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**REPORT
ON
FOREST RESOURCES OF**



**SANTHAL PARGANA DISTRICT
OF JHARKHAND**

**FOREST SURVEY OF INDIA
EASTERN ZONE
KOLKATA
2002**

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PREFACE

The present inventory of the forest resources of undivided Santhal Pargana district which is at present split into five separate districts viz. Deoghar, Dumka, Godda, Sahibganj and Pakaur districts, was carried out during the year 1994-95, with the objective of evaluating the status of forest resources providing details of crop composition including species-wise number and growing stock estimation, extent of degradation of forests, status of regeneration, grazing incidence and fire incidence etc. This district had earlier been surveyed during the period 1981-82 by the F.S.I. The findings of the present inventory has been compared with the past inventory of 1981-82.

The geographical area of the district is 14206 sq.km. The green wash area as marked on the toposheet taken as the forest area of the district is 1886.53 sq.km, which is 13.28%.

The survey revealed a total growing stock of 1.725 million m^3 with an average volume of 13.651 m^3 per hectare. The number of stems/ha for Sal and Misc. Stratum has been estimated as 100.290 and 69.845 respectively with an average of 85.288 ha for the district. The total number of stem is 10.778 million in the district.

Officers and staff members of Eastern Zone of Forest Survey of India who were entrusted with carrying out the inventory and bringing out the report in the present form deserve appreciation. The co-operation and help extended by the State Forest Department of Bihar is thankfully acknowledged.

It is hoped that the report will help the State Government in planning and provide inputs and facilitate forest resource management in the State

(Dr. J.K Rawat)
Director

**FOREST SURVEY OF INDIA
EASTERN ZONE
KOLKATA**

ACKNOWLEDGEMENT

This organization is extremely thankful and expresses gratitude to the forest officers and field staff of the Forest Department of Jharkhand State who rendered all possible cooperation to the field parties of our organization during the survey period without which it would not have been possible to complete the survey work in stipulated time. We are also thankful to the Deputy Commissioner and Superintendent of Police of Deoghar, Dumka, Godda, Sahibganj and Pakur districts and other officials of Jharkhand administration who extended all possible help to our field parties. Thanks are also expressed to the Deputy Directors and staff members of Forest Survey of India, Eastern Zone, who were entrusted with carrying out the field inventory and bringing out the report in the present form.

(Madhava Tripathy)
Regional Director.

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PART-I

(MAIN REPORT WITH MAPS, CHARTS AND DIAGRAMS)

CHAPTER I

BACKGROUND INFORMATION

1.1 INTRODUCTION:

Ever since the early days of civilization, man has been interacting with the environment through his several activities. With the gradual increase of population and demands of modern civilization, tremendous pressure has been placed on the natural resources of the earth. Today, environmental pollution has reached such alarming proportions that it now threatens the very existence of mankind. It is now felt that we can not advance in the path of development ignoring the well being of our natural habitat. Among the natural resources, some are renewable and others non-renewable. Forests comes under the first category. We must maintain and use it in perpetuity for the sake of a viable environment. For this purpose a complete and detailed assessment of the forest resources is an essential pre requisite. Keeping this in view , the Forest Survey of India, Eastern Zone has undertaken a study of the forest resources of undivided Santhal pargana district in the State of Bihar in the year 1994-95.

1.2 LOCATION AND AREA:

The present inventory pertains to the forest resources in undivided Santhal Pargana district of the then Bihar (now Jharkhand) State. The jurisdiction of Santhal Pargana district remained intact between 1971 and 1981 Censuses. However, as a result of the upgradation of Santhal Pargana as a separate division a couple of years ago, the erstwhile district was divided into four new districts , viz.Dumka, Deoghar, Godda and Sahibganj. After the 1991 Census, the district of Sahibganj was again divided into two parts i.e Sahibganj and Pakaur. Therefore, the earlier Santhal Pargana district has now been divided into five separate districts viz Deoghar, Dumka, Godda, Pakaur and Sahibganj. The results and findings of the study are, however, worked out for the undivided Santhal Pargana district because of the similarity in vegetation and nature of crop composition. In this report, the focus is on

the undivided Santhal Pargana district while elaborating the characteristics of the inventory area. The erstwhile district of Santhal Pargana extended over an area of 14,206 sq.kms. and happened to be the second largest district in the state next only to Ranchi district. It is bounded on the north by Bhagalpur and Purnia districts, on the east by Malda, Murshidabad and Birbhum districts of West Bengal, on the south by the districts of Burdwan and Dhanbad and on the west by Hazaribagh, Munger and Bhagalpur districts of Bihar.

1.3 PHYSICAL FEATURES:

Physiographically, the district of Santhal Pargana may be divided into three parts. One is the hilly region stretching from the bank of the Ganges in the north to the border of Bengal in the South. This region contains the famous Ranmahal hills and other hill ranges. Many of these hills and slopes are covered with forests, once dense but scanty now. The second region covers almost half of the district and comprises of uplands, undulations, long ridge and depressions. This area has a wide range of fertile lands which is cultivated intensively. There are high hills with lofty peaks like Tieur, Phuljore and Massanjore. The third region is a narrow strip of low, fertile alluvial plain lying between the Ganges and the hills running along the loop line of Eastern Railway. The principal ranges of this district are that of the Rajmahal hills which rise abruptly to some 1000-2000 ft. on the southern bank of the river Ganges. These hills stretch southward almost upto the Bengal border and form the backbone of the district. These hill ranges bifurcate into two parts near Borio. The western range passes through Godda and Dumka and the eastern range runs parallel to the loop line of the Eastern Railway. The hill ranges enclose between them a wide area of hilly tract, part of which is known as Damin-i-koh. The southern and south-eastern parts of the district are uplands. This area also contains some hills, lying here and there. Notable peaks are Phyljore Patardha, Tieur and Koeridih. The Nomihat and Massanjore hills are situated in the central part of the district.

1.4 CLIMATIC CONDITION:

The climate of Santhal Pargana district is of varied nature depending on its physical configuration in different parts of the district. The climate in the undulated tableland and in the hilly region is of extreme type. It becomes quite cold in winter and is sufficiently hot in summer. In the alluvial tract on the bank of the Ganges, the

heat is moist and more oppressive. The tableland in the southern portion of the district and in the rolling and hilly region is swept by dry hot winds during summer and is fairly cold during winter. March-June comprise the summer months. May and June are extremely hot when the temperature even rises to around 46°C . January is the coldest month when the minimum temperature at times goes down to 5°C . Annual humidity varies between 68% and 65% throughout the year. The monsoon usually sets in the later part of June and during the month of July, rainfall is the heaviest. August and September are also rainy months. The district has an average of 58 rainy days throughout the year. The average annual rainfall of the district is 1377 mm. The district also receives some winter rains due to the effect of north east monsoon.

1.5 DRAINAGE SYSTEM :

The district has a good drainage system all over its area. A couple of big and small rivers flow through it. The Ganges is the most important river of the district. The river forms the northern boundary of the district and enters it at its north western corner. Thereafter, it flows eastward up to Saknigali where it takes a turn to the south and then moves to form a part of the southern boundary of the district.

The Bankar is another important river of the district which serves as its south western boundary. The other two rivers, Mor and Ajar are also of importance to the district. The river Mor which is also known as Morakhi or Mayurakshi, originates in the Tiew hills and flows through the district in a south-easterly direction. The river Ajar flows through Deoghar and then merges with the river Bhagarathi in West Bengal. Other major rivers in the district lying east of the Rajmahal hills are Gumari, Bansloi, Palsi and Brahmani.

1.6 IRRIGATION FACILITIES:

The district of Santhal Pargana remains far behind in respect of providing good irrigational facilities. The district, abounding by rivers and rivulets, has got immense water resources. If exploited, the rivers can supply water for irrigation and electricity for power generation. During the pre-independence days, no tangible steps were taken for using these resources. The result is that failure of rains involves

failure of crop yields excepting some small pockets. The most common source of irrigation is the well and the popular device is the 'latha'. Major part of the district being rocky, it becomes difficult to dig wells in many areas. Besides, the sub-soil water level in uplands falls as the summer approaches. Wells, therefore, are not a very dependable source of irrigation. The undulatory nature of the land makes it possible to store rain water by bunding. Seepage ponds are also found. In the post-independence period the government has taken various steps to utilize the river resources. Irrigation is generally provided to wheat and sugarcane crops. Maize grown in bari and homestead land is also irrigated. The irrigational potential of the district has increased during the recent past through the adoption of various lift irrigation schemes and other minor, medium and major irrigational projects throughout the district. The important canal systems commissioned in recent past are the Mayurakshi left bank canal and the Jaminikola Irrigation Scheme.

1.7 FLORA AND FAUNA

The recorded forest area of the Santhal Pargana is 13.28% of the geographical area of the district at present. The district once known for its thick and extensive forests is now bereft of it. There has been a gradual destruction of the forests in recent past. However, the forest department has now begun some afforestation activities to arrest this trend. There are mainly three types of forests existing in the area.

i) TROPICAL DRY PENINSULAR SAL FORESTS

Sal is the dominant species of the forests and occurs in association with some dry miscellaneous species. The trees are mostly stunted and malformed and are in pole to mid-mature stage with very few mature trees which occur in valley bottoms in the interior of the forests. This forest type occurs mostly on the northern aspects of hills where the slope is moderate to steep. The common associates in the top canopy are *Terminalia tomentosa*, *Terminalia bellerica*, *Adina cordifolia*, *Buchanania lanzan* etc.

ii) NORTHERN TROPICAL DRY MIXED DECIDUOUS FORESTS:

This type occurs where the soil is shallow and degraded both in the hills as well as in plains. Due to adverse biotic factors, this forest type is gradually replacing Sal in the plains. In Deoghar, miscellaneous forest of poor quality occur in higher reaches above the Sal forests. In Dumka, the forest ranges

occur in higher reaches above the Sal forests. In Dumka, the forest ranges from fair to poor quality. The miscellaneous species occupying the upper storey are *Anogeissus latifolia*, *Mitragyna parviflora*, *Terminalia tomentosa*, *Lagerstroemia parviflora*, *Boswellia serrata*, *Madhuca latifolia*, *Acacia catechu* etc. with occasional Sal.

iii) TROPICAL DRY DECIDUOUS SCRUB FORESTS:

This type represents degraded form of forests and occurs due to adverse biotic as well as edaphic factors. Thorny species are common in these areas. *Acacia* species, *Euphorbia* species and *Zizyphus* species are common. Other species common in the area are *Boswellia serrata*, *Anogeissus latifolia*, *Butea monosperma*, *Diospyros melanoxylon* etc.

Growth of forest accounts for a wide variety of faunal wealth and in fact, Santhal Pargana was a sanctuary of wild animals upto the 19th century. Thereafter, large scale destruction of forests and wanton killing has reduced their number considerably. Tigers have vanished and leopards are met with only occasionally. Bears are seen in the Dumka Damru area and other hilly areas where the forests are dense. Hyenas, Chital and Barking Deer are rare in the district.

1.8 MINES AND MINERALS

Santhal Pargana has got a good deposit of minerals in different parts of the district. The geographical formations in major portions of Santhal Pargana consist of Archean gneiss and Gondwana rocks. The highlands along the eastern boundary of the district are made up mostly of volcanic rocks. The greater portion of the Rajmahal hills consists of these volcanic rocks. The district is the producer of several minerals like coal, building stones, road metal, lime, china clay, fire clay, iron, copper and lead. There are a number of coal fields in Santhal Pargana. Sizeable deposits of building stones and road metal are found in the Rajmahal hills. Pakur chips are quite well known and are used extensively all over Bihar and in parts of West Bengal as road metal. Deposits of kaolin occur near Mangal Hat in Rajmahal subdivision. Small deposits of copper ore and low grade lead are also found in the district. Besides, glass-making silica made out of sandstone is available near Mangal Hat.

1.9 DEMOGRAPHIC DEPICTION

Demographic picture of the inventory area is reflected by the data provided by 1991 census. The population figures for the split up districts viz Deoghar, Dumka, Godda, Sahibganj and Pakaur according to 1991 census is as below.

DISTRICT	TOTAL POPULATION	RURAL POPULATION	URBAN POPULATION
DEOGHAR	9,33,113	8,07,954	1,25,159
DUMKA	14,95,709	14,04,794	90,915
GODDA	8,61,182	8,37,545	23,637
SAHIBGANJ & PAKAUR	13,01,088	12,06,087	95,001

Thus the total population of the inventoried area amounts to 45,91,002. Of these, 23,73,034 persons are males and 22,18,058 are females. The percentage of urban population in the inventory area is only 7.29% of the total population. Santhal Pargana is typically characterised by high percentage of tribal and scheduled caste population with low literacy. The literate scheduled caste and scheduled tribe population of age 7 years and above for the districts of Deoghar, Dumka, Godda, Sahibganj and Pakaur is given in the following table.

DISTRICT	S C POPULATION	S T POPULATION	LITERACY RATE (7+ AGE)
DEOGHAR	115697	119085	37.92
DUMKA	104094	621484	34.02
GODDA	72893	216047	34.02
SAHIBGANJ & PAKAUR	70788	507321	27.03

Hindi is the principal language spoken in the district. The religion practised by the people are mainly Hinduism, Islam, Christianity, Santhal, Svama, Adivasi, Paharia etc.

