	Rs. 450/-
1970	Rs. 500/-	Rs. 600/-
1975	Rs. 700/-	Rs. 850/-
1976	Rs. 900/-	Rs. 1100/-
1982	Rs. 1775/-	Rs. 2485/-

5.4 Terrain classification:

Excepting some small hillocks in Ranibundh area and isolated peaks dotted mainly in the western part of the district, the entire forest tract is undulating to gradually slopping land where the general slope is less than 10%. For the purpose of extraction of forest produce the entire forest area of the district may be considered as accessible as by simple

cutting of forest and dressing of soil extraction paths can be prepared. The cost of construction of such extraction paths in general is not more than Rs. 1000/- per km. in ordinary areas. This, however, may be as high as Rs. 5000/- per km. in heavily stocked and gullied areas where some uprooting of stump may become necessary including filling up of the depressions.

5.5 Proposed logging practices including road planning:

No specific proposal of construction of any new road is made at this stage. It is, however, suggested that the extraction paths in areas having good forests where successive annual coupes are likely to be laid may be improved upon by investment for its gradual conversion into all weather roads. This will allow forest working and entry of bigger trucks inside the forest areas over longer period and may reduce to some extent the crisis of labour and availability of trucks during the peak working season.

5.6 Conclusions:

The district being situated in the drought prone area and forest patches having been restricted in table lands the land adjoining forest belt in general are not double cropping areas, therefore, surplus labour is easily available in the forest belt between the period middle of August to middle of November and again from end of January to end of May. In view of this, and also because of the analysis made in Chapter 5.3 introduction of sophisticated logging equipments does not appear to be a necessity in the district. However, since at present the logging and extraction operation is mainly restricted between the months December to May, the surplus labour cannot be fully utilised. Opening of more all weather roads may make forest operation possible from the middle of September and this when done can greatly solve the economic crisis of the people in the pre-harvesting season.

CHAPTER - VI

CONSUMPTION STUDY

6.1 Objectives:

The objective of the present study is to ascertain the pattern and level of wood consumption under various categories and to compare it with the availability of forest produce in order to find out the surplus if any for establishment of any industrial complex in this lesser developed part of the state.

Data was collected either by direct enquiry in the field or from the records of the Forest Department in the district. The informations were collected and analysed mainly on the following parameters :-

- (a) Wood consumption by large industries.
- (b) Wood consumption for cottage and small scale industries.
- ✓(c) Wood consumption for the construction and repairs of the houses.
- ✓(d) Wood consumption for agricultural implements.
- ✓(e) Wood consumption for furniture making.
- ✓(f) Wood consumption for fuel wood requirements.

6.2 Consumption by large industries:

Timber production in the area is very low owing to scarcity of sizeable trees in the project area. The area is industrially backward and there is no large scale industrial establishment in the district. Only a few medium sized Saw Mills are there of which 20 Saw Mills are actually functioning in the area with a total intake capacity of 11,836 m³ of wood annually.

A regular supply of raw materials from the forests under the control of the Department in this district is maintained to the various Paper Mills located in Calcutta and Ranigunge. In addition as evident from records of State Forest, some minor quantity of timber as is available from the forests is also supplied to the Saw Mills of the district as per details given below :-

Sl.No. & nature of industries	Qty. supplied in metric tonnes
1. Paper Mills	10,000 annually
2. Mines/Collieries	5,000 ,,
3. Wood based industries (Saw Mills)	1,500 ,,

The Forest Development Corporation has also undertaken a contract of direct supply of roughly about 3,00,000 numbers of Sal poles and pit props to the Eastern Coal Field Limited from the forest areas of South Bengal over a period of three years from 1981. Out of this, approximately about 1,00,000 poles and pit props is expected to be supplied from Bankura District.

6.3 Consumption: All scale and cottage industries:

The small scale cottage industries requiring forest produce includes Mollasses, toddy and boiled rice making industries. The requirement of these small scale individual enterprises are mostly met from the end product of forests like small branches or twigs and dry leaves found after working of coupes and sweeping of the forest floor. These products have been excluded from our volume estimation. Hence, these may be considered to be met from sources beyond our estimated yield.

6.4 Household consumption:

Under this three broad categories are considered namely (i) Wood requirement for house construction and repair (ii) Wood required for agricultural implements and (iii) Wood required for furniture making.

6.4.1 Wood for construction and repair of houses:

As already mentioned the total population in the project area is 23,74,000 and the number of houses is about 3,96,000.

A sample survey was carried out to find out the exact quantity of wood used for construction of new houses and it is found that a house under the project area needs about 0.677 m^3 of wood for new construction. Considering the rate of new house construction to be 3.01% (as per analysis of data obtained from sample survey), the total wood required for construction of new houses works out to be 8069.56 m^3 . Further, it is assumed that repairs of wood material of the houses is generally carried out at an interval of 10 years and the quantity of timber required at the time of repair is about 10% of the wood required for new construction. Accordingly, the annual requirement of timber for repairs of houses works out to be 2680.92 m^3 .

6.4.2 Wood consumption for agricultural implements:

Economy of the area is primarily based on agriculture and nearly 80% of the population is dependant on agriculture. In spite of the extension of agricultural activities, the age old orthodox implements-like wooden plough and Rice pounder, are still in use. Further for Bullock carts also some timber is regularly used. It has been ascertained that about 0.12 m^3 of wood is annually required for agricultural implements per family. Thus the total wood requirement for agricultural implements by rural population comes to 37594.87 m^3 .

6.4.3 Furniture making:

During the course of inventory, it was ascertained that about 0.04 m^3 of wood is annually required on an average per family in the project area. Based on this estimate, the total requirement of wood for furniture making comes to 15840.00 m^3 .

6.5 Fuel wood consumption:

Wood is primarily conventional material that serves the purpose of both domestic and industrial fuel. The share of commercial fuel in rural India is meagre.

According to the survey conducted by National Council of Applied Economic Research, the total consumption of commercial fuel in rural India is barely 5.5%. In such areas the non-commercial wood such as firewood, baggasse, Saw Mill waste, vegetable waste, Cowdung etc. are largely used.

A sample survey was conducted in order to find out per capita consumption of firewood. It is found that about 0.3 m³ of firewood is annually required per capita in the area. Thus the total firewood requirement works out to be 7,12,200 m³ annually for 23,34,000 population.

6.6 Total demand:

The total demand for all categories of wood in the district will thus be :-

S.No.	Category of demand	Requirement in m ³
1.	Saw Mill	11,836.00
2.	Paper Mill	14,200.00
3.	Mines/Collieries	710.00
4.	House construction	8,069.56
5.	House repair	2,613.92
6.	Agricultural implements	37,544.87
7.	Furniture	15,840.00
8.	Fuel	7,12,200.00

Total : 8,03,131.35

Thus the demand for timber, poles, firewood and pulpwood is as follows :

Item	Timber & Poles	Firewood	Pulpwood	Total
Demand in-m ³	76,731.35	7,12,200.00	14,200.00	8,03,131.35

6.7 Wood balance :

The present wood balance is drawn keeping in view the following considerations :-

- the trend in the local utilisation pattern of timber, poles, firewood and pulpwood.
- the actual average cutting figures of forest produce as collected from the records of Forest Department has been considered to be the availability.

The wood balance is as below :-

Item	Timber & poles	Firewood	Pulpwood	Total
Availability(m^3) (outturn/exploitation from forests)	58429.66	99211.00	11682.77	169323.43
Demand	76731.35	712200.00	14200.00	803131.35
Balance(m^3)	(-) 18301.69	(-) 612989.00	(-) 2517.23	(-) 633807.92

Thus there is considerable deficit of wood in the district. Again timber, pole and firewood are sent outside the district for sale as shown in para 6.8.

6.8 Movement of forest produce outside the district:

It has been seen from available records that on an average following forest produce go out of the district annually :

Supply of Forest produce outside the project area

S.No.	Particulars	To other districts within the state (m^3)		Outside the State(m^3)		Total for both the Divn(m^3)
		Bankura(N)	Bankura(S)	Bankura(N)	Bankura(S)	
1.	Timber	132.22	5.32	-	-	137.54
2.	Pole	243490(Nos)	453817(Nos)	16740(Nos)	3600(Nos)	717647(Nos)
3.	Firewood	14621.27	50655.66	-	-	65276.93
4.	Pulpwood	6736.32(MT)	3422.26(MT)	-	-	10158.58(MT)

The above table shows that considerable amount of timber, pole and firewood are exported out of the district. These amounts will also not be available for local use and the deficit will thus be increased further.

6.9 Conclusion:

It is thus seen that the total deficit of wood in the district will be more than 633807.92 m^3 . Out of this, approximately 96.7% consists of firewood.

Major part of the deficit of timber is met from the import of timber by the Saw Mill owners from Bihar, Orissa and Madhya Pradesh. A portion of the above deficit is also met from the trees existing in private land. No assessment of wood available from these sources have been made during the inventory.

Rural people depend almost solely on the forest for meeting their firewood need as they have no resources to purchase other fuels to meet their daily requirement. Firewood is generally available from the forest in winter and dry months when some felling operations are in progress. Besides the yield of firewood in stacks, other forms of firewood like small branches, barks, stumps etc. are also collected during this period, by the local people, on headload and cart load basis on permit from the local forests. An indication of annual removal of the category of produce from available records in some offices has already been given in para 4.3.5, which also meet up the deficit. The rural population also continue to collect firewood in the form of Jhati, twigs, leaves and dry fallen branches from the forest throughout the year. These removals are not always recorded and these also go to an extent to meet up the local requirement of firewood.

Firewood and poles are also collected from the forest through illicit removals. A portion of these removals are sold for cash earning as the demand is high. These illicit removals are highly motivated. No authentic record is available for these removals but they have been the primary cause for bringing about degradation in 21% of the Sal crop and for converting, 22587 ha. of forest area into a scrub and blank forest and reducing the density of 32407 ha. of forest area into less than .3 of canopy cover.

C H A P T E R - VII

ECOLOGICAL CHANGES AND STATUS OF FLORA AND FAUNA

7.1. Degree of disturbance and status of forests:

Bankura continued to form one district with Birbhum prior to 1793 after which it was transferred to Burdwan collectorate. Most of the areas of the present Bankura district was a part of & "Jungle Mahal" - a vague term applied in the eighteenth century to denote the forest tract under the Company's possession. In the early part of 19th century, the whole area of Jungle Mahals situated in the present district of Birbhum, Bankura, Burdwan and Midnapore was placed under the jurisdiction of a single officer called the Magistrate of the Jungle Mahal. The judge and Magistrate of the Jungle Mahal Zilla had his Headquarters at Bankura. Bankura continued to form a part of Jungle Mahal till 1833 when it was separated on account of the disturbances which took place in the year 1832 in the west of the district by the Bhumijes of the Jungle Mahals, who were mostly notorious robbers and had long been creating terror in the surrounding districts. The area was then distributed between Burdwan, Manbh-um district and south-west frontier Agency. Subsequently, numerous changes in the jurisdiction of the district took place and the district of Bankura was created in the year 1877. Further modification of the jurisdiction of the district was made in the year 1879 leading to the formation of the Bankura district of present dimension.

To start with large tracts of this district was under forests comprising of principally Sal crop, and trees of higher dimension were available in the uplands, hills slopes and interior valleys. Cultivation was restricted to low lying areas and gentle slopes with deep soils. With the increase of population gradually people started moving from these productive low lying lands to fringe areas and intermediate type of land by cutting forests and extending their cultivation. The erstwhile big areas of forest patches was thus gradually split into smaller units with increased length of forests fringe making the forests more vulnerable to human interference. Cultivation continued to extend further leading to shrinkage of the forest areas and even the forested patches started becoming depleted of stock due to pilferage of trees and poles for human use.

Forests remained under the control of the private owner locally called as Zamindars and management of forests meant only removal of large trees to earn money and diffused collection of fuel to meet the local demand. This was because the export facilities were limited and the private owners were not interested in any investment in developing the forest areas.

Regular exploitation of forests started only after the Kharagpur - Gomoh Railway line of the then Bengal - Nagpur Railway was laid in 1902 to connect the district with the main communication system of the country. Thereafter, the landlord began to treat the forest as an asset by itself which could yield periodic returns. The scientific principle of management being unknown to them, they adopted a cutting cycle of 4 to 5 years only under coppice system because it meant quicker returns. Control of grazing

and fire was not attempted. No interest was taken in conserving and developing the forests. This resulted into vanishing of forests over many areas and the quality as well as stocking of forests in other areas became poor. The forest soil was exposed in many places, surface erosion started in many areas and gully formation proceeded at an alarming rate.

The situation turned so bad that the Government of West Bengal became concerned on the issue and appointed a Forest Committee in 1936 to study the condition and status of the forest area and recommend measures to check the wanton destruction of forests as the larger interest of the country was at stake. As an outcome of this Committee's findings, West Bengal Private Forest Act came into existence in the year 1948 laying down the control of these forests through regular Working Plans which were to be approved by the State Forest Officers. Bankura Forest Division was created in the year 1947 for controlling the management of private forests as well as afforesting the waste land on a very large scale. The main feature of the Working Plan at that time was increasing the rotation of cutting of forests to ten years and retention of standards at the rate of 15 to 20 numbers per acre. Rules for control of grazing and fire were also laid.

Though this control brought in some improvement in the forests by giving the coppice shoots the much needed rest, other provisions of the Working Plan were not seriously carried out because of the investment involved and the rights of the people. It became gradually obvious that a mere control was inadequate for the ultimate improvement of the forests in the area. In this process a large part of ~~ex~~ erstwhile forests was completely denuded and was replaced by rooted waste, which subsequently became invaded by thorny shrubs and useless climbers and hispid herbs.

The Government, therefore, took a bold step and acquired all the erstwhile private forest under the West Bengal Estate acquisition act of 1953. In the beginning the resentment of the people mounted very high and found expression in large scale destruction of forests, which could not be prevented by the Forest Department - the machinery to control being inadequate and legal status being not fully finalised. Gradually, however, people began to accept the acquisition as inevitable and beneficial and with proper demarcation and improved control the forest areas started showing improvement in stocking and growth.

Initial attempt of raising plantations was also marred by local people out of vengeance of loss of propriety right over the forest areas. A portion of the plantations was also damaged due to grazing and fire, control of which took some years. The massive effort of man-made forests started after 1962 on introduction of Eucalyptus as a principal afforestation species in the tract. This species was not only fire hardly but also a good coppicer and was initially avoided by the cattles for grazing and browsing.

7.2. Status of Wild Life:

The district of Bankura had varied wild life population in the 19th century consisting of Tiger, Elephants, Leopard, Bear, Marsh crocodile, Spotted Deer, Wolf, Hyaena, smaller cat and a wide variety of reptiles and birds. With the shrinkage of vegetation, increased interference of forest by man and ruthless destruction of wild life by tribal population in their annual hunting ceremony, (which formed a part of their social culture)

there was wanton destruction of most of the big wild animals most of which moved westward into the areas of Bihar. Grazing and unabated fire destroyed most of the animal fodder in the forests and the herbivorous animal found it difficult to sustain themselves most of which gradually became extinct. The present population of wild life include Wolves, Hyenas, Jackals, Civet cats and other wild cats, Mangose, Hares, squirrels, porcupines, rats, Misc. etc.

Wild Goose, ducks, snipes and Water fowls are found on Damodar and Kangsabati beds. Other birds include partridges, quails, storks, hornbills, Titirs, Warblers, Flycatchers, Munias, Sparrows, Orioles, Pigeons, Doves etc. Jungle Fowl which was once abundant in the area is very much restricted now and Indian Peafowls which were once of frequent occurrence in the area is hardly seen at present. Of the Reptiles, Cobra, Kraits, Dhaman and Vipers are common. With strict enforcement of the wildlife protection act in general (which, however, do not have much control on the annual tribal hunt), in recent years some movement of Leopards and Elephants are again seen in the district.

C H A P T E R - V I I I

8. PHOTO-INTERPRETATION AND REMOTE SENSING STUDIES:

No aerial photographs or satellite imageries were available for the project area and hence it was not possible to make an assessment of forests with respect to geographic distribution, area computation, quantitative or qualitative stock based on photo-interpretation or interpreted imageries. The area assessment has therefore, been made on the basis of the figures supplied by the State Forest Department.

CHAPTER - IX

PLANTATION ACTIVITIES IN THE FORESTS AND URBAN AREAS WITH SPECIAL REFERENCE TO SOCIAL FORESTRY.

9.1 Plantation activities:

Majority of the forests were under the control of Zamindars in past and the forests were managed under coppice system. This was preferred as it yielded easy and early profit. As the input costs required in raising of plantations were high and technique of development of plantations of commercially important species were not fully known, the plantation activities in the district did not receive much impetus in earlier years. Upto 1950 the total area of plantation raised was 91 ha. From 1950 to 1964, plantation over an area of approximately 5000 ha. was raised.

However with the vesting of Zamindari forests with the Government, a large area of poorly stocked and damaged forests came under the management of forest department. Some of these forests had received severe maltreatment under private ownership. Rehabilitation and stocking of some of these areas and their subsequent management were not possible in the traditional coppice system. Areas had to be restocked by large scale plantation activity in order to improve the yield from these forests. The plantation activities were thus accelerated after 1965.

The plantation activities received a further boosting with the advent of special schemes like D.P.A.P., I.T.O.P., Special Component Plan for Scheduled Caste etc. under which plantations of various types were raised.

Plantations are now being raised with quick growing species like Eucalyptus & Acacia auriculiformis to supply pulpwood to the Paper Mills. Miscellaneous plantations and mixed plantations of Asan, Arjun, Cashew, Mahul, Neam, Kusum etc. which yield oil seeds and offer scope for development of cottage industries, are also being raised. In addition, plantations of fodder trees are being raised as an effort towards pasture development. Fuelwood plantations are also being raised to meet the demand for fuelwood. Besides the above, large areas of degraded forests are being planted up under the R.D.F. scheme.

The area planted under different types of plantations for the year 1979-80, 1980-81, 1981-82 have been shown below :-

Year	Plantation of quick growing species	Plantation under R.D. F. scheme	Miscellaneous plantation	Mixed plantation	Rural fuel-wood plantation	Total
1979-80	700 ha.	999 ha.	-	789 ha.	117 ha.	2605 ha.
1980-81	375 ha.	661 ha.	270 ha.	2173 ha.	-	3479 ha.
1981-82	640 ha.	1025 ha.	400 ha.	1691 ha.	200 ha.	3956 ha.

Farm forestry programmes are also being carried out which include distribution of seedlings to the local people. Plantations as shelter belt and on roadside, at an average of 58 km. per year are also being raised.

It is thus seen that the plantation activities at present are of varied nature. It is also seen during the inventory that approximately 21% of the plantation areas have become sparsely stocked and the balance area also does not contain good density crop. Illicit felling has been noticed frequently in plantation areas.

9.2. Social forestry programme and activities:

Though Bankura division came into existence in the year 1947, for control and scientific management of the erstwhile private forests and afforesting the waste land as well as denuded forest land on a very large scale, achievement in forestry in the district had not reached the level of expectation. The forests adjoining the villages still remained subject to maltreatment by the fringe population and even a number of plantations raised to improve the value of the crop was completely ravaged by the local people to meet their demand of fuelwood and sometimes even to earn their livelihood.

This was primarily because of the fact that the early foresters true to the sense of the term worked within the small confines of their professional precincts. Conservation of forests was the sole word in management and a forest officer was for all purpose a pioneer environmentalist. The realisation was slow that with the passage of time and with the increasing population the erstwhile small provisional domain of the foresters is now linked up not only with the life style of the people living by the side of the forests but it has also got intermixed with the total social development where forestry has a great role to play in offering employment to the people living by the side of the forest and opening new avenues of establishment of local small scale industries for their economic sustenance. Thus the age old conservation strategy of the foresters was put to a hard test. Fortunately however, though late, it was realised that a forester's job is not policing alone. He has to study the problem, the need of human population around his forest and mould his forestry strategy accordingly. He cannot have his forests flourishing while the fringe population goes starving on their minimum needs not only of fuel, timber and fruits but also of the basic amenities like water supply, irrigation and economic sustenance.

It also became clear that mere planting of suitable species, protecting them and offering employment to the local people or extending small concessions in the matter of supplying low price forest products could be of little help. Forestry activities in economically backward district like Bankura has to be suitably re-oriented to make forestry an integral part of rural development.

The forest resources as well as land area of the forests of the district being limited, it would be wrong to divert the resources of the entire reserved and protected forests under the direct control of the forest department to meet the requirement of people as lot of industrial projects, paper mills and other nation building activities also demand that

a part of the forest produce must be kept earmarked to meet the commercial and economic development. It was, therefore, felt that the only approach to make forestry an integral part of rural development could be to launch a large scale social forestry programme involving the mass living outside forests in the implementation of the project. All possible available land outside the control of reserved and protected forests should be utilised to build up forest resources by creation of village wood lots, through plantations of marginal lands, spareable cultivable lands, available other departmental lands along road side, canal bank, Railway line etc. and subsequently making the produce grown on this land largely available to local population at a very reasonable rate.

With this concept in view, a special forestry circle was organised in West Bengal about five years back and large scale social forestry programme has been drawn up for the whole state, including the district of Bankura.

The present programme of social forestry in the district consist of four distinct approach (i) establishment of village wood lot in the non-cultivable vested waste land (ii) strip plantation along roads, canal and Railway lines (iii) farm forestry in private land (including marginal lands as well as unutilised cultivable land) (iv) reforestation of isolated degraded forest land which are not economically viable for commercial utilisation and management.

An appraisal of the plantation programme upto 1983-84 indicate that the physical achievement in terms of establishment of plantations are far ahead of the project target.

The following table shows the actual achievement against the project target for three years in West Bengal:

Planting component	Project target for whole period	Project target for three years	Actual achievement in three years
Strip plantation	20,000 ha.	5,300 ha.	5,700 ha.
Village Wood lot	6,000 ha.	1,960 ha.	1,149 ha.
R.D.F.	15,000 ha.	4,500 ha.	10,835 ha.
Farm Forestry	52,000 ha.	14,780 ha.	20,704 ha.
Total	93,000 ha.	26,540 ha.	38,388 ha.