1.10 ECONOMIC PURVIEW

The economic purview of an area is reflected by factors like, distribution of working class, development of agriculture and industry trade opportunities in the surrounding areas, etc. The percentage of main workers (33.03) and marginal

workers (7.67) in this district is found to be quite low. But surprisingly, percentage of non-workers in the district is significantly high (59.3%) according to 1981 census. A large section of people among main workers are agriculturists in character. The main occupation of the people is cultivation as over 26 percent of the population of the district is either cultivator or working as agricultural labourer. Kharif and Rabi are the main agricultural seasons in the district. Paddy is the main crop of the district. Maize is another important crop grown in this district. A few vegetables are grown in the neighbourhood of the towns in the district. Ground nuts, sweet potatoes and Khesari are widely grown. Linseed is grown mainly in Godda and Rajmahal. Sugarcane is raised in areas having assured irrigation. Jute is cultivated in parts of Pakaur and Rajmahal subdivisions. Orchards are also maintained for the production of fruits such as mango, papaya, guava, jackfruits, etc.

The district of Santhal Pargana is not that sound from the industrial purview. The district is primarily inhabited by Santhals and Paharias. The handloom fabrics and earthen pottery made by the Santhals are the pride of the district. Manufacture of materials from bamboo, cane, leaves and other allied products from the vast jungle tracts is also an addendum to it. The traditional cottage and village industries practiced by the Santhals and Paharias include tassar rearing, village blacksmithy and carpentry, handloom weaving, rope making, stonewares, bird making etc. Among the large industrial establishments of the district, pharmaceutical works of Dabur Private Ltd. in Deoghar, Bihar Silicate works in Madhupur, Metal press works in Sahibganj, Tinsan manufacturing company in Sahibganj, Railway Wagon factory in Jaaidih, China clay factories in Rajmahal are notable. Besides a number of small scale industries have also been set up in the district. The district of Santhal Pargana has one of the largest livestock population in the State. Poultry is an important subsidiary occupation of the tribals. A number of poultry development centres and extension centres have been opened in the district in order to improve the breed of poultry stock. The extensive bed of the river Ganges at Sahibganj and Rajmahal offers one of the best fields in the State for collection of fish spawn and fishing. In fact the fish trade of Rajmahal and Sahibganj has considerable turnover.

11.11 TRANSPORT FACILITIES

The district of Santhal Pargana lags behind in respect of communications. Previously, it was only the Dhanbadpur Sim Road which passed through the district.

However, lately the situation has changed and now there is a good network of roads in the district. All the subdivisional headquarters and most of the development quarters are connected with the district headquarters by black topped all weather roads. All the important places in the district are connected with good metalled roads. There are two road-links with Calcutta through Jamtara and Suri. Patna the state capital, is connected with the district both via Bhagalpur and Chakri. The Jamtara Dumka-Sahibganj road provides a link with Assam using the ferry across the Ganges and is quite busy. A large number of buses ply on these roads.

The district remains behind in terms of railway communication. In fact the district is deprived of adequate railway communication facilities. The main line of the Eastern Railway traverses close to the south-western boundary of the district and the loop-line moves along the northern and eastern extremity of the district. Dumka and Godda have no rail link.

The only navigable waterway is the river Ganges. A ferry steamer service is maintained between Maharajpur Ghat (Sakrigali ghat) and Manikarni ghat (Purnia). The Zila Parishad runs three ghat ferries on the Ganges at Rajmahal, Sakrigali ghat and Maharajpur ghat. Small boats and large cargo boats ply on the Ganges.

Regarding air communication there are two small landing grounds in the district, one at Dumka and another at Deoghar. No regular air transport services operate from these two landing grounds. These are mainly used by small planes belonging to the State Govt.

CHAPTER II

DESIGN AND METHODOLOGY

2.1 SURVEY OBJECTIVE

The objective of the forest inventory was to collect a wide range of information covering the total growing stock, volume per hectare area, distribution of stems, number of stems per hectare area, details of area estimates according to land use, legal status, topography, forest status, incidence of fire, grazing, regeneration status etc. All these information form the basis of development planning for sustainable forest management and conservation. The usual FSI forest inventory design has been followed to carry out the present inventory on forest areas of Santal Parganas.

2.2 AREA SELECTION

The areas in which the inventory was carried out are as follows

- Area shown in green wash on the Survey of India toposheets
- All such areas in which woods such as thick jungle, open forests, bamboo etc. are printed.
- All these areas indicated by dotted line or spotted line or a pillar line as forest areas
- Any other area reported to be forest area by the local forest department.

2.3 MAPS USED

The latest published Survey of India toposheets on 1:50,000 scale have been used for the present inventory of forest areas in Santal Parganas. Altogether thirty three toposheets were used for the survey. These are as follows:

i)	72 I/6,7,8,10,11,12,14,15,16	= 9 nos
ii)	72 O/4,8,12,16	= 4 nos
iii)	72 P/1,2,3,4,5,6,7,8,9,10,11,12,13,14,15	= 15 nos
iv)	73 U/5,9,13	= 3 nos
v)	73 M/1,5	= 2 nos
	Total	= 33 nos

2.4 SURVEY DESIGN.

The survey was essentially a systematic sampling under which the Survey of India toposheets of 1:50,000 scale is divided into 36 grids of $2.5' \times 2.5'$ of latitude and longitude. In each of such grids, two sample points were selected on the toposheets. Selection of the first point is random and the second point is linked to the first one in the opposite direction at an equal distance from the grid center. The inventory data was collected from a square plot of 0.1 hectare laid out at each of these sample points on the ground. Only the plots falling within the forest areas were surveyed. One sample plot of 0.1 hectare represents about 10 sq.km. on the ground and the intensity of sampling is 0.01%. The length of each side of the square plot is 31.62 meter on the ground and 0.6324 mm (say 0.6 mm) on the toposheet of scale 1:50,000.

2.5 PRECISION AND ACCURACY.

The result of the present survey would be at the provision level of 95% probability with error limit of $\pm 10\%$. This accuracy is however, obtained for the entire state and not for the district.

2.6 PLOT LAYOUT.

The method of marking of the plot centres of the two sample plots on the map in each grid of $2.5' \times 2.5'$ is depicted in Diagram. The length and width of each grid are measured to the smallest convenient scale. The length of the side of a plot on the map corresponding to 0.1 hectare square plot on the ground is calculated. Let X & Y be the length and width of the grid and s is the side of the plot. Subtract side s from both sides, i.e. find $(X-s)$ and $(Y-s)$. Let these numbers be X' and Y' . The random numbers one in the range of 0 to X' and the other in the range of 0 to Y' are selected. These numbers are called x & y respectively. Half of the side of the plot i.e. $s/2$ is added to x & y to get $x+s/2$ and $y+s/2$, which will be the coordinates of the center of first plot in the grid considering the left hand bottom corner i.e. south west corner of the grid as origin of the axis. The center of second plot is located by joining the center of first plot with the grid center and extending this line in the opposite direction. A point at equal distance from the grid center in the opposite direction is marked which is the center of the second plot.

After fixing the plot center with the help of topsheet and reference point, the four corners of the plot are obtained by measuring 22.36 meter from the plot centre in each of the directions viz North-west, south-west, north-east, south-east. Thus, it may be seen that the sampling design adopted was a random sampling with grids as sampling units having a cluster of two plots.

2.7 DATA COLLECTION

Data from the field is collected by an inventory crew headed by a crew leader. To visit a plot, a prominent reference point is selected in the vicinity of the plot center. The reference point is a clearly visible point both on the map as well as on the ground e.g. a nala junction or identifiable natural feature on the spot. It is marked by a peg with appropriate markings. For collection of codified information from each sample plot, the following forms are used:

Plot approach form - It gives an account of details regarding the approach to the plot. All the details from camp site to the plot center are recorded. A prominent reference point along with bearings is recorded which serves as an aid to reach the plot at a future date.

Plot description form - The description of several parameters such as topography, soil, land use class, forest type, regeneration, crop data etc. are collected and recorded in this form for an area of 2 ha around the plot.

Plot enumeration form - This form is filled up for each plot. The details recorded are the name of the species, its code and diameter. Trees less than 10 cm d.b.h. and utility less than 70% are usually not recorded. Border trees are counted "IN" when they touch NW-NE and NW-SW boundaries and considered "OUT" when they touch NE-SE and SW-SE boundary lines.

Sample tree form - Data for trees with diameter 10 cm. and above at breast height are collected from the North-West quadrant of the plot. In this form, additional data e.g. tree height, bark thickness, length of clear bole, shape of the tree etc. are recorded.

CHAPTER:III

DATA PROCESSING AND COMPILATION

3.0 GENERAL:

Data processing was carried out in the following three phases

- i) Manual processing
- ii) Data entry in Computer
- iii) Processing by computer.

3.1 MANUAL PROCESSING:

Manual processing involves the following steps:

- a) Proper documentation of the field information received.
- b) Codification of the information in the field forms which has not already been incorporated
- c) Manual checking of the information filled in the forms
- d) Reconciliation of the discrepancies with the help of the field officers.

3.2 DATA ENTRY IN COMPUTER:

After manual checking, the information in the field forms was fed into the computer. The following data was stored in the hard disk for onward processing

- 1) Plot description data
- 2) Plot enumeration data
- 3) Sample tree data.

3.3 PROCESSING ON COMPUTER:

Processing by the computer includes the following steps

- i) Verification of data for the creation of clean file and the transference of the same to hard /floppy disk.
- ii) Consistency checking of the data on computer
- iii) Correction of the data to remove discrepancies noticed during consistency checking.
- iv) Tabulation of plot wise stem distribution and for the district as a whole
- v) Preparation of tables of volume distribution

3.4 DERIVATION OF VOLUME EQUATIONS

No trees were felled during the survey for the district. It was decided that the local volume equations generated earlier by Forest Survey of India, Eastern Zone for Ranchi forest inventory, should be used for the present inventory.

3.4.1 LOCAL VOLUME EQUATION :

Following local volume equations borrowed from earlier survey of forest resources of Ranchi district were used for volume calculations.

Species	Equations
<i>Anogeissus latifolia</i>	$V=0.028653-0.97687D+11.024D^2$
<i>Syzygium cumini</i>	$V/D^2 = 6.2214-0.49647/D+0.016042/D^2$
<i>Adina cordifolia</i>	$V/D^2=13.437-1.3527/D+0.04472/D^2$
<i>Shorea robusta</i>	$V/D^2=8.714-0.70158/D+0.022585/D^2$
<i>Boswellia serrata</i>	$V/D^2=10.316-1.124/D+0.03356/D^2$
<i>Terminalia tomentosa</i>	$V/D^2=9.4721-0.84158/D+0.022389/D^2$
Rest of species	$V/D^2=9.5879-0.89224/D+0.025584/D^2$

3.5 TREE VOLUME

Volume of each enumerated tree was estimated with the help of volume equations and was used for generation of stock tables by species and diameter class.

3.6 PLOT VOLUME

Volume of each enumerated tree in a plot when added up provided the plot volume. These plot volume figures were the basis for estimation of sampling error.

3.7 ANALYSIS OF GROWING STOCK

Analysis of growing stock was carried out from plot data and per hectare figures worked out for each stratum by species and diameter class. Following were the important tables generated for each stratum.

- 1) Stems/ha for individual species and its distribution into diameter classes as 10-19cm, 20-29cm, 30-39 cm etc.
- 2) Total stems by species and diameter classes.
- 3) Corresponding volume/ha by species and diameter classes.
- 4) Total volume by species and diameter class.

CHAPTER IV

RESULTS OF INVENTORY

4.0 GENERAL

In the present inventory, data has been analyzed with a view to highlight the composition and distribution of the trees in various strata in the district. Data collected during field inventory were analyzed and various informations were generated. Important and relevant extracts from these tables are presented in this chapter.

4.1 FOREST COVER AS PER STATE OF FOREST REPORT 1997(F.S.I.)

The report relates to the forest resources of the entire undivided Santhal Parganas district of Bihar State. The geographical area and the extent of forest cover of the above district is given below :

District	Geo area in sq km	<u>Forest cover (sq km)</u>			
		Dense forest	Open forest	Mangrove	Total
Santhal Parganas	14206	282	1187	-	1469

Source: State of Forest Report F.S.I. Publication 1997.

4.1.1 RECORDED FOREST AREA

The forest area of Santhal Parganas district by legal status as recorded in the Annual Administration report for the period from 1989-90 to 1992-93 published from Forest Research Division, Bihar is tabulated below :

<u>LEGAL STATUS</u>	<u>RECORDED FOREST AREA(Sq km)</u>
1. Reserved forest	12853
2. Protected forest	179536
3. Unclassed forest	-
Total	192389

N.B. The difference in the total forest area in para 4.1 and 4.1.1 and also in the para 4.1.2 arises due to the difference in the source of information as well as the year of determination and definition.

4.1.2 INVENTORIED AREA :

The forest area as represented by 206 plots marked on the green wash area of the toposheets of Santal Parganas district was calculated using 'dot grid' method. The total forest area comes out to be 1886.53 sq.km. Henceforth, the inventoried forest area as calculated by 'dot grid' method, would be taken as the total forest area of the district i.e. 1886.53 sq.km. Thus, each inventoried plot represents 9.1579 sq.km area.