Against this background, the physical achievement of the district of Bankura is quite promising and ranks second. The physical achievement of Bankura district upto 1983-84 is as follows :-

Planting component	Actual achievement
Strip plantation	595 ha.
Village wood lot	113 ha.
R.D.F.	3,228 ha.
Farm Forestry	4,140 ha.
Total :-	8,079 ha.

The physical achievement percentage contribution of the district of Bankura under various component of plantation is as under :-

Planting component	Cumulative % achievement for Bankura
Strip plantation	10.44
Village wood lot	9.84
Farm Forestry	20.00
R.D.F.	42.54
Total:	21.04

An availability of the project target and achievement for the State shows that out of a total target of 93,000 ha., the physical achievement till 1983-84 is 38,388 ha. Thus an area of 54,612 ha. is to be tackled in the balance period of three years.

Based on the assumption that the present rate of achievement of 21.09% will continue for Bankura district, the contribution of the plantation programme for the district for balance three years works out to be 11,490 ha. Thus the expected total contribution of plantation under social forestry programme in Bankura district at the end of the present six years phase works out as follows :-

(1) Plantation already raised upto 1983-84	-	8,079 ha.
(2) Plantations to be raised in next three years.	-	11,490 ha.
Total	-	19,569 ha.

A study of the available land use data of Bankura district shows that there is about 12,000 ha. of recorded vested non-agricultural waste land in Bankura district. With some initiative and approach 6,000 ha. of this land can easily be taken up for creation of village wood lot under social forestry programme.

A rough assessment of the road side, canal bank, Railway line land etc. indicate the theoretical availability of about 8000 ha. under this category. Keeping about half of this area for other development easily about 4,000 ha. of such strip plantation can be raised in the district. It is, however, mentioned here that in Bankura-district already a good amount of strip plantation along road side has been raised in recent years under area development programme of D.P.A.P. financed by Agricultural Department.

Regarding Farm forestry on private land, a rough assessment shows that in this district, there is about 55,000 ha. of current fallow land a large portion of which with local cooperation and education can easily be taken for development of social forestry. In addition to this out of recorded cultivated land of 3,80,000 ha. about 10% of land remains unutilised with individual people for various purpose. With proper involvement of social forestry ideas within the rural population of the district it is also possible to make a large percentage of these unutilised cultivated land for cyclical social Forestry programme to meet the requirement of forest product of the local people.

It is estimated that the degraded forest land in Bankura district will be roughly to the tune of 40,000 ha. Out of this degraded forest land 35,000 ha. of land occurring in more or less sizeable patches can be tackled by normal afforestation programme through schemes of industrial plantation, rehabilitation of degraded forests, soil conservation, D.P.A.P., I.T.D.P., etc. But small patches of degraded forest land scattered within habitations or agricultural land and which are far away from forest staff location, is not possible to be managed by normal forestry programmes and this category of land which amounts to about 5,000 ha. in the district, can also be treated and afforested by social forestry programme. Thus total land available from above for plantation under social forestry programme of various types will be as under :-

Particulars	Vested agricultural waste land	Roadside, canal bank, Railway line etc.	Current fallow land	Unutilised cultivated land	Degraded forests	Total
Land available as fallow in ha.	12,000	8,000	55,000	3,80,000	40,000	4,83,000
Land available for social forestry in ha.	6,000	4,000	13,750	19,000	5,000	47,750

The contemplated social forestry activities will not however be the usual forest plantation work that have been undertaken in West Bengal so far, because these plantations will not be raised through departmental finance alone. The concept is that people must give free labour to raise the plantations themselves and volunteer to spare their own land and protect such plantations raised on community land spread over large areas of district in small strips or patches within populated areas. The department will give free seedling, minikits required for proper development of seedlings and some incentives for rearing of seedlings on assessment of actual success in first one or two years. It is the local population who has to do the bulk of work, tend the plantations or seedlings themselves at their own level and be responsible for protection of the seedlings till such seedlings become due for exploitation as per principles fixed by the foresters in consultation with village representatives.

Success will, therefore, depend not only on the dedication of the project workers and their ability to motivate and involve the local people but also on the feeling and willingness of the basic unit of the local assistance - that is the Panchayat Institutions. The obvious question is how to bring about this motivation among rural communities. Following steps have been suggested as a guideline to draw the local cooperation and participation of the village people in the work and objective of social forestry :

- 1) To impress upon the communities that the project is a departure from conventional forest activities in as much as the basic outlook is to consider the human aspects as guiding factor for forest resources development in the area.

- 2) Explaining group discussions, public meetings, conventions etc. to remove the fear from the mind of local people that raising of forest plantations in the land will not mean or lead ultimate taking over of the land by Forest Department, and that the benefit of the forest produce of these social plantations will largely flow to the local people who will participate in the programme.
- 3) Helping local people in exploring the establishment of rural forest based industries and giving them technical guidance for successful running of such cottage industries.
- 4) Giving field training to the local people by holding classes in the villages, for raising of nurseries, forest plantations and its tending.
- 5) Introduction of Social forestry programme as compulsory course in the primary education in the village schools.
- 6) Giving monetary incentives to the group workers and Volunteers who will be instrumental in the steering of social forestry programme in the villages.
- 7) Intensive publicity about the basic concept of forestry and the role forestry plays in developing the social economic and cultural upliftment of the people through distribution of pamphlets, brochures, short documentary films; and mass media advertisements through cine slides, newspapers, Radio, Television Programme etc.

CHAPTER - X

RESULTS AND CONCLUSIONS.

10.1. Main results and conclusions:

The total area of the forest is 1,39,452.56 ha. The inventory result has shown that 22,587 ha. of the forest area has now become blank and scrub forests. This covers 16.2% of the total forest area.

Approximately 41,447 ha. of the forest area contains damaged and poor density crop. This constitutes approximately 29.7% of the total forest area.

Thus only about 54% of the forest area, at present has fair stocking. Approximately 46% of this fairly stocked area contains crop of predominant diameter less than 10 cm. Adequate protection must be provided to the crop against pilferage.

The extent of area containing predominant crop as Sal is 78,564.81 ha. which constitute 56.34% of the total forest area. Out of this, 33,590.51 ha. which constitute 42.76% of the existing Sal crop, has become understocked and damaged.

The area containing predominantly miscellaneous high forests has been found to be 10,802.66 ha. which is approximately 8% of the total forest area.

The balance area of approximately 19.5% of the total forest area is occupied by plantations of miscellaneous species. Approximately 21% of the plantation area has been found to be severely damaged. Another about 57% of plantation area is also partially damaged.

The total growing stock of the forest has been estimated to be 14,94,604 m³.

The present average outturn of timber, poles, firewood and pulpwood, which is actually removed from the forest has been found to be 1,69,323.43 m³.

The total present demand of wood from the forests has been estimated to be 8,03,131.35 m³. The demand of firewood constitutes about 89% of this total demand. There is an overall deficit of 6,33,807.92 m³. of wood in the district, out of which, the deficit due to firewood constitutes 96.8%. A considerable portion of forest produce is also exported outside the district and is not available for use by local population. This heavy deficit of wood, specially firewood, has created a vicious cycle which is progressively causing damage to the forest. Providing adequate protection to the existing forest has now become extremely difficult.

Under the social forestry scheme the total area of plantation to be raised under various categories is 19,569 ha. during a period of six years.

This will cover only 40.98% of land which has been estimated to be available for social forestry programme in the district. Thus there is scope for expansion of social forestry programme in future.

The yield from the forest in near future with improved technique, management and protection is estimated to be 2,15,820 m³. The demand of wood is expected to rise to 11,04,263 m³ by 1991 at the present rate of consumption, assuming the rate of growth of population of the district to remain at present level of 1.689% per annum. A deficit of 8,88,443 m³ of wood will thus remain. An alternative source of fuel to replace the firewood for cooking will have to be located besides augmenting the present supply of firewood as fuelwood constitutes the major share of the deficit.

Firewood and timber from private land also contributed towards meeting a part of the demand of wood in the district. The quantum of such contribution has not been estimated. Availability of fuelwood and timber in private land should be estimated in order to ascertain how much of the demand of wood is met from sources outside the forest area.

10.2. Variation from past studies:

The present study indicates that compared to past, there has been a sizeable shrinkage in the forest area under Sal which has been replaced by inferior miscellaneous species. Bigger diameter trees which were once not very infrequent in the area is now rare. The record kept in the publication "West Bengal Forests" in the Centenary Commemoration Volume, 1964 shows that out of 1402 km² of total forest areas at that time 1376 km² was under Sal and 26 km² was under miscellaneous species. But in the present study, it is found that the percentage area covered by miscellaneous species including plantation is about 27.5% of the total area, and the miscellaneous species constitute 24% of the total volume of the forests.

10.3. Final recommendations and proposals:

The overall assessment indicates that a comprehensive approach is necessary in this district to improve the forest resources and following suggestions are therefore made for future management of forests in the area :-

- 1) Increasing per ha. cutturn of forests by enforcing rigid protection in the adequately stocked Sal areas and through afforestation of denuded land by fast growing and economically important species.
- 2) Enforcing some control on the movement of forest produce so that a balance is struck between the supply of forest produce outside the district and meeting the requirement of local population.
- 3) Social forestry programme which has already been taken up should be expanded and any limitation coming in the way of execution of social forestry programme must be met up and removed.
- 4) There should be mass media publicity to involve local people in the matter of forest development and to explain to them the benefits of forest preservation and proper management in the ultimate interest of human welfare.

- 5) Increasing forest activity in all spheres, tapping whatever financial resources available, to provide more employment to the local people for raising the economic standard of population living by the side of the forests.
- 6) Creating a condition congenial to the implementation of the forestry work so that staff concerned can work peacefully and can also effectively enforce legal provisions which have been laid to safeguard the ultimate interest of the nation.
- 7) Removing intermediaries from the forest working to stop local exploitation and ensuring fair wage earning to the people employed in forest working.
- 8) Opening more avenues for development of small scale industries based on minor forest produce particularly Sal seed oil extraction which has got tremendous potential not only in offering employment to the local people but also in ultimate use ~~of~~ to meet various requirements.
- 9) Incentives and motivations have to be provided to the rural people in use of alternative fuel like kerosene, coal, Bio-gas, Solar cooking and these should be supported by subsidisation of cost, demonstrations and publicity whenever necessary.
- 10) A study of wood availability in private land is necessary to estimate the net pressure on forest area and to plan strategies for meeting the deficit.

A beginning of comprehensive and coordinated approach of forest development has already been made in the district and the work of last one or two years is showing good promise in the matter. Let us hope, that this massive effort taken in recent years to develop the forest resources in the district to save the forests will progress in the desired speed and magnitude and the next generation of foresters and people will see a positive outcome of this concerted activity oriented towards attainment of biotic balance to serve the interest of population in perpetuity.