4.2 ANALYSIS OF PLOT DESCRIPTION DATA:

The plot data collected during inventory in respect of terrain condition, regeneration, fire incidence, grazing incidence, degradation status etc. were analysed. The distribution of the forest land in the different land use classes is as below :

4.2.1 DISTRIBUTION OF FOREST AREA BY LAND USE CLASSES:

Code No	Land use	Description	No of plots	Forest Area in (ha.)	%
1	Dense tree forest	Forest with canopy density 70% and above	4	3663	1.94
2	Moderately dense tree forest	- do - 30- 69%	33	30222	16.02
3	Open tree forest	-do- 5-29%	68	62274	33.01
4	Scrub forest	- do - less than 5%	22	20147	10.68
5	Bamboo brakes	Areas completely covered with bamboo	2	1832	0.97
6	Shifting cultivation	Areas under current as well as previous Years shifting cultivation	30	27474	14.56
7	Young plantation of forestry species		8	7326	3.88
8-10	Trees in line	-	-	-	-
11	Barren land		9	8242	4.37
12	Agricultural land without trees	-	-	-	-
13	Agricultural land with trees		4	3663	1.94
14	Non forest plantation	-	-	-	-
15	Habitation		3	2747	1.46
16	Water bodies		-	-	-
18	Young crop of natural or artificial regeneration		23	21063	11.17
	Total		206	188653	100.00

It is observed from the above table that bulk of the forest area is covered under open tree forest (33.01%) followed by moderately dense tree forest. It also shows scrub forest to the extent of 10.68% of the total forest area. In all 77.67% of the forest land is under vegetation including scrub forest and bamboo forest and the rest of the area is being used for non-forestry purposes. The major factor responsible for diversion of forest land to non-forestry purposes is agricultural use mainly due to shifting cultivation, habitation and encroachment of forest land for agricultural use.

4.2.2 TREE FOREST AREA FOR GROWING STOCK ESTIMATION

The area falling under the following land use classes have been considered as tree forest area and included for growing stock estimation.

Code No	Land use classes
1	Dense tree forest
2	Moderately dense tree forest
3	Open tree forest
5	Bamboo braka
7	Young plantation of forest species
18	Young crop of natural or artificial regeneration

The total tree forest area for growing stock estimation is 1263.79 sq.km. Thus, out of the 206 plots inventoried data from 138 plots have been used for growing stock estimation.

4.2.2.1 STRATIFICATION

Stratification was based on proportional distribution of the forested plots as per forest composition and land use classes. An abstract of the same is furnished below:

Crop composition	Number of plots
1. Sal forest	70
2. Khair forest	4
3. Miscellaneous forest	64
Total:	138

From the above table it is clear that only two major strata could be formed in this district e.g. Sal stratum and Miscellaneous stratum. 4 plots falling in Khair forest have been merged with miscellaneous stratum for analytical purposes. It is worthwhile to mention that only the plots which are considered as tree forest area are shown in the above table. Thus, the forest area falling under Sal and Miscellaneous strata are as follows.

Strata	Number of plots	Total forest area (ha)
Sal	70	64105
Miscellaneous	68	62274
Total	138	126379

4.2.3 DISTRIBUTION OF TREE FOREST AREA BY TOPOGRAPHY

The distribution of tree forest area in terms of topography was found to fall under the following four types.

Code	Topography	No. of plots	Forest area (ha)	Percentage
1	Flat	2	1872	1.45
2	Gently rolling	16	42126	33.33
3	Hilly	82	75095	59.42
4	Very hilly	8	7326	5.80
	Unrecorded	-	-	-
	Total	138	126379	100.00

Most of the forest can be categorized under hilly area and covers 59.42% of the total tree forest area. Gently rolling area constitutes 33.33% whereas very hilly area constitutes 5.80% of the tree forest area only.

4.2.4 DISTRIBUTION OF FOREST AREA BY ASPECT

The distribution of forest area by various aspect classes for the district is stated below.

Code	Aspect	No. of plots	Forest area (ha)	Percentage
1	Northern	16	14651	11.59
2	North-eastern	23	21063	16.67
3	Eastern	9	8242	6.51
4	South-eastern	19	17400	13.77

5	Southern	21	19232	15.22
6	South-western	19	17400	13.77
7	Western	12	10989	8.70
8	North-western	19	17400	13.77
9	No aspect	-	-	-
	Unrecorded	-	-	-
Total		138	126379	100.00

The above table is self explanatory

4.2.5 DISTRIBUTION OF FOREST AREA BY ROCKINESS

The inventory result reveals that the district does not bear significant rocky area.

Code	Rockiness	No. of plots	Forest area(ha)	Percentage
1	High	2	1832	1.45
2	Medium	3	2747	2.17
3	Low	13	11905	9.42
4	No rock	120	109895	86.96
	Unrecorded	-	-	-
	Total	138	126379	100.00

Rockiness refers to the degree of presence of rock covering the land surface in 2 ha. area around the plot centre. The above table indicates that 86.96% of the surface is available for tree growth.

4.2.6 DISTRIBUTION OF FOREST AREA BY SOIL CONSISTENCY

Distribution of tree forest area by soil consistency class is given below :

Code	Soil consistency	No. of plots	Forest area(ha)	Percentage
1	Frable	13	11905	9.42
2	Slightly compact	118	108063	85.51
3	Compact	7	6411	5.07
4	Cemented	-	-	-
5	No soil	-	-	-
	Unrecorded	-	-	-
	Total	138	126379	100.00

Soil consistency represents the nature of soil material that is expressed by the degree and kind of cohesion or resistance to deformation or rupture. The above table indicates that most of the soil is slightly compact to the extent of 85.51% of the tree forest area which supports good forest crops. Friable and compact soil consist of 9.42% and 5.07% respectively of the tree forest area.

4.2.7 DISTRIBUTION OF TREE FOREST AREA BY SOIL TEXTURE

Texture of soil refers to relative occurrence of clay, silt and sand particles. The following table indicates the soil classification:

Code	Soil texture	No. of plots	Forest area(ha)	Percentage
1	Clayey	-	-	-
2	Clayey loam	48	43958	34.78
3	Loam	77	70516	55.80
4	Sandy loam	13	11905	9.42
5	Sandy	-	-	-
6	No soil	-	-	-
	Unrecorded	-	-	-
	Total	138	126379	100.00

A high percentage of 55.80% of the total tree forest area has a loamy texture i.e. soil having mostly silt and with some clay followed by clayey loam and sandy loam to the extent of 34.78% and 9.42% of tree forest area respectively.

4.2.8 DISTRIBUTION OF TREE FOREST AREA BY SOIL EROSION

The distribution of tree forest area by soil erosion status is given in the following table:

Code	Soil erosion	No. of plots	Forest area(ha)	Percentage
1	Heavy	10	9158	7.25
2	Moderate	39	35716	28.26
3	Mild	85	77842	61.59
4	No erosion	4	3663	2.90
	Unrecorded	-	-	-
	Total	138	126379	100.00

Erosion means the wearing away of the earth's surface by the forces of water and wind. 61.59% of the tree forest area is marked as mildly eroded areas (less than 25% of top soil appears to be washed away), followed by moderately eroded areas 28.26% (25 to 75% top soil appears to be washed away). More than 75% top soil has been removed (i.e. heavy erosion) in 7.25% tree forest area.

4.2.9 DISTRIBUTION OF FOREST AREA BY INJURIES TO CROP

Injuries to crop as observed during inventory is as under:

Code	Injuries to crop	No of plots	Forest area (ha)	Percentage
1	Borer attack, leaf defoliation attack or damage by other forest epidemic	-	-	-
2	Top drying	-	-	-
3	Girdling and illicit felling	135	123631	97.83
4	Scaring of trees	-	-	-
5	Lopping for fodder	-	-	-
6	Wind damage or flood damage	-	-	-
7	Other injuries	-	-	-
8	No injuries	2	1832	1.45
	Unrecorded	1	916	0.72
	Total	138	126379	100.00

Data on the injuries to crop indicates that the district forests are subjected to maximum injuries by human agencies in the form of girdling and illicit felling. It is needless to mention that the damage caused by illicit felling reduces the quality of crops and therefore needs proper attention.

4.2.10 DISTRIBUTION OF TREE FOREST AREA BY FIRE INCIDENCE

Percentage of tree forest area affected by fire, is as follows.

Code	Fire incidence	No. of plots	Forest area(ha.)	Percentage
1	Heavy	1	916	0.72
2	Moderate	13	11905	9.42
3	Light	84	76926	60.87
4	No fire	39	35716	28.27
	Unrecorded	1	916	0.72
	Total	138	126379	100.00

From the above table, it is observed that there is no appreciable incidence of 'heavy' fire in the forests. However, 'moderate' to 'light' fire incidence occurs in 70.29% tree forest area in the district. Forest area free from fire damage constitute 28.27% forest area only.

4.2.11 DISTRIBUTION OF FOREST AREA BY GRAZING INCIDENCE

Intensity of grazing in the district forests is furnished below :

Code	Grazing	No. of plots	Forest area(ha.)	Percentage
1	Heavy	11	10073	7.97
2	Moderate	59	54032	42.76
3	Light	57	52200	41.30
4	No grazing	10	9158	7.25
	Unrecorded	1	916	0.72
	Total	138	126379	100.00

The study reveals that of the tree forest area 42.75% suffers from moderate grazing, 41.30% light grazing, while 7.97% heavy grazing. It is, therefore, evident that tree forest area is moderately disturbed due to grazing which causes damage to regeneration and soil condition of the tree forest area.

4.2.12 DISTRIBUTION OF FOREST AREA BY PLANTATION POTENTIALITY:

From the following table the plantation potentiality can be assessed:

Code	Plantation potentiality	No. of plots	Forest area(ha.)	Percentage
1	Plantable	46	42126	33.33
2	Unplantable	4	3663	2.90
3	Not applicable	88	80590	63.77
4	Unrecorded	-	-	-
	Total :	138	126379	100.00

Plantation potentiality in the tree forest area of the district is 33.33% and these plantable areas may be afforested with choice of suitable species according to the specific site.

4.2.13 DISTRIBUTION OF FOREST BY INTENSITY OF REGENERATION:

Degree of regeneration in the district is as under:

Code	Description (No. of seedlings in 4m x 4 m square plot)	No. of plots	Forest area(ha.)	Percentage
1	Adequate (8 or more)	14	12821	10.14
2	Inadequate (less than 8)	81	74179	58.70
3	Absent	41	37547	29.71
4	Unrecorded	2	1832	1.45
	Total :	138	126379	100.00

Only 10.14% of the tree forest area has adequate regeneration, inadequate or no regeneration is observed in 88.41% of the tree forest area. The overall position of regeneration is thus not satisfactory.

4.2.14 DISTRIBUTION OF FOREST AREA BY DEGRADATION:

Degradation status of the tree forest area is reflected in the following table:

Code	Degradation status	No. of plots	Forest area(ha.)	Percentage
A	Grazing, fire, pollarding, illicit cutting and lopping			
11	Heavily degraded	52	47621	37.68
12	Moderately degraded	62	56779	44.93
13	Mildly degraded	24	21979	17.39
14	Not degraded	-	-	-
	Total :	138	126379	100.00

Code	Degradation status	No. of plots	Forest area(ha.)	Percentage
B	Other natural calamities such as land slides, glaciers, flood, rainfall etc.			
21	Heavily degraded	-	-	-
22	Moderately degraded	-	-	-
23	Mildly degraded	-	-	-
24	Not degraded	-	-	-
	Total	-	-	-

Heavy to moderate degradation due to biotic interference is observed in 82.61% of the total tree forest area. Mildly degraded forest area constitutes 17.39% of the tree forest area only. Degradation due to natural calamity is insignificant.

4.3 TREE DENSITY STUDY :

The distribution of stems/ha. by species and diameter classes in different strata have been calculated which are given in Table No.1.1 and Table No.1.2(vide Part II of this report). The number of stems/ha. by stratum and district are summarized below :

<u>Stratum</u>	<u>Number of stems/ha.</u>
Sal	100 290
Miscellaneous	69 845
for the district	85 288

a) Sal stratum

Following observation can be made from the table No.1.1(vide Part II of this report) of stems/ha. table of this stratum

- Number of stems/ha. is 100.290 in this stratum. Concentration of trees in the lower diameter class i.e. 10-19 cm. is maximum which accounts for 93.59% of the total trees of this stratum followed by 3.71% in diameter class 20-29 cm.
- It is also noticed that 2.71% of the trees is above 30 cm Diameter class.
- Trees above 70 cm. is practically absent

- iv) The value of stems/ha. with percentage of some of the important species are furnished below .

Species	Number of stems/ha.	Percentage(%)
<i>Shorea robusta</i>	62.857	62.68
<i>Terminalia crenulata</i>	5.857	5.84
<i>Buchanania lanzan</i>	5.714	5.70
<i>Madhuca latifolia</i>	4.858	4.84
<i>Diospyros melanoxylon</i>	3.429	3.42

Shorea robusta is the main species. *Terminalia crenulata* and *Buchanania lanzan* are also found in some sizeable quantity.