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TABLE NO. 1.1

STEMS PER HECTARE BY SPECIES AND DIAMETER CLASS (IN CM.)												STRATUM - SAL		
Species Name	Code	D I A M E T E R C L A S S E S (I N C M.)								100+ Total				
		5-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79		80-89	90-99		
Anogeissus latifolia	1	0.633	0.127	-	-	-	-	-	-	-	-	-	0.759	
Adina cordifolia	2	0.127	-	-	-	-	-	-	-	-	-	-	0.127	
Aegle marmelos	4	0.253	0.506	0.253	0.127	-	-	-	-	-	-	-	1.139	
Albezziia lebbek	5	0.127	0.127	-	-	-	-	-	-	-	-	-	0.253	
Albizziia procera	6	0.127	-	-	-	-	-	-	-	-	-	-	0.127	
Alstonia scholaris	19	-	1.265	0.380	-	-	-	-	-	-	-	-	1.645	
Bombax ceiba	73	-	0.127	-	-	-	-	-	-	-	-	-	0.127	
Buchanania latifolia	76	2.530	1.139	-	-	-	-	-	-	-	-	-	3.669	
Butea monosperma	86	-	-	0.253	-	-	-	-	-	-	-	-	0.253	
Careya arborea	116	0.127	-	-	-	-	-	-	-	-	-	-	0.127	
Diospyros melanoxylon	161	8.855	0.506	0.506	0.253	-	-	-	-	-	-	-	10.120	
Dalbergia species	187	-	-	-	0.127	-	-	-	-	-	-	-	0.127	
Diospyros species	188	-	1.012	0.127	-	-	-	-	-	-	-	-	1.139	
Diospyros marmorata	191	0.127	-	-	-	-	-	-	-	-	-	-	0.127	
Eugenia species	210	-	0.127	-	-	-	-	-	-	-	-	-	0.127	
Elaeodendron galucum	216	0.127	-	-	-	-	-	-	-	-	-	-	0.127	
Emblica officinalis	222	-	0.127	-	-	-	-	-	-	-	-	-	0.127	
Ficus species	233	-	0.127	-	-	-	-	-	-	-	-	-	0.127	
Lagerstroemia parviflora	299	0.253	-	-	-	-	-	-	-	-	-	-	0.253	
Lannea coromandelica	301	0.253	-	-	-	-	-	-	-	-	-	-	0.253	
Madhuca latifolia	326	5.566	4.428	0.759	0.253	-	0.127	-	-	-	-	-	11.132	
Odini wodier	383	0.633	-	-	-	-	-	-	-	-	-	-	0.633	
Pterocarpus marsupium	403	0.253	0.127	-	-	-	-	-	-	-	-	-	0.380	
Pterocarpum heyneamum	406	0.127	-	-	-	-	-	-	-	-	-	-	0.127	
Schleichera trijiga	461	0.127	-	-	-	-	-	-	-	-	-	-	0.127	
Shorea robusta	462	298.920	44.528	3.036	0.127	0.127	-	-	-	-	-	-	346.737	
Syzygium cumini	469	1.771	-	-	-	-	-	-	-	-	-	-	1.771	
Semecarpus anacardium	472	0.506	0.127	-	-	-	-	-	-	-	-	-	0.633	
Terminalia belerica	506	0.886	0.633	0.253	-	-	-	-	-	-	-	-	1.771	
Terminalia chebula	507	0.127	0.380	-	-	-	-	-	-	-	-	-	0.506	
Tamarindus indica	515	-	0.127	0.253	-	-	0.127	-	-	-	-	-	0.633	

Species Name	DIAMETER CLASSES (IN CM.)											Total
	Code	5-09	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	
Terminalia tomentosa	516	6.958	0.759	-	0.253	-	-	-	-	-	-	7.970
Terminalia citrina	518	-	-	0.127	-	-	-	-	-	-	-	0.127
Zizyphus xylopyra	550	0.253	-	-	-	-	-	-	-	-	-	0.253
Zizyphus species	552	0.127	-	-	-	-	-	-	-	-	-	0.127
Bambusa trees	562	0.127	-	-	-	-	-	-	-	-	-	0.127
Others	600	7.590	0.759	-	-	0.127	-	-	-	-	-	8.476
TOTAL		337.502	57.052	5.946	1.139	0.253	0.253	-	0.127	-	-	402.270

STEMS PER HECTARE BY SPECIES AND DIAMETER CLASS (IN CM.)

Species Name with code	D I A M E T E R C L A S S E S (IN CM.)										100+ Total
	5 -09	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	
Anogeissus latifolia (1)	0.909	0.909	0.909	0.909	-	-	-	-	-	-	3.636
Aegle marmelos (4)	-	2.727	1.818	-	-	-	-	-	-	-	4.545
Azadirachta indica (11)	-	1.818	0.909	0.909	-	-	-	-	-	-	3.636
Buchanania latifolia (76)	14.544	0.909	-	-	-	-	-	-	-	-	15.453
Diospyros melanoxylon (161)	19.089	0.909	1.818	-	-	-	-	-	-	-	21.816
Diospyros species (188)	-	-	-	0.909	-	-	-	-	-	-	0.909
Hclarrhena antidysenteric(266)	1.818	-	-	-	-	-	-	-	-	-	1.818
Madhuca latifolia (326)	21.816	3.636	0.909	0.909	0.909	-	-	-	-	-	28.179
Odini wodier (383)	2.727	0.909	-	-	-	-	-	-	-	-	3.636
Shorea robusta (462)	270.882	1.818	-	-	-	-	-	-	-	-	272.700
Syzygium cumini (469)	4.545	-	-	-	-	-	-	-	-	-	4.545
Semecarpus anacardium (472)	1.818	0.909	-	-	-	-	-	-	-	-	2.727
Terminalia belerica (506)	9.090	-	0.909	0.909	-	-	-	-	-	-	10.908
Terminalia chebula (507)	1.818	-	-	-	-	-	-	-	-	-	1.818
Terminalia tomentosa (516)	20.907	3.636	4.545	3.636	0.909	-	-	-	-	-	33.633
Others (600)	13.635	5.454	-	0.909	-	-	-	-	-	-	19.998
Total #	383.598	23.634	11.817	9.090	1.818	-	-	-	-	-	429.957

TABLE NO. 1.3

STEMS PER HECTARE BY SPECIES AND DIAMETER CLASS (IN CM.) STRATUM - PLANTATION

Species name with code	DIAMETER CLASS (IN CM.)										STRATUM - PLANTATION			
	5-09	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100+	Total		
Albezzia lebbek (5)	-	0.345	-	-	-	-	-	-	-	-	-	0.345	-	0.345
Alstonia scholaris (19)	-	3.448	1.034	-	-	-	-	-	-	-	-	4.482	-	4.482
Bridelia retusa (75)	-	0.345	-	-	-	-	-	-	-	-	-	0.345	-	0.345
Bauhinia racemosa (83)	-	-	0.345	-	-	-	-	-	-	-	-	0.345	-	0.345
Butea monosperma (86)	-	-	0.345	-	-	-	-	-	-	-	-	0.345	-	0.345
Casuarina tomentosa (117)	0.345	-	-	-	-	-	-	-	-	-	-	0.345	-	0.345
Eucalyptus hybrid (206)	-	1.034	-	-	-	-	-	-	-	-	-	1.034	-	1.034
Eugenia frondosa (217)	0.690	-	-	-	-	-	-	-	-	-	-	0.690	-	0.690
Eucalyptus species (218)	115.853	10.69	-	-	-	-	-	-	-	-	-	126.542	-	126.542
Madhuca latifolia (326)	-	0.690	0.690	-	-	-	-	-	-	-	-	1.379	-	1.379
Shorea robusta (462)	0.345	1.72	-	-	-	-	-	-	-	-	-	2.069	-	2.069
Acacia auriculiformis (597)	7.930	0.345	-	-	-	-	-	-	-	-	-	17.240	-	17.240
Others (600)	-	0.345	-	-	-	-	-	-	-	-	-	0.345	-	0.345
Total :-	125.162	27.929	2.414	-	-	-	-	-	-	-	-	155.505	-	155.505

TABLE NO. 2.1

VOLUME PER HECTARE BY SPECIES AND DIAMETER CLASSES (IN CM.) STRATUM - SAL

Species name with code	05-09	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100+	Total
Anogeissus latifolia (1)	0.006	0.004	-	-	-	-	-	-	-	-	-	0.010
Adina cordifolia (2)	0.004	-	-	-	-	-	-	-	-	-	-	0.004
Aegle marmelos (4)	0.004	0.059	0.084	0.104	-	-	-	-	-	-	-	0.251
Albizia lebbek (5)	0.001	0.025	-	-	-	-	-	-	-	-	-	0.026
Albizia procera (6)	0.002	-	-	-	-	-	-	-	-	-	-	0.002
Alstonia scholaris (19)	-	0.111	0.119	-	-	-	-	-	-	-	-	0.230
Bombax ceiba (73)	-	0.025	-	-	-	-	-	-	-	-	-	0.025
Buchanania latifolia (76)	0.019	0.059	-	-	-	-	-	-	-	-	-	0.078
Butea monosperma (86)	-	-	0.138	-	-	-	-	-	-	-	-	0.138
Careya arborea (116)	0.003	-	-	-	-	-	-	-	-	-	-	0.003
Diospyros melanoxylon (161)	0.092	0.053	0.170	0.222	-	-	-	-	-	-	-	0.538
Dalbergia species (187)	-	-	-	0.111	-	-	-	-	-	-	-	0.111
Diospyros species (188)	-	0.064	0.066	-	-	-	-	-	-	-	-	0.130
Diospyros marmorata (191)	0.001	-	-	-	-	-	-	-	-	-	-	0.001
Eugenia species (210)	-	0.005	-	-	-	-	-	-	-	-	-	0.005
Elasodendron galucum (216)	0.001	-	-	-	-	-	-	-	-	-	-	0.001
Emblica officinalis (222)	-	0.016	-	-	-	-	-	-	-	-	-	0.016
Ficus species (233)	-	0.011	-	-	-	-	-	-	-	-	-	0.011
Lagerstroemia parviflora (299)	0.002	-	-	-	-	-	-	-	-	-	-	0.002
Lannea coromandelica (301)	0.004	-	-	-	-	-	-	-	-	-	-	0.004
Madhuca latifolia (326)	0.046	0.349	0.332	0.230	-	0.247	-	-	-	-	-	1.204
Odini wodier (383)	0.006	-	-	-	-	-	-	-	-	-	-	0.006
Pterocarpus marsupium (403)	0.004	0.011	-	-	-	-	-	-	-	-	-	0.015
Pterospermum heyneanum (406)	0.001	-	-	-	-	-	-	-	-	-	-	0.001
Schleichera trijuga (461)	0.002	-	-	-	-	-	-	-	-	-	-	0.002
Shorea robusta (462)	5.340	3.522	0.889	0.100	0.153	-	-	-	-	-	-	10.003

Species name with code	D I A M E T E R C L A S S E S (I N C M.)										Total
	05-09	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100+
Syzygium cuminii (469)	0.021	-	-	-	-	-	-	-	-	-	0.021
Semecarpus anacardium (472)	0.005	0.009	-	-	-	-	-	-	-	-	0.014
Terminalia belerica (506)	0.009	0.042	0.116	-	-	-	-	-	-	-	0.167
Terminalia chebula (507)	0.002	0.042	-	-	-	-	-	-	-	-	0.044
Tamarindus indica (515)	-	0.013	0.084	-	-	0.247	-	0.594	-	-	0.938
Terminalia tomentosa (516)	0.063	0.045	-	0.196	-	-	-	-	-	-	0.304
Terminalia citrina (518)	-	-	0.029	-	-	-	-	-	-	-	0.029
Zizyphus xylopyra (550)	0.002	-	-	-	-	-	-	-	-	-	0.002
Zizyphus species (552)	0.001	-	-	-	-	-	-	-	-	-	0.001
Bambusa trees (562)	0.001	-	-	-	-	-	-	-	-	-	0.001
Others (600)	0.066	0.056	-	-	0.177	-	-	-	-	-	0.300
Total :-	5.707	4.523	2.026	0.963	0.329	0.494	-	0.594	-	-	14.636

TABLE NO. 2.2

VOLUME PER HECTARE BY SPECIES AND DIAMETER CLASSES (IN CM.) STRATUM - MISC.

Species name with code	D I A M E T E R C L A S S E S (I N C M .)										Total
	05-09	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100+
Anogeissus latifolia (1)	0.022	0.135	0.276	1.000	-	-	-	-	-	-	1.433
Aegle marmelos (4)	-	0.279	0.507	-	-	-	-	-	-	-	0.787
Azadirachta indica (11)	-	0.156	0.298	0.656	-	-	-	-	-	-	1.110
Buchanania latifolia (76)	0.187	0.117	-	-	-	-	-	-	-	-	0.303
Diospyros melanoxylon (161)	0.242	0.081	0.805	-	-	-	-	-	-	-	1.128
Diospyros species (188)	-	-	-	0.807	-	-	-	-	-	-	0.807
Holarrhena antidysenterica (266)	0.010	-	-	-	-	-	-	-	-	-	0.010
Madhuca latifolia (326)	0.253	0.292	0.402	0.974	1.220	-	-	-	-	-	3.140
Odini wedier (383)	0.036	0.081	-	-	-	-	-	-	-	-	0.117
Shorea robusta (462)	4.203	0.188	-	-	-	-	-	-	-	-	4.391
Syzygium cumini (469)	0.039	-	-	-	-	-	-	-	-	-	0.039
Semecarpus anacardium (472)	0.020	0.065	-	-	-	-	-	-	-	-	0.085
Terminalia belerica (506)	0.085	-	0.479	0.656	-	-	-	-	-	-	1.220
Terminalia chebula (507)	0.010	-	-	-	-	-	-	-	-	-	0.010
Terminalia tomentosa (516)	0.188	0.697	1.651	2.493	1.154	-	-	-	-	-	6.183
Others (600)	0.182	0.607	-	0.656	-	-	-	-	-	-	1.445
Total :-	5.478	2.697	4.418	7.241	2.374	-	-	-	-	-	22.205

VOLUME PER HECTARE BY SPECIES AND DIAMETER CLASSES (IN CM.) STRATUM - PLANTATION

Species name with code	DIAMETER CLASSES (IN CM.)								
	05-09	10-19	20-29	30-39	40-49	50-59	60-69	70-79	Total
Albizia lebbek (5)	-	0.072	-	-	-	-	-	-	0.072
Alstonia scholaris (19)	-	0.318	0.339	-	-	-	-	-	0.658
Bridelia retusa (75)	-	0.012	-	-	-	-	-	-	0.012
Bauhinia racemosa (83)	-	-	0.188	-	-	-	-	-	0.188
Butea monosperma (86)	-	-	0.205	-	-	-	-	-	0.205
Cassaria tomentosa (117)	0.002	-	-	-	-	-	-	-	0.002
Eucalyptus hybrid (206)	-	0.084	-	-	-	-	-	-	0.084
Eugenia frondosa (217)	0.006	-	-	-	-	-	-	-	0.006
Eucalyptus species (218)	1.333	0.754	-	-	-	-	-	-	2.087
Maduca latifolia (326)	-	0.083	0.240	-	-	-	-	-	0.323
Shorea robusta (462)	0.003	0.128	-	-	-	-	-	-	0.131
Accacia auriculiformis (597)	0.053	0.443	-	-	-	-	-	-	0.496
Others (600)	-	0.072	-	-	-	-	-	-	0.072
Total :-	1.396	1.966	0.973	-	-	-	-	-	4.335

TABLE NO. 3.1.

[illegible]

Species name with code	DIAMETER CLASSES (IN CM.)										Total
	05-09	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100+
Terminalia belerica (506)	68.700	49.071	19.628	-	-	-	-	-	-	-	137.399
Terminalia chebula (507)	9.814	29.443	-	-	-	-	-	-	-	-	39.257
Tamarindus indica (515)	-	9.814	19.628	-	-	9.814	-	9.814	-	-	49.071
Terminalia tomentosa (516)	539.782	58.885	-	19.628	-	-	-	-	-	-	618.296
Terminalia citrina (518)	-	-	9.814	-	-	-	-	-	-	-	9.814
Zizyphus exlopyra (550)	19.628	-	-	-	-	-	-	-	-	-	19.628
Zizyphus species (552)	9.814	-	-	-	-	-	-	-	-	-	9.814
Bambusa trees (562)	9.814	-	-	-	-	-	-	-	-	-	9.814
Others (600)	588.853	58.885	-	-	9.814	-	-	-	-	-	657.553
Total :-	26184.333	4426.212	461.268	88.328	19.628	19.628	-	9.814	-	-	31209.213

TABLE NO. 3.2.
TOTALSTEMS (IN '000 UNIT) BY SPECIES AND DIAMETER CLASSES (IN CM.) STRATUM -MISC.

Species name with code	DIAMETER CLASSES (IN CM.)										Total
	05-09	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100+
Anogeissus latifolia (1)	9.820	9.820	9.820	9.820	-	-	-	-	-	-	39.279
Aegle marmelos (4)	-	29.459	19.639	-	-	-	-	-	-	-	49.098
Azadirachta indica (11)	-	19.639	9.820	9.820	-	-	-	-	-	-	39.279
Buchanania latifolia (76)	157.114	9.820	-	-	-	-	-	-	-	-	166.934
Diospyros melenoxylon (161)	206.212	9.820	19.639	-	-	-	-	-	-	-	235.671
Diospyros species (188)	-	-	-	9.820	-	-	-	-	-	-	9.820
Holarrhena antidysenteric (266)	19.639	-	-	-	-	-	-	-	-	-	19.639
Madhuca latifolia (326)	235.671	39.279	9.820	9.820	9.820	-	-	-	-	-	104.408
Odini wodier (383)	29.459	9.820	-	-	-	-	-	-	-	-	39.279
Shorea robusta (462)	2926.249	19.639	-	-	-	-	-	-	-	-	2945.888
Syzygium cumini (469)	49.098	-	-	-	-	-	-	-	-	-	49.098
Samocarpus anacardium (472)	19.639	9.820	-	-	-	-	-	-	-	-	29.459
Terminalia belerica (506)	98.196	-	9.820	9.820	-	-	-	-	-	-	117.836
Terminalia chebula (507)	19.639	-	-	-	-	-	-	-	-	-	19.639
Terminalia tomentosa (516)	225.851	39.279	49.098	39.279	9.820	-	-	-	-	-	363.326
Others (600)	147.294	58.918	-	9.820	-	-	-	-	-	-	216.032
Total :-	4143.883	255.310	127.655	98.196	19.639	-	-	-	-	-	4644.684

TOTAL STEMS (IN '000 UNIT') BY SPECIES AND DIAMETER CLASSES (IN CM.)

[illegible]

TABLE NO. 4.1.

TOTAL VOLUME (IN '000 M ³) BY SPECIES AND DIAMETER CLASSES (IN CM.) STRATUM - SAL											
Species name with code	D I A M E T E R C L A S S E S (I N CM.)								TOTAL		
	05-09	10-19	20-29	30-39	40-49	50-59	60-69	70-79		80-89	90-99
Anogeissus latifolia (1)	0.442	0.341	-	-	-	-	-	-	-	-	0.783
Adina cordifolia (2)	0.309	-	-	-	-	-	-	-	-	-	0.309
Aegle marmelos (4)	0.286	4.613	6.521	8.055	-	-	-	-	-	-	19.474
Albizia lebbek (5)	0.048	1.961	-	-	-	-	-	-	-	-	2.009
Albizzia procera (6)	0.151	-	-	-	-	-	-	-	-	-	0.151
Alstonia scholaris (19)	-	8.640	9.217	-	-	-	-	-	-	-	17.857
Bombax ceiba (73)	-	1.961	-	-	-	-	-	-	-	-	1.961
Buchanania latifolia (76)	1.472	4.559	-	-	-	-	-	-	-	-	6.032
Butea monosperma (86)	-	-	10.674	-	-	-	-	-	-	-	10.674
Gareya arborea (116)	0.223	-	-	-	-	-	-	-	-	-	0.223
Diospyros melanoxylon(161)	7.176	4.138	13.188	17.220	-	-	-	-	-	-	41.721
Dalbergia species (187)	-	-	-	8.610	-	-	-	-	-	-	8.610
Diospyros species (188)	-	4.995	5.115	-	-	-	-	-	-	-	10.110
Diospyros marmorata (191)	:0.098	-	-	-	-	-	-	-	-	-	0.098
Eugenia species (210)	-	0.421	-	-	-	-	-	-	-	-	0.421
Elaeodendron galucum (216)	0.064	-	-	-	-	-	-	-	-	-	0.064
Emblica officinalis (222)	-	1.244	-	-	-	-	-	-	-	-	1.244
Ficus species (233)	-	0.859	-	-	-	-	-	-	-	-	0.859
Lagerstroemia parviflora(299)	0.146	-	-	-	-	-	-	-	-	-	0.146
Laranea coromandelica(301)	0.286	-	-	-	-	-	-	-	-	-	0.286
Madhuca latifolia (326)	3.583	27.056	25.762	17.831	-	19.167	-	-	-	-	93.399
Odini woder (383)	0.440	-	-	-	-	-	-	-	-	-	0.440
Pterocarpus marsupium(403)	0.286	0.859	-	-	-	-	-	-	-	-	1.145
Ptercsperrum heyneamum(406)	0.064	-	-	-	-	-	-	-	-	-	0.064
Schleichera trijuga (461)	0.151	-	-	-	-	-	-	-	-	-	0.151
Shorea robusta (462)	414.313	273.229	68.936	7.758	11.832	-	-	-	-	-	776.068
Syzygium cumini (469)	1.622	-	-	-	-	-	-	-	-	-	1.622
Semecarpus anacardium(472)	0.414	0.695	-	-	-	-	-	-	-	-	1.108

Species name with code	D I A M E T E R C L A S S E S (I N C M .)										Total
	05-09	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100 +
Terminalia belerica (506)	0.692	3.237	9.011	-	-	-	-	-	-	-	12.940
Terminalia chebula (507)	0.151	3.257	-	-	-	-	-	-	-	-	3.408
Tamarindus indica (515)	-	1.042	6.521	-	-	19.167	-	46.061	-	-	72.791
Terminalia tomentosa (516)	4.880	3.473	-	15.220	-	-	-	-	-	-	23.573
Terminalia citrina (518)	-	-	2.237	-	-	-	-	-	-	-	2.237
Zizyphus xylopyra (550)	0.162	-	-	-	-	-	-	-	-	-	0.162
Zizyphus species (552)	0.064	-	-	-	-	-	-	-	-	-	0.064
Bambusa trees (562)	0.048	-	-	-	-	-	-	-	-	-	0.048
Others (600)	5.158	4.359	-	-	13.720	-	-	-	-	-	23.238
Total :-	442.727	350.940	157.181	74.694	25.552	38.334	-	46.061	-	-	1135.489