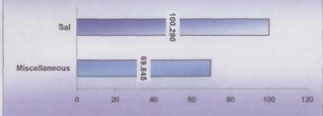
- b) Miscellaneous stratum :

Following observation can be made from the table No. 1.2(vide Part II of this report) of stems/ha. table of this stratum.

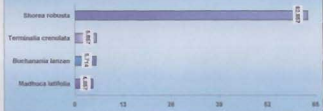
- i) Number of stems/ha. is 69.845 in this stratum.
- ii) Concentration of trees in the lower diameter classes i.e. 10-19 cm. is maximum which accounts for 80.84% of the total trees of this stratum followed by 13.26% & 2.74% in diameter class 20-29 cm. and 30-39 cm. respectively.
- iii) The value of stems/ha. with percentage of some of the important species are furnished below :

Species	Number of stems/ha.	Percentage(%)
<i>Terminalia crenulata</i>	8.382	12.00
<i>Madhuca latifolia</i>	6.029	8.63
<i>Pterocarpus marsupium</i>	4.706	6.74
<i>Lannea coromandelica</i>	4.853	6.95
<i>Bombax ceiba</i>	4.412	6.32
<i>Acacia catechu</i>	2.647	3.79
<i>Shorea robusta</i>	2.647	3.79

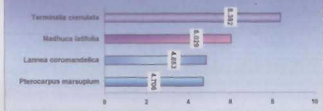
DISTRIBUTION OF NO. OF STEMS/HA. BY STRATA



NO. OF STEMS/HA. FOR THE DOMINANT SPECIES UNDER SAL STRATUM



NO. OF STEMS/HA. FOR THE DOMINANT SPECIES UNDER MISCELLANEOUS STRATUM



4.4 TOTAL STEMS

The total number of stems in different strata by species and diameter classes are given in table No.2.1 and 2.2 (vide Part II of this report). These are summarized below :

<u>Stratum</u>	<u>Total stems('000 no.)</u>
Sal	6429
Miscellaneous	4349
Total	10778

Thus, total number of stems in the forest of undivided Santhal Parganas district has been estimated as 10.778 million.

Total number of stems which are predominant and occur abundantly in the respective stratum are summarized below :

a) Stratum Sal.

<u>Species</u>	<u>Total stems('000 no.)</u>
Shorea robusta	4029
Terminalia crenulata	375
Buchanania lanzan	366
Madhuca latifolia	311
Diospyros melanoxylon	220

b) Stratum Miscellaneous

<u>Species</u>	<u>Total stems('000 no.)</u>
Terminalia crenulata	522
Madhuca latifolia	175
Pterocarpus marsupium	293
Lannea coromandelica	302
Acacia catechu	165
Shorea robusta	165

4.5 VOLUME STUDIES :

The distribution of volume/ha. by species and diameter classes in different stratum has been calculated and given in Table 3.1 to 3.2 (vide Part II of this report)

The volume / ha. by stratum and district is summarized below :

<u>Stratum</u>	<u>Volume(m^3)/ha.</u>
Sal	12 237
Miscellaneous	15 108
Average for the dist.	13.651

a) Stratum : Sal:

Salient features of this stratum are given below :

- Volume/ha. is 12 237 m^3 .
- Shorea robusta* is the main volume contributing species which accounts for 43.04% of the volume of this stratum.
- Volume is mostly concentrated in lower diameter classes i.e. 10-19cm, 20-29cm. and 30-39 cm. which accounts 57.08%, 9.74% and 7.22% of the total volume respectively.
- Important volume contributing species with percentage: are summarized below :

Species	Volume (m^3)/ha.	Percentage(%)
<i>Shorea robusta</i>	5,267	43.04
<i>Terminalia crenulata</i>	1,957	15.99
<i>Buchanania lanzan</i>	0.432	3.53
<i>Madhuca latifolia</i>	1,399	11.43
<i>Diospyros melanoxylon</i>	0,700	5.72
<i>Dombax eciba</i>	0.434	3.55

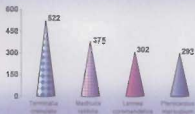
DISTRIBUTION OF TOTAL STEMS (IN '000 NO.) BY STRATA



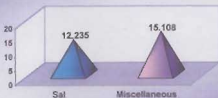
TOTAL STEMS ('000 NO.) FOR THE DOMINANT SPECIES UNDER SAL STRATUM



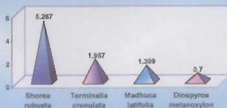
TOTAL STEMS ('000 NO.) FOR THE DOMINANT SPECIES UNDER MISCELLANEOUS STRATUM



DISTRIBUTION OF VOLUME(M^3)/HA. BY STRATA



VOLUME(M^3)/HA. FOR THE DOMINANT SPECIES UNDER SAL STRATUM



VOLUME(M^3)/HA. FOR THE DOMINANT SPECIES UNDER MISCELLANEOUS STRATUM



b) Miscellaneous stratum :

Following observation can be made from the table No 3.2(vide Part II of this report)

- i) Volume/ha. is 15.108 m^3 in this stratum.
- ii) Concentration of volume is maximum in the 10-19cm dia. classes which accounts for 26.17% followed by 20.40% and 11.07% in 20-29cm. and 30-39cm dia. classes respectively.
- iii) The value of volume (m^3)/ha. with percentage of some of the important species are furnished in the table given below .
- iv) Significant contribution of volume is also noticed in higher diameter classes .

Species	Volume(m^3)/ha.	Percentage(%)
<i>Terminalia crenulata</i>	0.882	5.84
<i>Madhuca latifolia</i>	2.891	19.14
<i>Bombax ceiba</i>	2.112	13.98
<i>Trema orientalis</i>	1.714	11.33
<i>Syzygium cumini</i>	0.535	3.53
<i>Bauhinia</i> species	0.520	3.44

4.6 TOTAL VOLUME :

The total volume in different strata by species and diameter classes are given in table No 4.1 and 4.2 (vide Part II of this report). These are summarized below :

Stratum	Total volume('000 m^3)
Sal	784
Miscellaneous	941
Total:	1725

Thus, total volume in the forest of undivided Santhal Parganas district has been estimated as 1,725 million m^3 .

Significant volume contribution by some of the important species are given below :

Stratum Sal :

Species	Total volume ('000 m ³)
<i>Shorea robusta</i>	338
<i>Terminalia crenulata</i>	125
<i>Buchanania lanzon</i>	28
<i>Madhuca latifolia</i>	90
<i>Diospyros melanoxylon</i>	45
<i>Bombax ceiba</i>	28

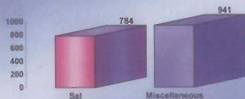
Stratum Miscellaneous :

Species	Total volume ('000 m ³)
<i>Terminalia crenulata</i>	55
<i>Madhuca latifolia</i>	180
<i>Trema orientalis</i>	107
<i>Bombax ceiba</i>	132
<i>Syzygium cumini</i>	33
<i>Bauhinia species</i>	32

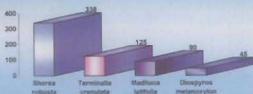
4.6.1 ESTIMATION OF TOTAL STEMS AND VOLUME IN DIFFERENT DISTRICT:

With the creation of five separate districts (after survey) viz. Deoghar, Dumka, Godda, Sahibganj and Pakour district from the earlier Santhal Pargana district (as mentioned in para 1.2) it is felt necessary to estimate the total growing stock for the individual district. Tree forest area has been determined on the basis of distribution of the plots under the landuse classes as mentioned under 4.2.2 for the respective district.

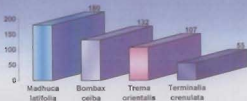
DISTRIBUTION OF TOTAL VOLUME (in '000 M³) BY STRATA



TOTAL VOLUME ('000 M³) FOR THE DOMINANT SPECIES UNDER SAL STRATUM



TOTAL VOLUME ('000 M³) FOR THE DOMINANT SPECIES UNDER MISCELLANEOUS STRATUM



The following table indicates the estimated tree forest area and the growing stock of the individual district :

Sl.No.	District	No. of tree forest plots	Tree forest area (ha.)	Estimated total stems (in '000 no.)	Estimated total volume (in '000 m ³)
1	Deoghar	18	16484	1406	225
2	Dumka	49	44874	3828	612
3	Godda	19	17400	1484	238
4	Sahibganj	31	28369	2420	387
5	Pakur	21	19232	1640	263
		138	126379	10778	1725

Stratification as 'Sal' and 'Miscellaneous' stratum is not done due to insufficient number of plots in most of the districts.

4.7 STANDARD ERROR :

The standard error percentage has been calculated by ratio method of estimation for growing stock for Sal and Miscellaneous stratum which are given below :

<u>Stratum</u>	<u>S.E. %</u>
Sal	12.35
Miscellaneous	12.49
For the district:	8.97

The standard error % for the district is estimated as 8.97.

CHAPTER: V

SUMMARY AND CONCLUSION

5.1 SUMMARY:

Result of the inventory can be summarized as follows:

1. The inventory area is comprised of the forest area of undivided Santhal Parganas district presently split into Dumka, Godda, Deoghar, Sahibganj and Pakur districts.
2. The geographical area of undivided Santhal Parganas district is 14206 sq.km. Area shown in green wash on the Survey of India toposheets have been treated as forest area for the purpose of the inventory. The forest area thus calculated by 'dot grid' method is 1886.53 sq.km. which is 13.28% of the geographical area of the district. Growing stock estimation is based on the tree forest area as explained in the report.
3. Total area of Reserved forest is 12853 ha and the extent of Protected forest is 179536 ha as per Annual Administrative report.
4. Landuse classification data indicates preponderance of open tree forest followed by moderately dense tree forest which accounts for 33.01% and 16.02% of the forest area respectively. Dense forest occupies only 1.94% of the inventoried area. Scrub forest also occupies a bulk percentage (10.68%) of the forest area.
5. Soil consistency is slightly compact in 85.51% of the tree forest area in the district. This type of soil consistency which is prevalent in most of the tree forest areas supports good forest crops. Friable and compact soil constitute 9.42% and 5.07% of the tree forest area respectively.
6. It is noticed that 7.25% of the forest area is heavily eroded in the district. Moderately eroded area constitute 28.26% whereas the greater part of the district falls in the mildly eroded belts constituting 61.59% of the forest area respectively.
7. Incidence of 'light' and 'moderate' fire incidence occurs in 60.87% and 9.42% of the tree forest area respectively. Heavy fire incidence is practically absent in the tree forest area of the district.

8. Moderate to light grazing occurs in 84.06% of the tree forest area. Only 7.97% of the tree forest area is subject to heavy grazing.
9. Injuries to crop indicates that maximum injuries occur due to human agencies to the extent that 97.83% of the tree forest area is effected by illicit felling. Area completely free from injuries constitute only 1.45% of the tree forest area only.
10. Adequate regeneration is observed in only 10.14% of the total tree forest area. It is observed that inadequate regeneration is prevalent in 58.70% of tree forest area whereas regeneration is absent in 29.71% of the tree forest area. Therefore the overall position of regeneration is not satisfactory.
11. Majority of the tree forest areas are heavily degraded (37.68%) or moderately degraded (44.93%). 17.39% of the tree forest area is affected by mild degradation.
12. The number of stems / ha. under the two significant strata e.g. Sal and Miscellaneous in the tree forest area are 100.290 and 69.845 respectively and for the district the number of stems/ha. is 85.29.
13. The stems under both the strata are mostly concentrated in lower diameter classes i.e. 10-19 cm. followed by 20-29 cm. and 30-39 cm. respectively.
14. The total number of stems is estimated as 10.778 million and the total growing stock is 3.725 million m^3 in the district.
15. The volume/ha. in the tree forest area of the district is 13.65 m^3

5.2 CONCLUSION :

The findings of the forest inventory of the district lead us to the following conclusions:

1. The forest area cover in the district is about 13.28% of the geographical area but the health of these forest is not satisfactory. Out of these forests, dense and moderately dense forests are about 17.96% of the forest area and rest of the area are either open forest, scrub forest or belong to other land use classes of non-forestry nature.
2. Illicit felling was noticed in 97.83% of the forest area and needs special attention.
3. Soil erosion is a problem as noticed during the survey as 7.25% of the forest area is heavily affected under this category. Soil conservation measures should be

adopted in this district accordingly both by structural means as well as by adopting afforestation techniques.

4. Grazing is also a problem that need attention and appropriate measures should be taken to prevent the situation from worsening further.
5. Regeneration is either absent or very poor in the district. This is a serious problem in about 90% of the area. Intensive action is needed to alleviate the situation.

5.3 COMPARISON WITH PAST SURVEY RESULTS:

The earlier surveys in Santhal Parganas district was carried out by Forest Survey of India during the year 1981-82. The findings of the previous inventory were compared with the present inventory 1994-95 results in terms of stems/ha. and volume/ha. in different diameter classes and strata of the district.

Dia. Class in cm.	Stratum – Sal Number of stems/ha. Area surveyed in :		Stratum : Mixe, Number of stems / ha. Area surveyed in :	
	1981-82	1994-95	1981-82	1994-95
10-19	46.044	93.838	47.879	56.465
20-29	6.848	3.716	8.649	9.264
30-39	0.759	1.001	2.846	1.911
40-49	1.199	1.143	1.315	1.176
50-59	0.292	0.286	1.063	0.294
60-69	0.179	0.286	0.757	-
70-79	0.179	-	0.337	-
80-89	-	-	0.252	0.294
90-99	0.146	-	-	0.294
100+	0.325	-	-	0.147
Total:	55.971	100.290	63.098	69.845

From the above table the following conclusions may be drawn stratum wise :

A close perusal and examination of the above table, presents a comparative picture of the changed situation in the number of stems/ha. during one and half decades from 1981-82 to 1994-95. It shows that the tree density in terms of number of stems per hectare has registered a substantial increase in Sal stratum to the extent of 79.18% while a slight increase is noticed in miscellaneous stratum to the tune of 10.69%. It is also evident that maximum increase is noticed in lower diameter i.e. 10-19 cm. dia. class particularly in the Sal stratum. This is a significant increase and points to the retrospective effect of serious protection measure taken by State Forest Department. Increase in lower diameter class 10-19 cm. is also noticed in Miscellaneous stratum but it is not so significant. However, there is a decrease in higher diameter classes, which shows that timber yielding trees are being exploited severely.

COMPARISON OF VOLUME/HA.

The value of volume (m^3 /ha. from the earlier survey of 1981-82 and the present findings are furnished below for a comparative picture of the change in the growing stock character of the forest of Santal Parganas district over a period of one and half decade.

Dia. Class in cm.	Stratum - Sal Volume/ha. in m^3		Stratum - Misc. Volume/ha. in m^3	
	Area surveyed in :		Area surveyed in :	
	1981-82	1994-95	1981-82	1994-95
10-19	3.309	4.935	3.763	3.951
20-29	2.209	1.191	3.518	3.082
30-39	0.758	0.384	2.373	1.677
40-49	1.855	1.726	1.916	1.652
50-59	0.699	0.334	2.253	0.621
60-69	0.586	0.917	2.452	-
70-79	0.851	-	1.915	-
80-89	-	-	1.541	1.132
90-99	0.736	-	-	1.712
100+	6.170	-	-	1.283
Total	17.473	12.237	19.167	15.108

It may be concluded from the above table that percentage decrease in terms of volume/ha. stands as 29.97% and 21.18% in Sal and Miscellaneous stratum respectively. A close perusal of the above table leads to an interesting conclusion that increase in volume/ha. is noticed in 10-19 cm. diameter class in both the stratum. It is very significant in Sal stratum in the tune of 111.09%. Trees of higher girth are not contributory to total volume as they are being removed steadily.

At the end, it may be concluded that the forest areas which were badly affected need large scale afforestation, soil conservation treatment, protection and adoption of special management measures. Forestry development activities are required to be intensified. Village forest protection committees should be introduced and granted some form of recognition and legal sanctity to provide them certain amount of tenurial security and authority. Attention should be given to protect the new regeneration, so that they can reach the established plant stage, as well as protecting older trees as they reach large timber producing stage, in a diameter of 60 cm. and above. However, it is being felt that the forest Department should advance with this process of empowerment slowly and cautiously. It is also expected that joint management strategy along with sound silvicultural management certainly improve the growing stock position in all the diameter classes in near future.

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5. Bihar District Gazetteers, Santhal Parganas 1965 Govt. of Bihar

**PROJECT MAP OF UNDIVIDED
SANTAL PARGANA DISTRICT**
SCALE:-1:10,000,000

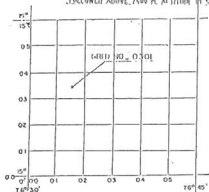
REFERENCE
STATE BOUNDARY
DISTRICT BOUNDARY
RAILWAY LINE
ROAD
RIVER

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

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

FOREST SURVEY OF INDIA INVENTORY DESIGN

FOLLOWED ABOVE, 7400 PL. AT 1:100,000 AT 5000 PL.

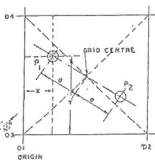


DIAGRAM_1

DIAGRAM SHOWING
IDENTIFICATION OF GRIDS
ON 1:50,000 OR 1:63,360
SCALE TOPO SHEETS

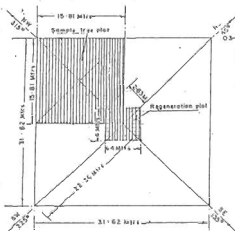
DIAGRAM_2

DIAGRAM SHOWING MARKING
OF PLOT IN $2\frac{1}{2} \times 2\frac{1}{2}$ GRID
 X' & Y' ARE THE DISTANCES ALONG
 X & Y AXES WITH S.W. CORNER AS
THE ORIGIN.