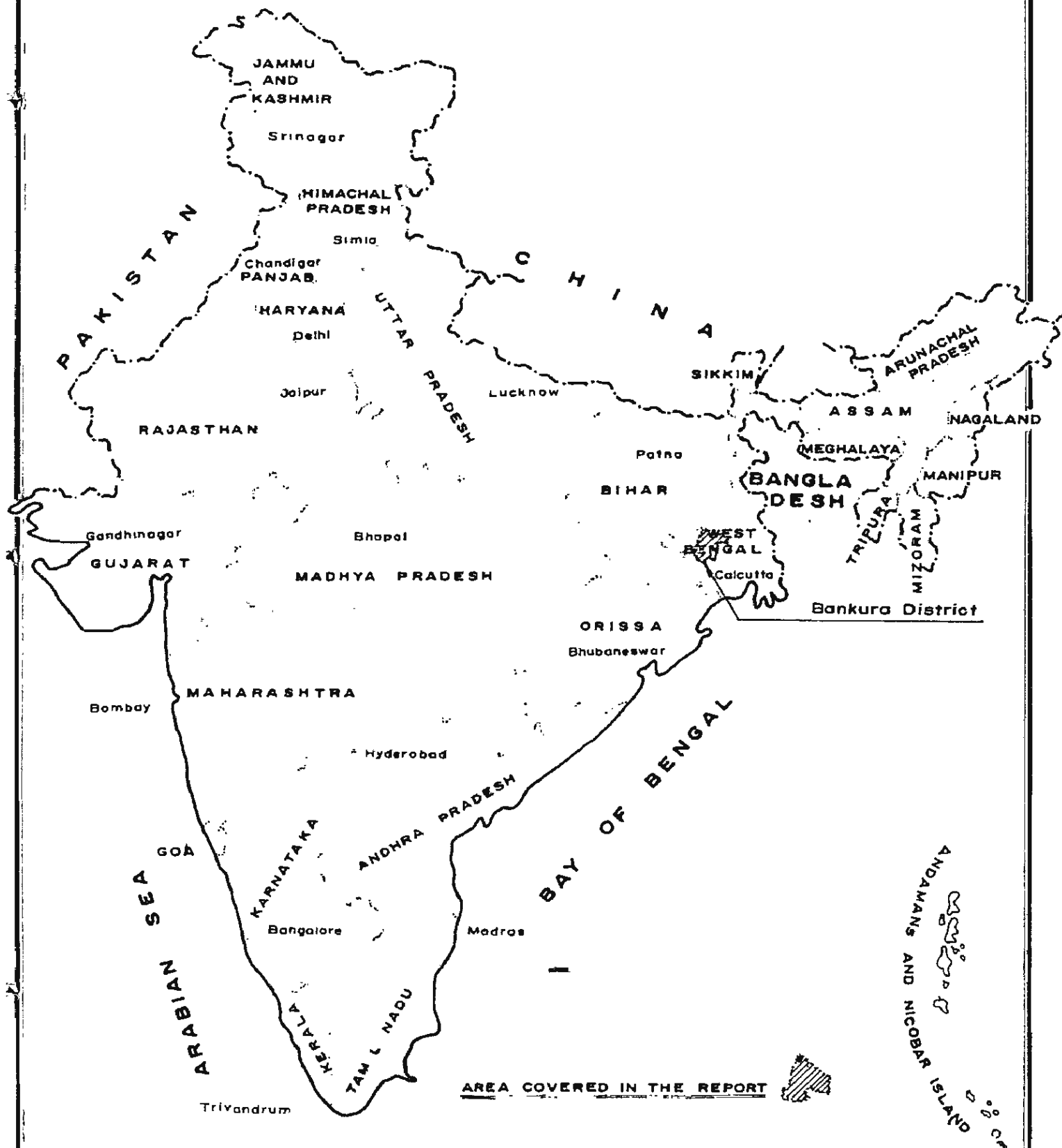
TABLE NO. 4.2.

TOTAL VOLUME (IN '000 M³) BY SPECIES AND DIAMETER CLASSES (IN CM.) STRATUM - MISC.

Species name with code	D I A M E T E R C L A S S I S (I N CM.)										Total
	05-09	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100 +
Anogeissus latifolia (1)	0.236	1.459	2.982	10.799	-	-	-	-	-	-	15.475
Aegle marmelos (4)	-	3.018	5.482	-	-	-	-	-	-	-	8.500
Azadirachta indica (11)	-	1.686	3.217	7.088	-	-	-	-	-	-	11.991
Buchanania latifolia (76)	2.015	1.260	-	-	-	-	-	-	-	-	3.275
Diospyros melanoxylon (161)	2.616	0.870	8.694	-	-	-	-	-	-	-	12.180
Diospyros species (188)	-	-	-	8.718	-	-	-	-	-	-	8.718
Holarrhena antidysenterica (266)	0.113	-	-	-	-	-	-	-	-	-	0.113
Madhuca latifolia (326)	2.737	3.152	4.338	10.517	13.179	-	-	-	-	-	33.924
Odini wodier (383)	0.389	0.870	-	-	-	-	-	-	-	-	1.259
Shorea robusta (462)	45.407	2.033	-	-	-	-	-	-	-	-	47.440
Syzygium cumini (469)	0.419	-	-	-	-	-	-	-	-	-	0.419
Semecarpus anacardium (472)	0.217	0.703	-	-	-	-	-	-	-	-	0.921
Terminalia belerica (506)	0.916	-	5.179	7.088	-	-	-	-	-	-	13.184
Terminalia chebula (507)	0.113	-	-	-	-	-	-	-	-	-	0.113
Terminalia tomentosa (516)	2.035	7.525	17.839	26.927	12.467	-	-	-	-	-	66.793
Others (600)	1.964	6.561	-	7.088	-	-	-	-	-	-	15.614
Total :-	59.177	29.138	47.730	78.226	25.646	-	-	-	-	-	239.917

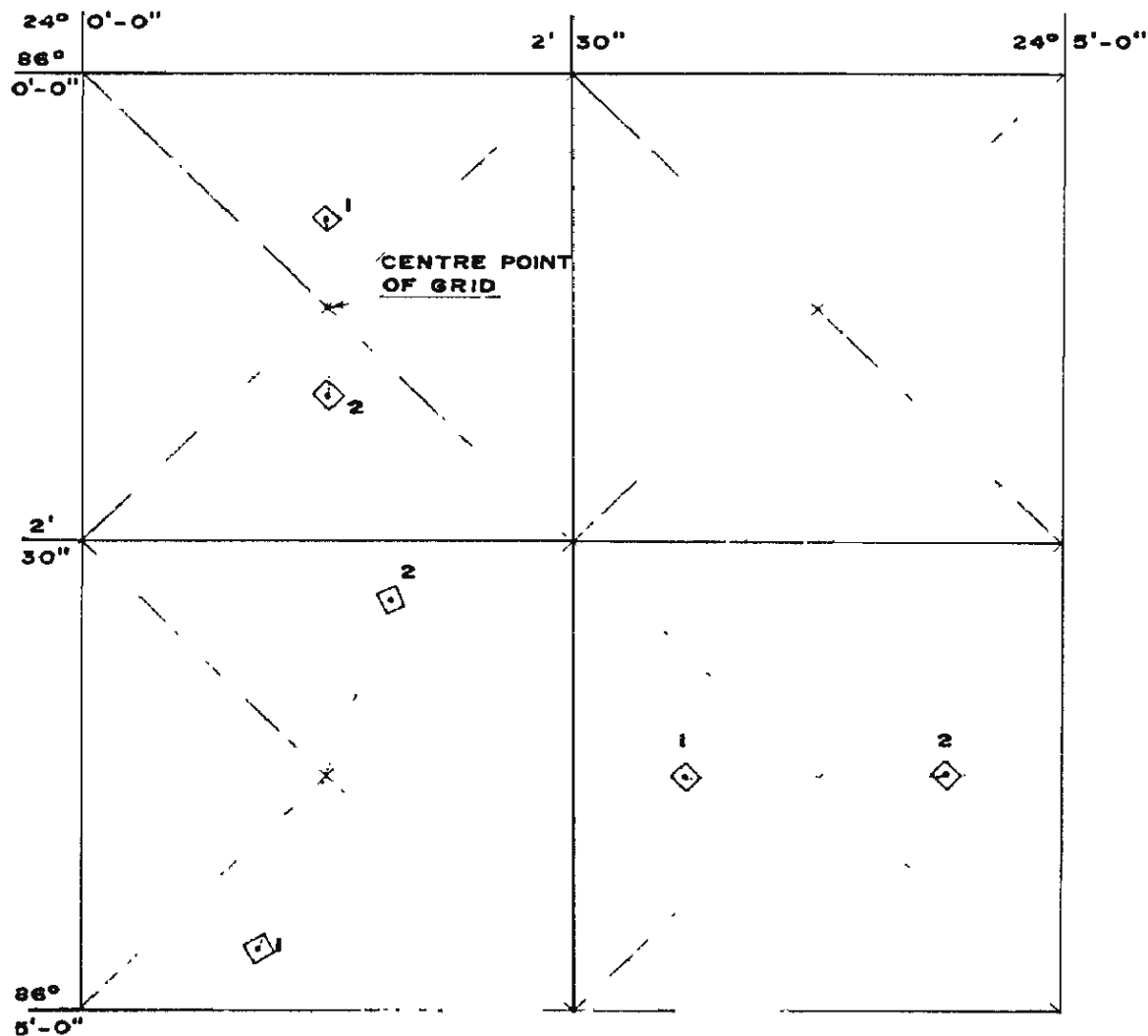
TOTAL VOLUME (IN '000 M³) BY SPECIES AND DIAMETER CLASSES (IN CM.) STRATUM - PLANTATION

[illegible]

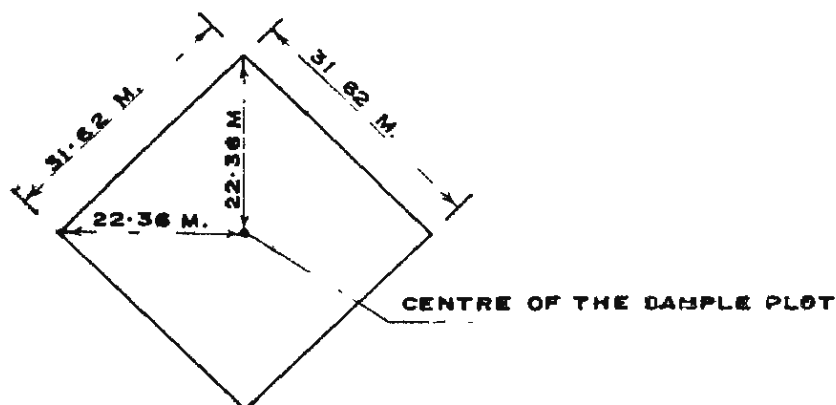
FOREST SURVEY OF INDIA**EASTERN ZONE****MAP OF INDIA****SHOWING PROJECT AREA IN BANKURA DISTRICT [WEST BENGAL]**SCALE - 1 15,000,000