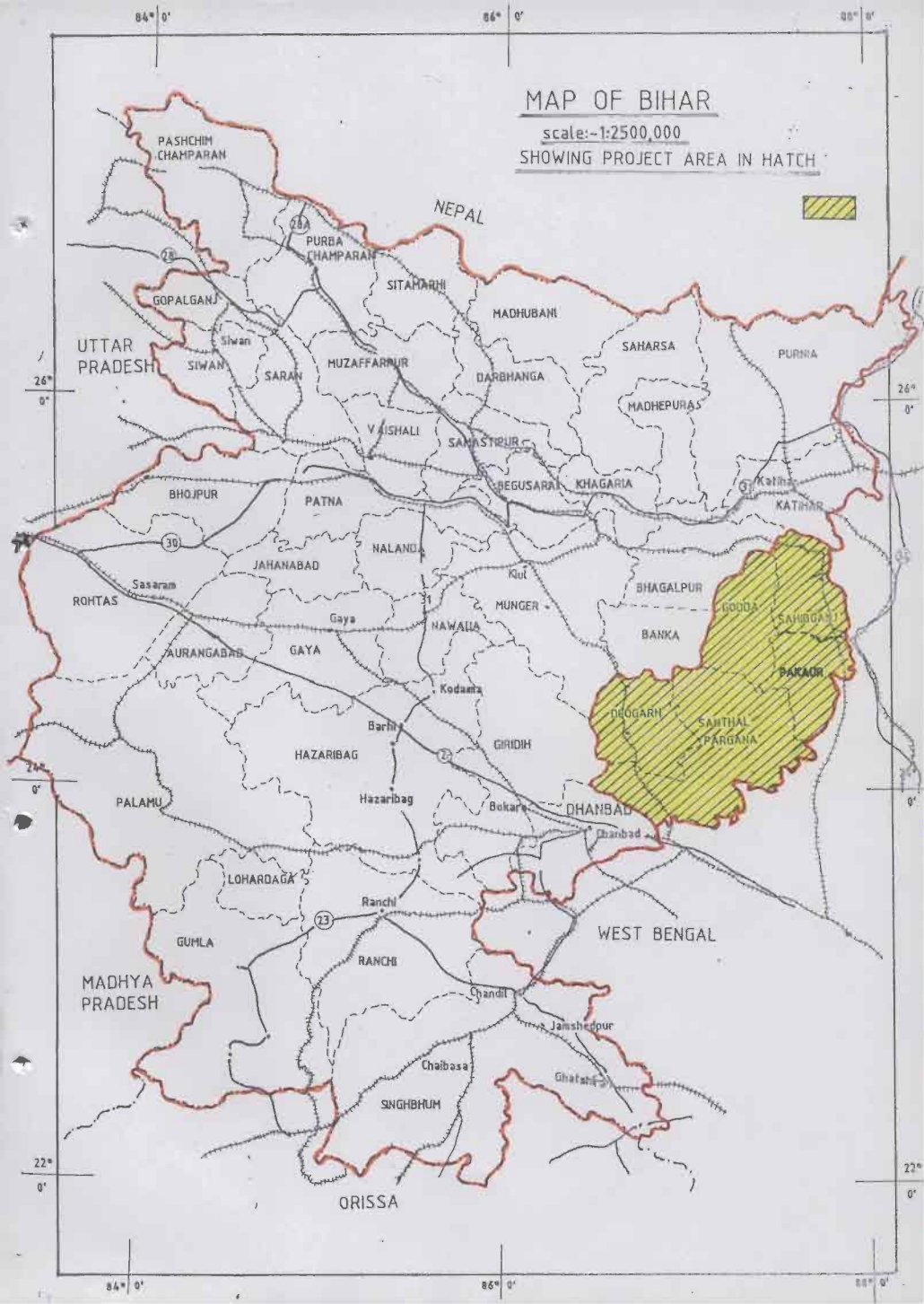


DIAGRAM_3

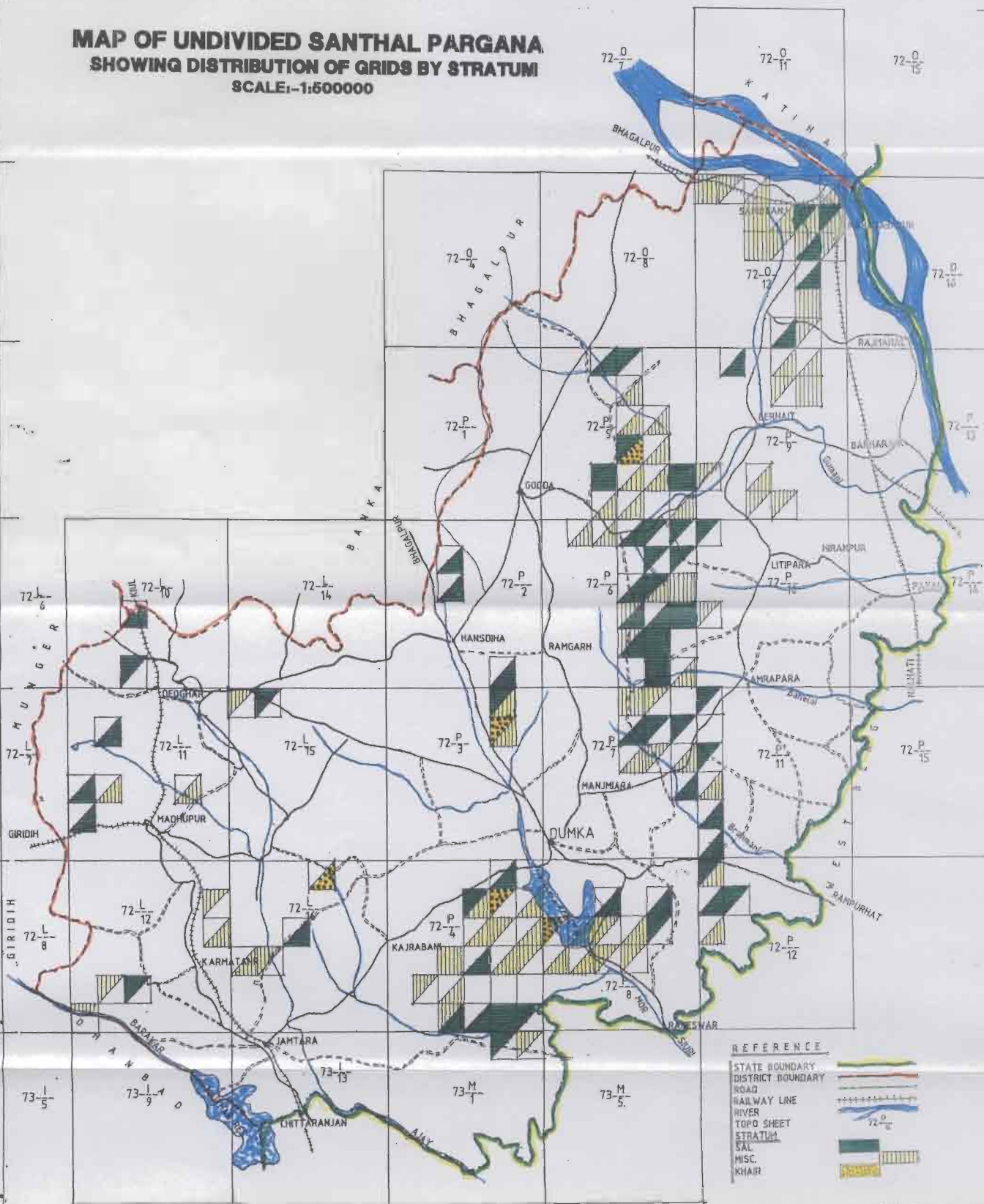
DIAGRAM SHOWING
LAY OUT OF PLOT



scale:-1:2500,000
SHOWING PROJECT AREA IN HATCH



MAP OF UNDIVIDED SANTHAL PARGANA **SHOWING DISTRIBUTION OF GRIDS BY STRATUM** **SCALE: 1:500000**

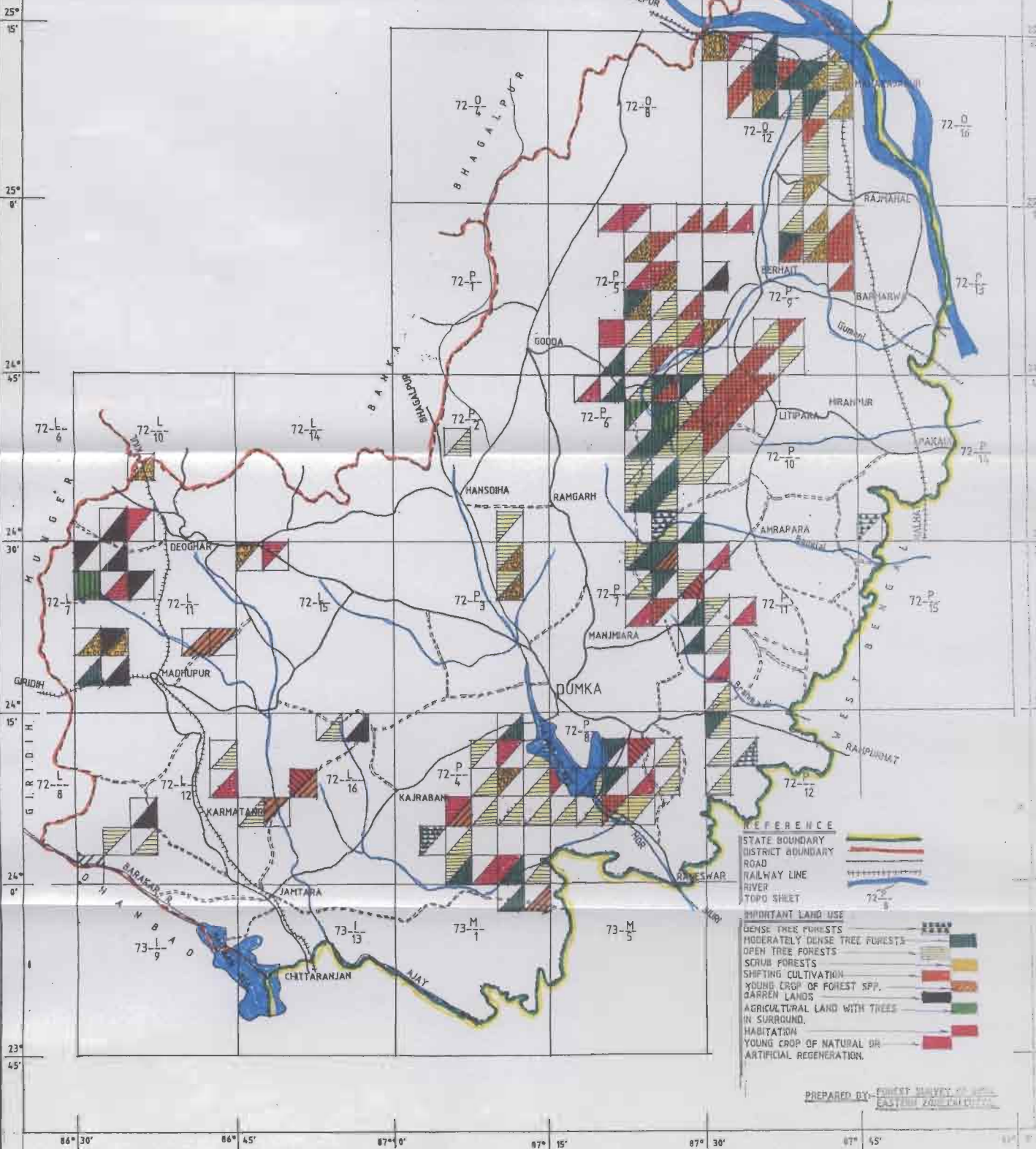


REFERENCE

- STATE BOUNDARY
- DISTRICT BOUNDARY
- ROAD
- RAILWAY LINE
- RIVER
- TOPO SHEET
- STRATUM
- SAL
- MISC.
- KHAR



MAP OF UNDIVIDED SANTHAL PARGANA
SHOWING DISTRIBUTION OF GRIDS
BY IMPORTANT LAND USE CLASSES
SCALE: 1:500000



PART-II

STATISTICAL TABLES.

LIST OF INDEXES

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1.2	Do	Miscellaneous	3, 4
2.1	Total stems (in no.) by species and diameter classes (in cm.)	Sal	5, 6
2.2.	Do	Miscellaneous	7, 8
3.1	Volume (in m ³) per hectare by species and diameter classes (in cm.)	Sal	9
3.2	Do	Miscellaneous	10, 11
4.1	Total volume (in m ³) by species and diameter classes (in cm.)	Miscellaneous	12, 13
4.2	Do	Sal	14

TABLE NO.1.1
STEMS PER HECTARE(NO) BY SPECIES AND DIAMETER CLASSES(IN CM.)
DISTRICT- SANTHAL PARGONA

SPECIES NAME	CODE	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100+	TOTAL
Albizia species	51	.571	.143	.000	.000	.000	.000	.000	.000	.000	.000	.714
Anogeissus latifolia	72	.714	.143	.143	.000	.000	.000	.000	.000	.000	.000	1.000
Bauhinia retusa	116	.286	.000	.000	.000	.000	.000	.000	.000	.000	.000	.286
Bauhinia species	118	.143	.000	.000	.000	.000	.000	.000	.000	.000	.000	.143
Bombax ceiba	131	.714	.000	.000	.286	.000	.000	.000	.000	.000	.000	1.000
Borassus flabellifer	132	.000	.143	.000	.000	.000	.000	.000	.000	.000	.000	.143
Boswellia serrata	133	.000	.143	.000	.000	.000	.000	.000	.000	.000	.000	.143
Bridelia retusa	138	.429	.000	.000	.000	.000	.000	.000	.000	.000	.000	.429
Buchanania lanzan	143	5.571	.143	.000	.000	.000	.000	.000	.000	.000	.000	5.714
Butea monspesia	146	1.143	.143	.000	.000	.000	.000	.000	.000	.000	.000	1.286
Callicarpa arborea	150	1.286	.000	.000	.000	.000	.000	.000	.000	.000	.000	1.286
Careya arborea	177	.143	.000	.000	.000	.000	.000	.000	.000	.000	.000	.143
Diospyros melanoxylon	285	3.143	.000	.143	.000	.143	.000	.000	.000	.000	.000	3.429
Gardenia resinifera	405	.286	.000	.000	.000	.000	.000	.000	.000	.000	.000	.286
Garuga pinnata	407	.143	.000	.000	.000	.000	.000	.000	.000	.000	.000	.143
Hollarrhena antidysenterica	452	.429	.000	.000	.000	.000	.000	.000	.000	.000	.000	.429
Lannea coromandelica	509	1.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	1.000
Madhuca latifolia	561	3.857	.286	.429	.143	.000	.143	.000	.000	.000	.000	4.858
Magnolia species	562	.143	.000	.000	.000	.000	.000	.000	.000	.000	.000	.143
Pterocarpus marsupium	722	.857	.000	.000	.000	.000	.000	.000	.000	.000	.000	.857
Sesecarpus anacardium	798	2.143	.000	.000	.000	.000	.000	.000	.000	.000	.000	2.143
Sesecarpus kurzii	799	.143	.000	.000	.000	.000	.000	.000	.000	.000	.000	.143
Shorea robusta	802	61.143	1.714	.000	.000	.000	.000	.000	.000	.000	.000	62.857
Sterculia villosa	821	.143	.286	.143	.000	.000	.000	.000	.000	.000	.000	.572
Syzgium cumini	843	1.143	.143	.000	.000	.000	.000	.000	.000	.000	.000	1.286

Cont. of Table No. 1.1

SPECIES NAME	CODE	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100+	TOTAL
<i>Terminalia belerica</i>	861	.571	.000	.000	.000	.000	.000	.000	.000	.000	.000	.571
<i>Terminalia chebula</i>	864	.000	.000	.000	.143	.000	.000	.000	.000	.000	.000	.143
<i>Terminalia crenulata</i>	866	4.571	.429	.143	.571	.000	.143	.000	.000	.000	.000	5.857
<i>Xerospermum glabratum</i>	917	.000	.000	.000	.000	.143	.000	.000	.000	.000	.000	.143
<i>Xylocarpus obovatus</i>	922	.143	.000	.000	.000	.000	.000	.000	.000	.000	.000	.143
<i>Zizyphus species</i>	930	.429	.000	.000	.000	.000	.000	.000	.000	.000	.000	.429
Unidentified trees	944	2.571	.000	.000	.000	.000	.000	.000	.000	.000	.000	2.571
TOTAL		93.858	3.715	1.001	1.143	.286	.286	.000	.000	.000	.000	100.290
PERCENTAGE		93.587	3.703	0.998	1.140	0.285	0.285	.00	.00	.00	.00	100.00

TABLE NO.1.2
STEMS PER HECTARE(NO) BY SPECIES AND DIAMETER CLASSES(IN CM.)
DISTRICT- SANTHALPARGONA
STRATA - MISCELLANEOUS

SPECIES NAME	CODE	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100+	TOTAL
Acacia catechu	6	2.647	.000	.000	.000	.000	.000	.000	.000	.000	.000	2.647
Adina cordifolia	28	1.029	.147	.147	.000	.000	.000	.000	.000	.000	.000	1.323
Aegle marmelos	32	.588	.000	.000	.000	.000	.000	.000	.000	.000	.000	.588
Albizia species	51	.588	.000	.000	.000	.000	.000	.000	.000	.000	.000	.588
Anogeissus latifolia	72	1.176	.000	.000	.000	.000	.000	.000	.000	.000	.000	1.176
Artocarpus lakoocha	93	.147	.000	.000	.000	.000	.000	.000	.000	.000	.000	.147
Acadirachta indica	103	.441	.000	.000	.000	.000	.000	.000	.000	.000	.000	.441
Bauhinia species	118	.882	1.324	.000	.000	.000	.000	.000	.000	.000	.000	2.206
Bombax ceiba	131	2.941	1.324	.000	.000	.000	.000	.000	.000	.000	.000	4.265
Borassus flabellifer	132	.000	.000	.000	.000	.147	.000	.000	.000	.000	.147	.147
Boswellia serrata	133	.294	.147	.147	.147	.000	.000	.000	.000	.000	.000	.735
Bridelia retusa	138	.147	.147	.000	.000	.000	.000	.000	.000	.000	.000	.294
Buchanania lanzan	143	2.059	.000	.000	.000	.000	.000	.000	.000	.000	.000	2.059
Callicarpa arborea	150	.294	.147	.000	.000	.000	.000	.000	.000	.000	.000	.441
Careya arborea	177	.147	.000	.000	.000	.000	.000	.000	.000	.000	.000	.147
Cassia fistula	186	.147	.000	.000	.000	.000	.000	.000	.000	.000	.000	.147
Cochlospermum religiosum	223	1.176	.588	.000	.000	.000	.000	.000	.000	.000	.000	1.764
Diospyros crumena	282	.441	.000	.000	.000	.000	.000	.000	.000	.000	.000	.441
Diospyros melanoxylon	285	.441	.000	.000	.000	.000	.000	.000	.000	.000	.000	.441
Ficus racemosa	382	.147	.000	.000	.000	.000	.000	.000	.000	.000	.000	.147
Garuga pinnata	407	1.029	.147	.000	.000	.000	.000	.000	.000	.000	.000	1.176
Gmelina arborea	420	.735	.441	.000	.000	.000	.000	.000	.000	.000	.000	1.176
Kydia calycina	501	1.176	.441	.000	.000	.000	.000	.000	.000	.000	.000	1.617
Lagerstroemia indica	503	.000	.147	.000	.000	.000	.000	.000	.000	.000	.000	.147
Lagerstroemia parviflora	505	1.765	.000	.000	.000	.000	.000	.000	.000	.000	.000	1.765
Lannea coromandelica	509	4.706	.147	.000	.000	.000	.000	.000	.000	.000	.000	4.853
Madhuca latifolia	561	2.647	1.618	1.029	.588	.147	.000	.000	.000	.000	.000	6.029
Mangifera indica	569	.147	.000	.000	.000	.000	.000	.000	.000	.000	.000	.147
Pterocarpus marsupium	722	4.412	.294	.000	.000	.000	.000	.000	.000	.000	.000	4.706
Schleichera trifluga	795	.000	.000	.147	.000	.000	.000	.000	.000	.000	.000	.147

Cont. of Table No.1.2

SPECIES NAME	CODE	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100+	TOTAL
<i>Semecarpus anacardium</i>	798	1.176	.294	.000	.000	.000	.000	.000	.000	.000	.000	1.470
<i>Shorea robusta</i>	802	2.500	.147	.000	.000	.000	.000	.000	.000	.000	.000	2.647
<i>Soymida febrifuga</i>	809	.294	.000	.000	.000	.000	.000	.000	.000	.000	.000	.294
<i>Spondias pinnata</i>	812	.588	.294	.000	.147	.000	.000	.000	.000	.000	.000	1.029
<i>Sterculia villosa</i>	821	.147	.147	.000	.000	.000	.000	.000	.000	.000	.000	.294
<i>Syzygium cumini</i>	843	.147	.000	.000	.000	.000	.000	.000	.147	.000	.000	.294
<i>Syzygium species</i>	850	.588	.000	.000	.000	.000	.000	.000	.000	.000	.000	.588
<i>Talauma phellocarpa</i>	855	.147	.000	.000	.000	.000	.000	.000	.000	.000	.000	.147
<i>Terminalia arjuna</i>	860	.147	.000	.000	.000	.000	.000	.000	.000	.000	.000	.147
<i>Terminalia belerica</i>	861	.882	.000	.000	.000	.000	.000	.000	.000	.000	.000	.882
<i>Terminalia crenulata</i>	866	7.941	.147	.147	.147	.000	.000	.000	.000	.000	.000	8.382
<i>Trema orientalis</i>	879	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.294
<i>Vateria indica</i>	891	.000	.000	.000	.000	.000	.000	.000	.147	.000	.000	.147
<i>Zizyphus mauritiana</i>	927	.882	.000	.000	.000	.000	.000	.000	.000	.000	.000	.882
Unidentified trees	944	6.765	.882	.147	.000	.000	.000	.000	.000	.000	.000	7.794
<i>Acacia auriculiformis</i>	1006	1.912	.000	.000	.000	.000	.000	.000	.000	.000	.000	1.912
<i>Ficus cunia</i>	1027	.000	.294	.147	.147	.000	.000	.000	.000	.000	.000	.588
TOTAL		56.465	9.264	1.911	1.176	.294	.000	.000	.294	.294	.147	69.845
PERCENTAGE		80.84	13.27	2.74	1.68	.42	.00	.00	.42	.42	.21	100.00

TABLE NO.2.1
TOTAL STEMS(IN NO.) BY SPECIES AND DIAMETER CLASSES(IN CM.)
DISTRICT- SANTHALPARGANA STRATA: SAL

SPECIES NAME	CODE	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100+	TOTAL
Albizia species	51	36603	9167	0	0	0	0	0	0	0	0	45770
Anogeissus latifolia	72	45770	9167	9167	0	0	0	0	0	0	0	64104
Bauhinia retusa	116	18334	0	0	0	0	0	0	0	0	0	18334
Bauhinia species	118	9167	0	0	0	0	0	0	0	0	0	9167
Bombax ceiba	131	45770	0	0	18334	0	0	0	0	0	0	64104
Borassus flabellifer	132	0	9167	0	0	0	0	0	0	0	0	9167
Boswellia serrata	133	0	9167	0	0	0	0	0	0	0	0	9167
Bridellia retusa	138	27501	0	0	0	0	0	0	0	0	0	27501
Buchanania lanzan	143	357128	9167	0	0	0	0	0	0	0	0	366295
Butea monosperma	146	73272	9167	0	0	0	0	0	0	0	0	82439
Callicarpa arborea	150	82439	0	0	0	0	0	0	0	0	0	82439
Careya arborea	177	9167	0	0	0	0	0	0	0	0	0	9167
Diospyros melanoxylon	285	201482	0	9167	0	9167	0	0	0	0	0	219816
Gardenia resinifera	405	18334	0	0	0	0	0	0	0	0	0	18334
Garuga pinnata	407	9167	0	0	0	0	0	0	0	0	0	9167
Hollarhena antidysenterica	452	27501	0	0	0	0	0	0	0	0	0	27501
Lannea coromandelica	509	64105	0	0	0	0	0	0	0	0	0	64105
Madhuca latifolia	561	247253	18334	27501	9167	0	9167	0	0	0	0	311422

CONT. OF TABLE NO.2.1

SPECIES NAME	CODE	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100+	TOTAL
Magnolia species	562	9167	0	0	0	0	0	0	0	0	0	9167
Pterocarpus marsupium	722	54937	0	0	0	0	0	0	0	0	0	54937
Sesecarpus anacardium	798	137377	0	0	0	0	0	0	0	0	0	137377
Sesecarpus kurzii	799	9167	0	0	0	0	0	0	0	0	0	9167
Shorea robusta	802	3919572	109875	0	0	0	0	0	0	0	0	4029447
Sterculia villosa	821	9167	18334	9167	0	0	0	0	0	0	0	36648
Syzygium cumini	843	73272	9167	0	0	0	0	0	0	0	0	82439
Terminalia belerica	861	36603	0	0	0	0	0	0	0	0	0	36603
Terminalia chebula	864	0	0	0	9167	0	0	0	0	0	0	9167
Terminalia crenulata	866	293023	27501	9167	36603	0	9167	0	0	0	0	375461
Xerospermum glabratum	917	0	0	0	0	0	9167	0	0	0	0	9167
Xylocarpus obovatus	922	9167	0	0	0	0	0	0	0	0	0	9167
Zizyphus species	930	27501	0	0	0	0	0	0	0	0	0	27501
Unidentified trees	944	164813	0	0	0	0	0	0	0	0	0	164813
TOTAL		6016759	238213	64169	73271	18334	18334	0	0	0	0	6429080

TABLE NO. 2.2
TOTAL STEMS (IN NO.) BY SPECIES AND DIAMETER CLASSES (IN CM.)
DISTRICT - SANTHAL PARAGONA STRATA: MISCELLANEOUS

SPECIES NAME	CODE	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100+	TOTAL
Acacia catechu	6	164839	0	0	0	0	0	0	0	0	0	164839
Adina cordifolia	28	64079	9154	0	0	0	0	0	0	0	0	82387
Aegle marmelos	32	36617	0	0	0	0	0	0	0	0	0	36617
Albizia species	51	36617	0	0	0	0	0	0	0	0	0	36617
Anogeissus latifolia	72	73234	0	0	0	0	0	0	0	0	0	73234
Artocarpus lakoocha	93	9154	0	0	0	0	0	0	0	0	0	9154
Azadirachta indica	103	27462	0	0	0	0	0	0	0	0	0	27462
Bauhinia species	118	54925	82450	0	0	0	0	0	0	0	0	137375
Bombax ceiba	131	183147	82450	0	0	0	0	0	0	0	9154	274751
Borassus flabellifer	132	0	0	0	0	9154	0	0	0	0	0	9154
Boswellia serrata	133	18308	9154	9154	0	0	0	0	0	0	0	45770
Bridelia retusa	138	9154	9154	0	0	0	0	0	0	0	0	18308
Buchanania lanzan	143	128222	0	0	0	0	0	0	0	0	0	128222
Callicarpa arborea	150	18308	9154	0	0	0	0	0	0	0	0	27462
Careya arborea	177	9154	0	0	0	0	0	0	0	0	0	9154
Cassia fistula	186	9154	0	0	0	0	0	0	0	0	0	9154
Cochlospermum religiosum	223	73234	36617	0	0	0	0	0	0	0	0	109851
Diospyros crumena	282	27462	0	0	0	0	0	0	0	0	0	27462
Diospyros melanoxylon	285	27462	0	0	0	0	0	0	0	0	0	27462
Ficus recemosa	382	9154	0	0	0	0	0	0	0	0	0	9154
Garuga pinnata	407	64079	9154	0	0	0	0	0	0	0	0	73233
Gmelina arborea	420	45771	27462	0	0	0	0	0	0	0	0	73233
Kydia calycina	501	73234	27462	0	0	0	0	0	0	0	0	100696
Lagerstroemia indica	503	0	9154	0	0	0	0	0	0	0	0	9154

Conf. Table No.2.2

SPECIES NAME	CODE	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100+	TOTAL
Lagerstroemia parviflora	503	109913	0	0	0	0	0	0	0	0	0	109913
Lanea coromandelica	509	293061	9154	0	0	0	0	0	0	0	0	302215
Madhuca latifolia	561	164839	100759	64079	36617	9154	0	0	0	0	0	375448
Mangifera indica	569	9154	0	0	0	0	0	0	0	0	0	9154
Pterocarpus marsupium	722	274752	18308	0	0	0	0	0	0	0	0	293060
Schleichera trifluga	795	0	0	9154	0	0	0	0	0	0	0	9154
Senecarpus anacardium	798	73234	18308	0	0	0	0	0	0	0	0	91542
Shorea robusta	802	155685	9154	0	0	0	0	0	0	0	0	164839
Sonchida febrifuga	809	18308	0	0	0	0	0	0	0	0	0	18308
Spondias pinnata	812	36617	18308	0	9154	0	0	0	0	0	0	14079
Sterculia villosa	821	9154	9154	0	0	0	0	0	0	0	0	18308
Syzgium cumini	843	9154	0	0	0	0	0	0	9154	0	0	36617
Syzgium species	850	36617	0	0	0	0	0	0	0	0	0	36617
Talauma phellocarpa	855	9154	0	0	0	0	0	0	0	0	0	9154
Terminalia arjuna	860	9154	0	0	0	0	0	0	0	0	0	9154
Terminalia bellerica	861	54925	0	0	0	0	0	0	0	0	0	54925
Terminalia crenulata	866	494517	9154	9154	9154	0	0	0	0	0	0	521979
Tresea orientalis	879	0	0	0	0	0	0	0	0	18308	0	18308
Vateria indica	891	0	0	0	0	0	0	0	9154	0	0	9154
Zizyphus mauritiana	927	54925	0	0	0	0	0	0	0	0	0	54925
Unidentified trees	944	421283	54925	9154	0	0	0	0	0	0	0	485362
Acacia auriculiformis	A06	119067	0	0	0	0	0	0	0	0	0	119067
Ficus cunia	A27	0	18308	9154	9154	0	0	0	0	0	0	36816
TOTAL	3516283	576897	119003	73233	18308	0	0	0	18308	18308	9154	4349494

TABLE NO.3.1
VOLUME(IN M3) PER HECTARE BY SPECIES AND DIAMETER CLASSES(IN CM.)
DISTRICT- SANTHAL PARGONA

SPECIES NAME	CODE	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100+	TOTAL
Albizia species	51	.044	.033	.000	.000	.000	.000	.000	.000	.000	.000	.077
Anogeissus latifolia	72	.043	.050	.158	.000	.000	.000	.000	.000	.000	.000	.251
Bauhinia retusa	116	.047	.000	.000	.000	.000	.000	.000	.000	.000	.000	.047
Bauhinia species	118	.010	.000	.000	.000	.000	.000	.000	.000	.000	.000	.010
Bombax calba	131	.090	.000	.000	.344	.000	.000	.000	.000	.000	.000	.434
Borassus flabellifer	132	.000	.069	.000	.000	.000	.000	.000	.000	.000	.000	.069
Boswellia serrata	133	.000	.069	.000	.000	.000	.000	.000	.000	.000	.000	.069
Bridelia retusa	138	.038	.000	.000	.000	.000	.000	.000	.000	.000	.000	.038
Buchanania lanzan	143	.399	.033	.000	.000	.000	.000	.000	.000	.000	.000	.432
Butea monosperma	146	.092	.042	.000	.000	.000	.000	.000	.000	.000	.000	.134
Callicarpa arborea	150	.065	.000	.000	.000	.000	.000	.000	.000	.000	.000	.065
Careya arborea	177	.006	.000	.000	.000	.000	.000	.000	.000	.000	.000	.006
Diospyros melanoxylon	285	.194	.000	.144	.000	.362	.000	.000	.000	.000	.000	.780
Gardenia resinifera	405	.009	.000	.000	.000	.000	.000	.000	.000	.000	.000	.009
Garuga pinnata	407	.006	.000	.000	.000	.000	.000	.000	.000	.000	.000	.006
Hollarrhena antidysenterica	452	.020	.000	.000	.000	.000	.000	.000	.000	.000	.000	.020
Lannea coromandelica	509	.073	.000	.000	.000	.000	.000	.000	.000	.000	.000	.073
Madhuca latifolia	561	.263	.080	.366	.270	.000	.420	.000	.000	.000	.000	1.399
Magnolia species	562	.008	.000	.000	.000	.000	.000	.000	.000	.000	.000	.008
pterocarpus marsupium	722	.058	.000	.000	.000	.000	.000	.000	.000	.000	.000	.058
Sesecarpus anacardium	798	.141	.000	.000	.000	.000	.000	.000	.000	.000	.000	.141
Semecarpus kurzil	799	.005	.000	.000	.000	.000	.000	.000	.000	.000	.000	.005
Shorea robusta	802	4.747	.520	.000	.000	.000	.000	.000	.000	.000	.000	5.267
Sterculia villosa	821	.006	.079	.089	.000	.000	.000	.000	.000	.000	.000	.174
Syzgium cumini	843	.092	.036	.000	.000	.000	.000	.000	.000	.000	.000	.128
Terninalia belerica	861	.038	.000	.000	.000	.000	.000	.000	.000	.000	.000	.038
Terninalia chebula	864	.000	.000	.000	.246	.000	.000	.000	.000	.000	.000	.246
Terninalia crenulata	866	.287	.180	.127	.866	.000	.497	.000	.000	.000	.000	1.957
Xerospermum glabratum	917	.000	.000	.000	.172	.000	.000	.000	.000	.000	.000	.172
Xylocarpus obovatus	922	.022	.000	.000	.000	.000	.000	.000	.000	.000	.000	.022
Zizyphus species	930	.023	.000	.000	.000	.000	.000	.000	.000	.000	.000	.023
Unidentified trees	944	.159	.000	.000	.000	.000	.000	.000	.000	.000	.000	.159
TOTAL		6.985	1.191	.884	1.726	.534	.917	.000	.000	.000	.000	12.237

TABLE NO.3.2
VOLUME(IN M3) PER HECTARE BY SPECIES AND DIAMETER CLASSES(IN CM.)
DISTRICT- SANTHALPARGONA
STRATA-MISCELLANEOUS