FOREST SURVEY OF INDIA

INVENTORY DESIGN



FIRST SAMPLE PLOT (1) IS SELECTED RANDOMLY AND THE SECOND SAMPLE PLOT (2) IS LOCATED BY JOINING THE FIRST SAMPLE PLOT TO THE CENTRE OF THE GRID AND EXTENDING THE LINE TO A DISTANCE SO THAT THE DISTANCES OF THE TWO PLOTS FROM THE CENTRE OF 2 1/2' x 2 1/2' GRID BECOME EQUAL



DETAILS OF SAMPLE PLOT

86° 45'

87° 00'

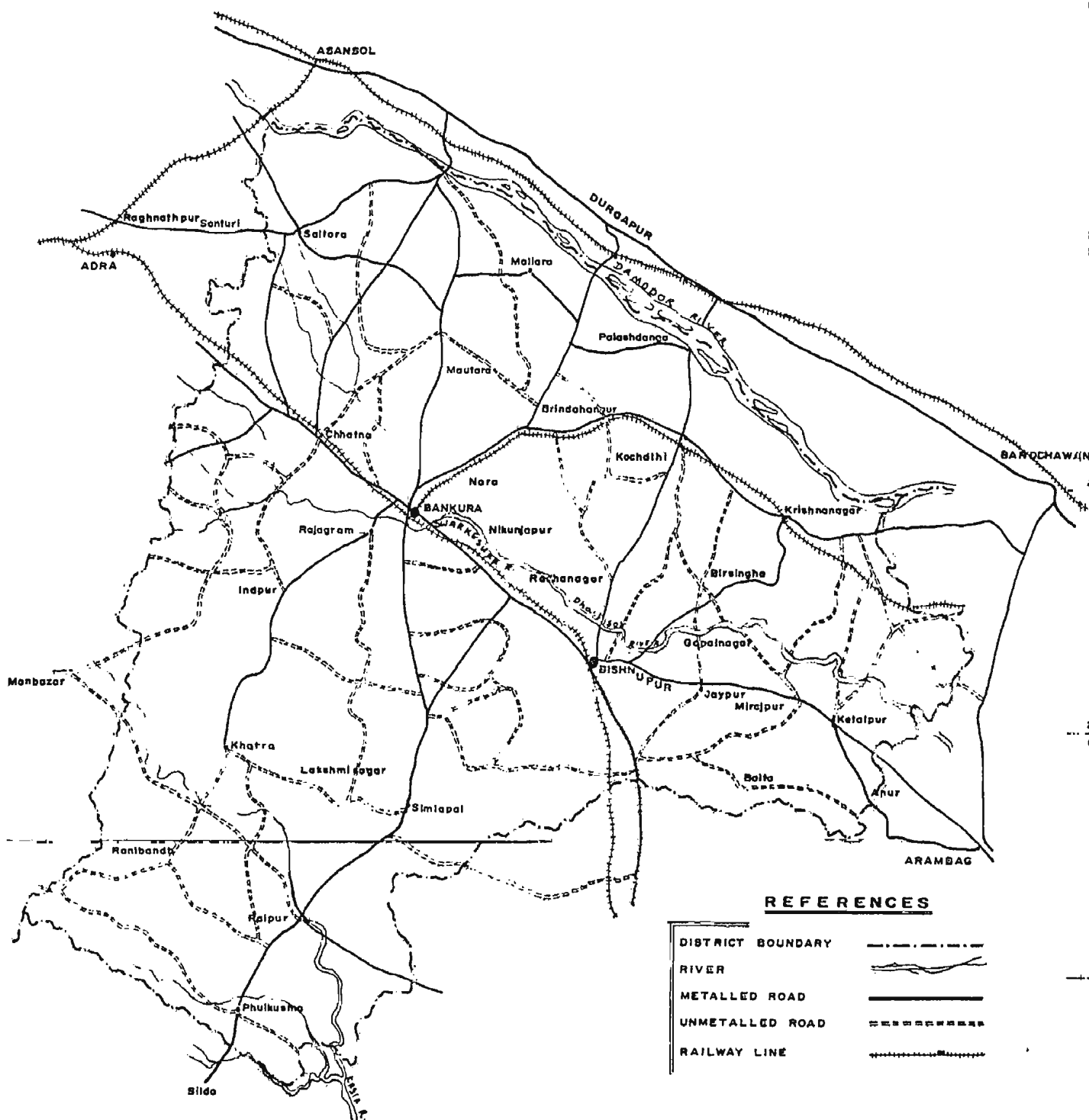
87° 15'

87° 30'

87° 45'

BANKURA DISTRICT**SHOWING ROAD AND RIVER**

SCALE - 1" = 8 Miles

23°
45'23°
30'23°
15'23°
00'22°
45'22°
30'

PREPARED BY - FOREST SURVEY OF INDIA,
EASTERN ZONE, CALCUTTA

DRAWN BY - Suman Bhattacharjee.

86° 45'

87° 00'

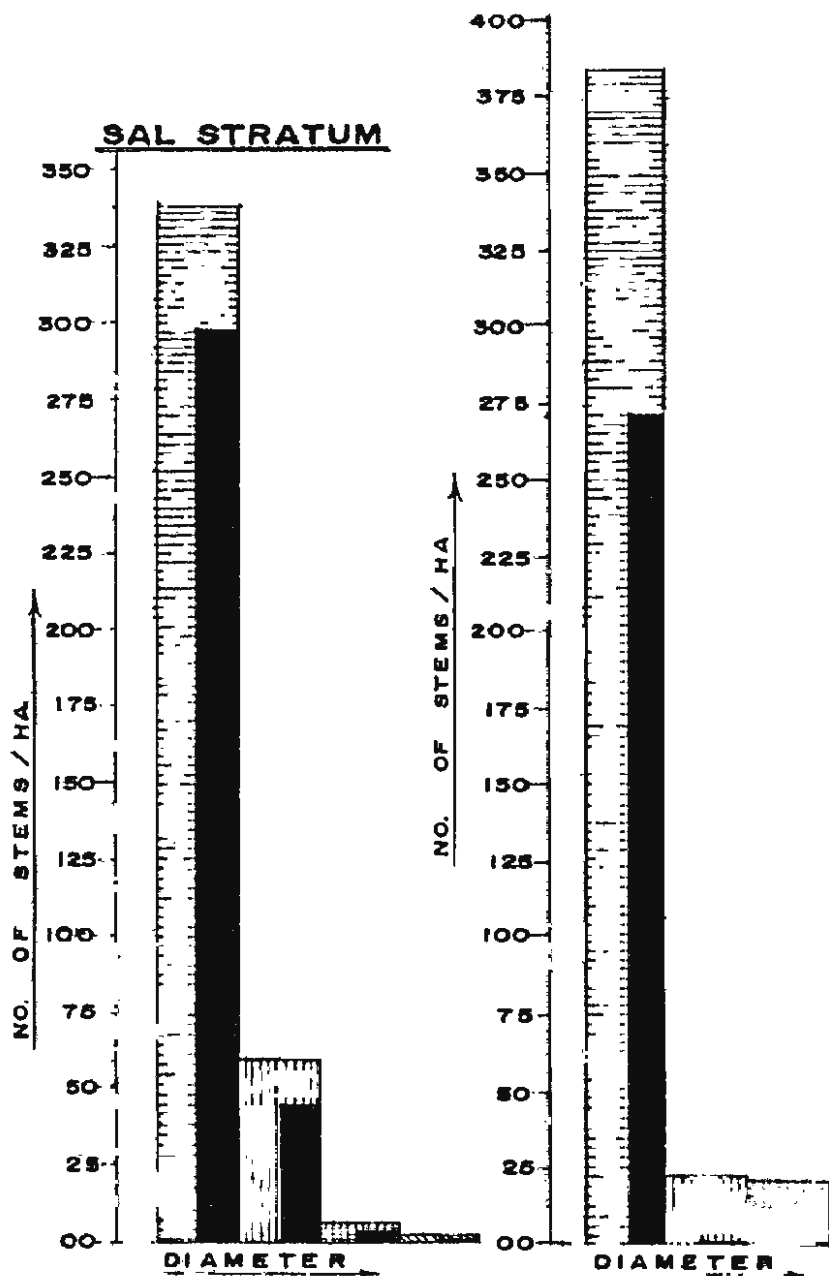
87° 15'

87° 30'

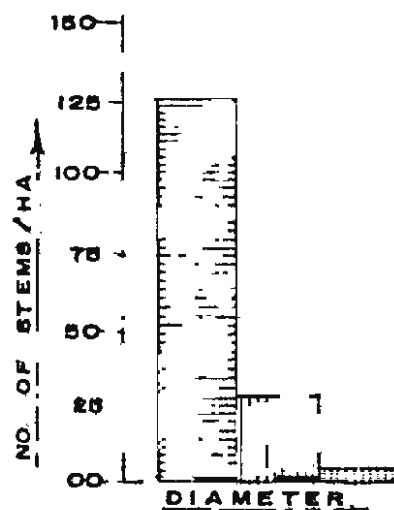
87° 45'

**DISTRIBUTION OF TOTAL STEMS PER HECTARE AND
STEMS PER HECTARE OF SAL ACCORDING TO DIAMETER
CLASS IN DIFFERENT STRATA**

MISC. STRATUM



PLANTATION STRATUM



REFERENCE

DIAMETER
IN CM.