SPECIES NAME	CODE	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100+	TOTAL
Acacia catechu	6	.209	.000	.000	.000	.000	.000	.000	.000	.000	.000	.209
Adina cordifolia	28	.096	.052	.179	.000	.000	.000	.000	.000	.000	.000	.327
Aegle marmelos	32	.051	.000	.000	.000	.000	.000	.000	.000	.000	.000	.051
Albizia species	51	.048	.000	.000	.000	.000	.000	.000	.000	.000	.000	.048
Anogeissus latifolia	72	.066	.000	.000	.000	.000	.000	.000	.000	.000	.000	.066
Artocarpus lakoocha	93	.022	.000	.000	.000	.000	.000	.000	.000	.000	.000	.022
Azadirachta indica	103	.031	.000	.000	.000	.000	.000	.000	.000	.000	.000	.031
Bauhinia species	118	.056	.464	.000	.000	.000	.000	.000	.000	.000	.000	.520
Bombax calba	131	.328	.501	.000	.000	.000	.000	.000	.000	.000	.000	2.142
Borassus flabellifer	132	.000	.000	.000	.000	.000	.317	.000	.000	.000	1.283	2.142
Boswellia serrata	133	.028	.033	.133	.192	.000	.000	.000	.000	.000	.000	.366
Bridelia retusa	138	.006	.038	.000	.000	.000	.000	.000	.000	.000	.000	.044
Buchanania lanzan	143	.104	.000	.000	.000	.000	.000	.000	.000	.000	.000	.104
Callicarpa arborea	150	.029	.034	.000	.000	.000	.000	.000	.000	.000	.000	.063
Careya arborea	177	.005	.000	.000	.000	.000	.000	.000	.000	.000	.000	.005
Cassia fistula	186	.005	.000	.000	.000	.000	.000	.000	.000	.000	.000	.005
Cochlospermum religiosum	223	.114	.149	.000	.000	.000	.000	.000	.000	.000	.000	.263
Diospyros crumena	282	.026	.000	.000	.000	.000	.000	.000	.000	.000	.000	.026
Diospyros melanoxylon	285	.021	.000	.000	.000	.000	.000	.000	.000	.000	.000	.021
Ficus recemosa	382	.011	.000	.000	.000	.000	.000	.000	.000	.000	.000	.011
Garuga pinnata	407	.041	.034	.000	.000	.000	.000	.000	.000	.000	.000	.075
Gmelina arborea	420	.052	.136	.000	.000	.000	.000	.000	.000	.000	.000	.188
Kydia calycina	501	.063	.137	.000	.000	.000	.000	.000	.000	.000	.000	.200
Lagerstroemia indica	503	.005	.000	.000	.000	.000	.000	.000	.000	.000	.000	.005
Lagerstroemia parviflora	505	.086	.000	.000	.000	.000	.000	.000	.000	.000	.000	.086

Cont. of Table No.3.2

SPECIES NAME	CODE	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100+	TOTAL
Lannea coromandelica	509	.276	.053	.000	.000	.000	.000	.000	.000	.000	.000	.329
Madhuca latifolia	561	.271	.630	.884	.802	.304	.000	.000	.000	.000	.000	2.891
Mangifera indica	569	.013	.000	.000	.000	.000	.000	.000	.000	.000	.000	.013
Pterocarpus marsupium	722	.220	.124	.000	.000	.000	.000	.000	.000	.000	.000	.344
Schleichera trilوبا	795	.000	.000	.091	.000	.000	.000	.000	.000	.000	.000	.091
Sesecarpus anacardium	798	.089	.097	.000	.000	.000	.000	.000	.000	.000	.000	.186
Shorea robusta	802	.179	.038	.000	.000	.000	.000	.000	.000	.000	.000	.217
Soysida febrifuga	809	.033	.000	.000	.000	.000	.000	.000	.000	.000	.000	.033
Spondias pinnata	812	.071	.068	.000	.219	.000	.000	.000	.000	.000	.000	.358
Sterculia villosa	821	.006	.034	.000	.000	.000	.000	.000	.529	.000	.000	.534
Strygium cumini	843	.005	.000	.000	.000	.000	.000	.000	.000	.000	.000	.061
Strygium species	850	.061	.000	.000	.000	.000	.000	.000	.000	.000	.000	.006
Talauma phellocarpa	855	.006	.000	.000	.000	.000	.000	.000	.000	.000	.000	.019
Terminalia arjuna	860	.019	.000	.000	.000	.000	.000	.000	.000	.000	.000	.050
Terminalia belerica	861	.050	.000	.000	.000	.000	.000	.000	.000	.000	.000	.882
Terminalia crenulata	866	.500	.054	.131	.197	.000	.000	.000	.000	1.712	.000	1.712
Trema orientalis	879	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.603
Vateria indica	891	.000	.000	.000	.000	.000	.000	.000	.603	.000	.000	.607
Zizyphus mauritiana	927	.067	.000	.000	.000	.000	.000	.000	.000	.000	.000	.937
Unidentified trees	944	.509	.280	.148	.000	.000	.000	.000	.000	.000	.000	.861
Acacia auriculiformis	1006	.081	.000	.000	.000	.000	.000	.000	.000	.000	.000	.469
Ficus cunia	1027	.000	.121	.106	.242	.000	.000	.000	.000	.000	.000	15.108
TOTAL		3.954	3.082	1.672	1.652	.620	.000	.000	1.132	1.712	1.283	15.108

TABLE NO.4.1
TOTAL VOLUME(IN H3) BY SPECIES AND DIAMETER CLASSES(IN CM.)
STRATA-MISCELLANEOUS DISTRICT: SANTHAKALPANGA

SPECIES NAME	CODE	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100+	TOTAL
Acacia catechu	6	13015	0	0	0	0	0	0	0	0	0	13015
Adina cordifolia	28	5978	3238	11147	0	0	0	0	0	0	0	20363
Aegle marmelos	32	3175	0	0	0	0	0	0	0	0	0	3175
Albizia species	51	2989	0	0	0	0	0	0	0	0	0	2989
Anogeissus latifolia	72	4110	0	0	0	0	0	0	0	0	0	4110
Artocarpus lakoocha	93	1370	0	0	0	0	0	0	0	0	0	1370
Azadirachta indica	103	1930	0	0	0	0	0	0	0	0	0	1930
Bauhinia species	118	3487	28895	0	0	0	0	0	0	0	0	32382
Bombax ceiba	131	20425	31199	0	0	0	0	0	0	0	79897	131521
Borassus flabellifer	132	0	0	0	0	19740	0	0	0	0	0	19740
Boswellia serrata	133	1743	2055	8282	11956	0	0	0	0	0	0	24036
Bridelia retusa	138	373	2366	0	0	0	0	0	0	0	0	2739
Buchanania lanzan	143	6476	0	0	0	0	0	0	0	0	0	6476
Callicarpa arborea	150	1805	2117	0	0	0	0	0	0	0	0	3922
Careya arborea	177	311	0	0	0	0	0	0	0	0	0	311
Cassia fistula	186	311	0	0	0	0	0	0	0	0	0	311
Cochlospermum religiosum	223	7099	9278	0	0	0	0	0	0	0	0	16377
Diospyros crumena	282	1619	0	0	0	0	0	0	0	0	0	1619
Diospyros melanoxylon	285	1307	0	0	0	0	0	0	0	0	0	1307
Ficus recemosa	382	685	0	0	0	0	0	0	0	0	0	685
Garuga pinnata	407	2533	2117	0	0	0	0	0	0	0	0	4670
Gmelina arborea	420	3238	8469	0	0	0	0	0	0	0	0	11707
Kydia calycina	501	3923	8531	0	0	0	0	0	0	0	0	12454
Lagerstroemia indica	503	0	311	0	0	0	0	0	0	0	0	311

Cont. of Table No. 4.1

SPECIES NAME	CODE	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100+	TOTAL
<i>Lagerstroemia parviflora</i>	505	5355	0	0	0	0	0	0	0	0	0	5355
<i>Lannea coromandelica</i>	509	17187	3300	0	0	0	0	0	0	0	0	20487
<i>Madhuca latifolia</i>	561	16876	39232	55050	49943	18931	0	0	0	0	0	160832
<i>Mangifera indica</i>	569	809	0	0	0	0	0	0	0	0	0	809
<i>Pterocarpus marsupium</i>	722	13700	7721	0	0	0	0	0	0	0	0	21421
<i>Schleichera trijuga</i>	795	0	0	5466	0	0	0	0	0	0	0	5466
<i>Sesecarpus anacardium</i>	798	5542	6040	0	0	0	0	0	0	0	0	11582
<i>Shorea robusta</i>	802	11147	2366	0	0	0	0	0	0	0	0	13513
<i>Soyabida febrifuga</i>	809	2055	0	0	0	0	0	0	0	0	0	2055
<i>Spondias pinnata</i>	812	4421	4234	0	13638	0	0	0	0	0	0	22293
<i>Sterculia villosa</i>	821	373	2117	0	0	0	0	0	0	0	0	2490
<i>Syzygium cumini</i>	843	311	0	0	0	0	0	0	32942	0	0	33253
<i>Syzygium species</i>	850	3798	0	0	0	0	0	0	0	0	0	3798
<i>Talauma phillocarpa</i>	855	373	0	0	0	0	0	0	0	0	0	373
<i>Terminalia arjuna</i>	860	1183	0	0	0	0	0	0	0	0	0	1183
<i>Terminalia belerica</i>	861	3113	0	0	0	0	0	0	0	0	0	3113
<i>Terminalia crenulata</i>	866	31137	3362	8187	12267	0	0	0	0	0	0	54923
<i>Trema orientalis</i>	879	0	0	0	0	0	0	0	0	0106613	0	106613
<i>Vateria indica</i>	891	0	0	0	0	0	0	0	37551	0	0	37551
<i>Zizyphus mauritiana</i>	927	4172	0	0	0	0	0	0	0	0	0	4172
Unidentified trees	944	31697	17436	9216	0	0	0	0	0	0	0	58349
<i>Acacia auriculiformis</i>	A06	5044	0	0	0	0	0	0	0	0	0	5044
<i>Ficus cunia</i>	A27	0	7535	6601	15070	0	0	0	0	0	0	29206
TOTAL		246215	191919	104119	102824	38671	0	0	70493	106623	79897	940801

TABLE NO. 4-2
TOTAL VOLUME(IN M3) BY SPECIES AND DIAMETER CLASSES(IN CM.)
DISTRICT: SANTHAL PARGONA
STRATA: SAL

SPECIES NAME	CODE	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100+	TOTAL
Albizia species	51	2820	2115	0	0	0	0	0	0	0	0	4925
Anogeissus latifolia	72	2756	3205	10128	0	0	0	0	0	0	0	16089
Bauhinia retusa	116	5012	0	0	0	0	0	0	0	0	0	5012
Bauhinia species	118	641	0	0	0	0	0	0	0	0	0	641
Bombax ceiba	131	5769	0	0	22052	0	0	0	0	0	0	27821
Borassus flaccidiflor	132	0	4423	0	0	0	0	0	0	0	0	4423
Borassus serrata	133	0	4423	0	0	0	0	0	0	0	0	4423
Brideia retusa	138	2435	0	0	0	0	0	0	0	0	0	2435
Butea indica	143	25577	2115	0	0	0	0	0	0	0	0	27692
Butea monosperma	146	5897	2692	0	0	0	0	0	0	0	0	8589
Callicarpa arborea	150	4166	0	0	0	0	0	0	0	0	0	4166
Careya arborea	177	384	0	0	0	0	0	0	0	0	0	384
Diospyros melanoxylon	285	12436	0	9231	0	23206	0	0	0	0	0	44873
Gardenia resinifera	405	576	0	0	0	0	0	0	0	0	0	576
Garuga pinnata	407	384	0	0	0	0	0	0	0	0	0	384
Hollarrhena antioxyenterica	452	1282	0	0	0	0	0	0	0	0	0	1282
Lannea coriandelica	509	4679	0	0	0	0	0	0	0	0	0	4679
Madhuca latifolia	561	16859	5128	23462	17308	0	26974	0	0	0	0	89681
Madhuca species	562	512	0	0	0	0	0	0	0	0	0	512
Pterocarpus marsupium	722	3718	0	0	0	0	0	0	0	0	0	3718
Sesacarpus acardium	798	9038	0	0	0	0	0	0	0	0	0	9038
Sesacarpus arizii	799	320	0	0	0	0	0	0	0	0	0	320
Shorea robusta	802	304306	33334	0	0	0	0	0	0	0	0	337640
Sterculia villosa	821	384	5064	5705	0	0	0	0	0	0	0	11153
Syzgium cumini	843	5897	2307	0	0	0	0	0	0	0	0	8204
Terminalia balerica	861	2435	0	0	0	0	0	0	0	0	0	2435
Terminalia chebula	864	0	0	0	15769	0	0	0	0	0	0	15769
Terminalia crenulata	868	18398	11538	9141	55514	0	31600	0	0	0	0	125451
Xerocarpus glabratum	917	0	0	0	0	11026	0	0	0	0	0	11026
Xylocarpus coccatus	922	1410	0	0	0	0	0	0	0	0	0	1410
Zizyphus species	930	1474	0	0	0	0	0	0	0	0	0	1474
Unidentified trees	944	10192	0	0	0	0	0	0	0	0	0	10192
TOTAL		447751	76344	56667	110643	34232	58784	0	0	0	0	784427