5-9

10-19

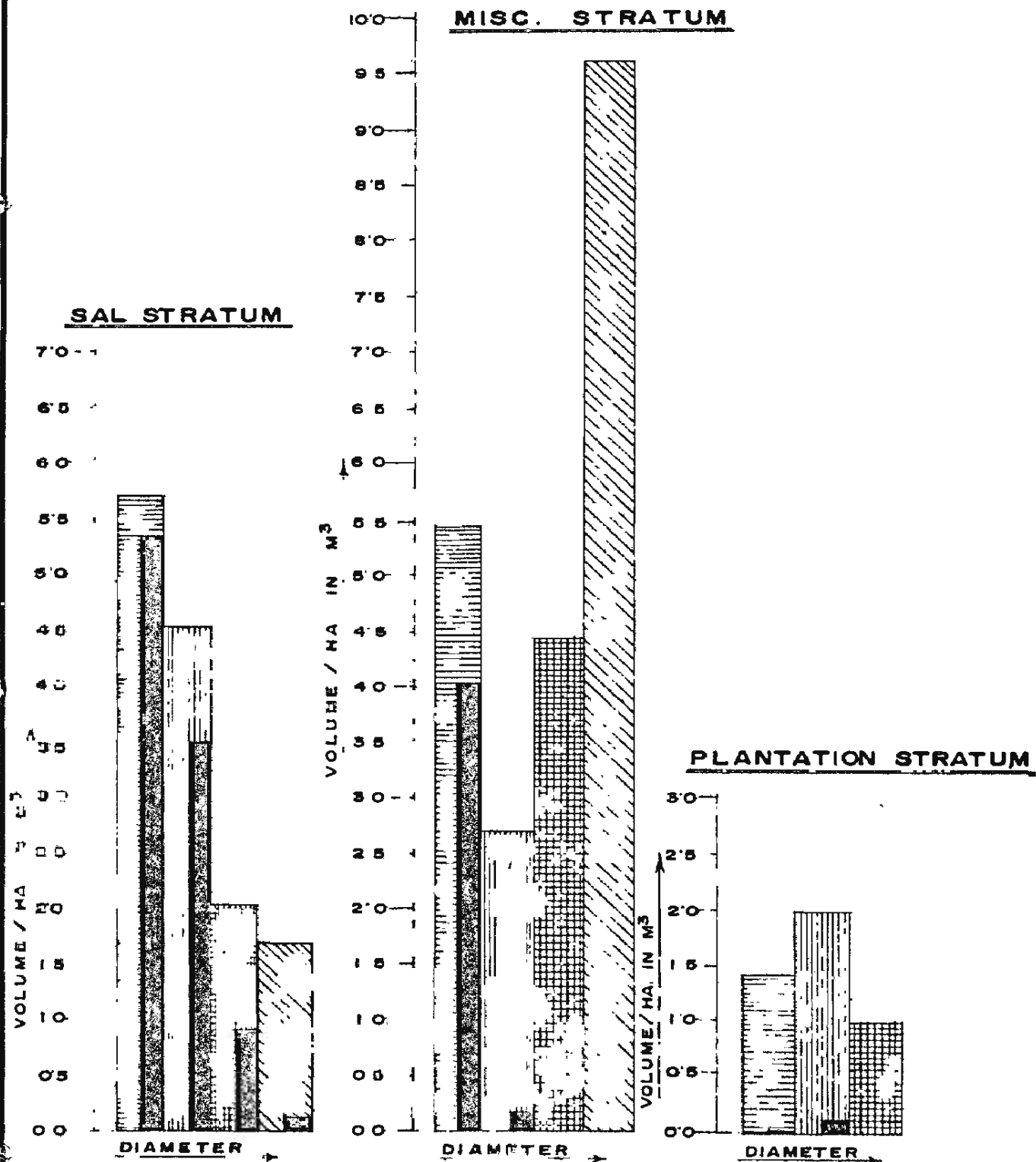
SAL SPECIES
IN EACH DIA.
CLASS.

DIAMETER
IN CM.

20-29

30 & ABOVE

DISTRIBUTION OF TOTAL VOLUME PER HECTARE AND VOLUME PER HECTARE OF SAL ACCORDING TO DIAMETER CLASS IN DIFFERENT STRATA



REFERENCE

DIAMETER
IN CM.

5-9

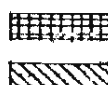
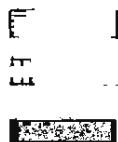
10-19

SAL SPECIES
IN EACH DIA
CLASS

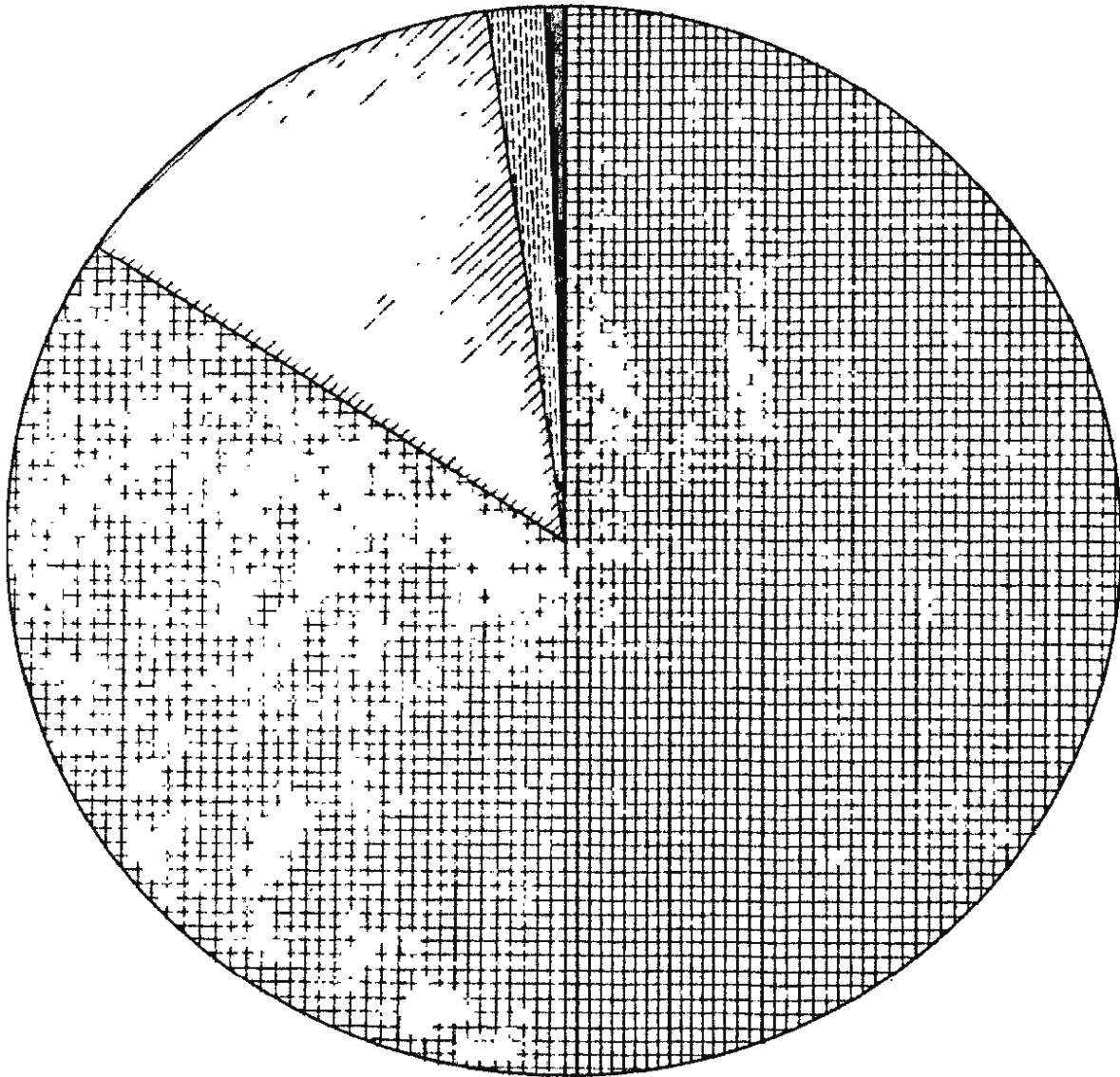
DIAMETER
IN CM.

20-29

30 & ABOVE







DISTRIBUTION OF TOTAL NUMBER OF STEMS
ACCORDING TO DIAMETER CLASSES

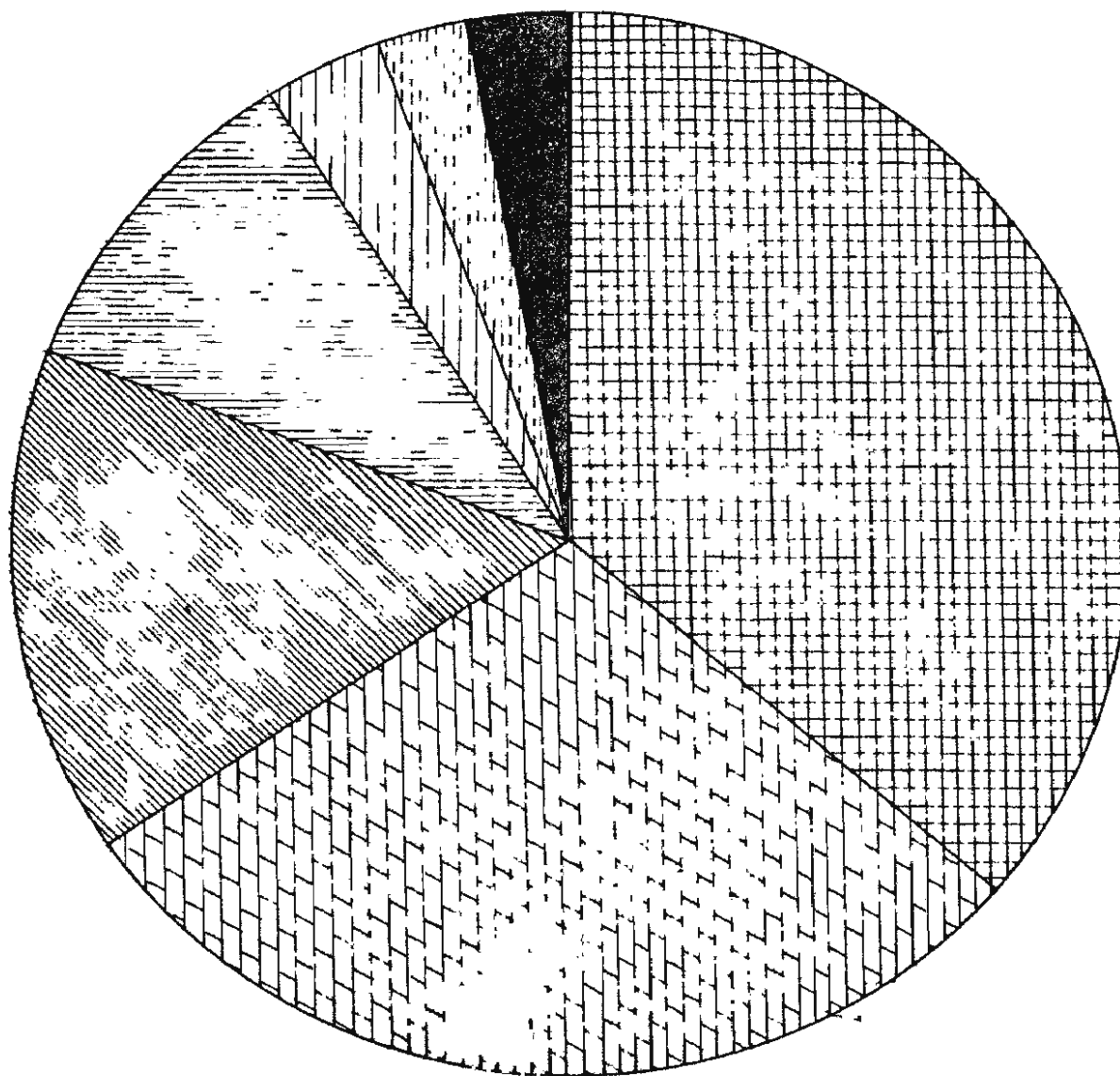


R E F E R E N C E

DIAMETER
IN CM.

5 - 9		04.14%
10 - 19		13.60%
20 - 29		17.63%
30 & ABOVE		07.63%

DISTRIBUTION OF TOTAL VOLUME ACCORDING
TO DIAMETER CLASSES



REFERENCE

DIAMETER
IN CM.

5—9



30 15%

10—19



29 05%

20—29



15 80%

30—39



17 63%

DIAMETER
IN CM.

40—49



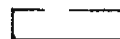
3 43%

50—59



2 56%

60—69



NIL

70—79



3 08%