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REPORT
ON
FOREST RESOURCES OF

BANKA AND BHAGALPUR DISTRICTS OF BIHAR

FOREST SURVEY OF INDIA
EASTERN ZONE
CALCUTTA
2001

Contents

PART-I

(MAIN REPORT WITH MAPS, CHARTS AND DIAGRAMS)

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PREFACE

Bhagalpur and Banka districts are situated in the Bihar State with about 454 sq km of its area under recorded forest area However, Forest cover area as reported from State of Forest Report published by Forest Survey of India is only 202 sq km whereas inventoried forest area, taken as the green wash area of topo sheets comes to 307 73 sq km Eastern Zone of Forest Survey of India had surveyed this district during the year 1981-82 and it was again resurveyed after one and half decade i.e in the year 1994-95

The study reveals a rather dismal picture of the status of forests in the districts Only 2 08% of the forest is found to be moderately dense tree forest. The growing stock in Sal forest area has been assessed as 2 012 m^3 per hectare whereas in miscellaneous forests it is 0 416 m^3 only The total growing stock in the district is 0 042 million m^3 The forest is losing its productivity mainly due to illicit cutting

The hard work put in by the 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 is gratefully acknowledged The co-operation and help extended by the State Forest Department is also thankfully acknowledged

It is hoped that the report will serve as database for the planning for forest management in the district

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GOVERNMENT OF INDIA,
MINISTRY OF ENVIRONMENT AND FORESTS,
FOREST SURVEY OF INDIA,
(EASTERN ZONE)
KOLKATA

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This organisation expresses its gratitude and sincere thanks to the officers and staff of Bihar Forest Department for their valuable co-operation extended to our field parties during the survey work, without which it would not have been possible to complete the survey work in stipulated time

I express my sincere thanks to all officers and staff members of Eastern Zone of Forest Survey of India who were entrusted with carrying out the forest inventory and bringing out the report in the present form.

Madhawa Trivedy
Regional Director.

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CHAPTER I

BACK GROUND INFORMATION

1.1 INTRODUCTION

The need for sound forestry is felt since ages for sustainable and viable development of environment in which man lives Forests provide a multitude of goods and services to the people at large, to all sectors of society And moreover, being renewable, they are capable of providing these effectively to that end Therefore, the well being of forestry carries great significance towards long-term prosperity of human life The ecological integrity, its overall bio-diversity and productive capacity may change over the time period and therefore, time-to-time assessment of forest resources is essential Keeping this in view, the Forest Survey of India (Eastern Zone) has been entrusted to carry out a survey on the growing stock of forest resources in undivided Bhagalpur district of Bihar State in 1994-95

1.2 AREA AND LOCATION

The present inventory area comprises of the undivided Bhagalpur district of Bihar State At present, the Bhagalpur district has been split into two separate districts viz , Bhagalpur and Banka The location of these two districts is shown in the map appended The total geographical area of the undivided Bhagalpur district is 5,589 sq km The district is situated between 24°32' to 25°30'N latitudes and 86°27' to 87°36'E longitudes It is bounded on the north by Saharsa district, on the Southeast, south of the Ganges, by the district of Santhal Parganas, on the Southeast, north of the Ganges by the district of Purnia and Katihar and on the west by the district of Munger Before going into the details of survey findings, let us look into the physical and socio-economic features of the inventoried area

1.3 PHYSICAL CONFIGURATION

The physical configuration of the district is almost similar to the maximum portions of the Bihar State The Ganga separates the district into two parts, north Bhagalpur and south Bhagalpur The northern portion is analogous in physical characteristics to the north Bihar plain The land in this portion of the district is

quite fertile The southern portion comprises the bulk of the district It has a general plain surface except towards the southern areas in Banka, adjoining Santhal Parganas The land begins to rise at an easy ascent about 48 Kms south of Bhagalpur city and then the hilly tracts commence Therefore, the entire district of Bhagalpur may broadly be divided into three natural divisions viz , the alluvial plains in the north of the Ganges, the plains in the south of the Ganges and the uplands bordering Santhal Parganas

1.4 CLIMATIC CONDITION

The climate of this district is characterised by extremities of weather like most of the other parts of Bihar That is, it has a hot summer and a pleasant winter season The highest annual temperature of the district is recorded to be 46 4°C On the other hand, the lowest annual temperature is 10 4°C However, the mean annual temperature recorded in the district is 28 3°C Annual humidity varies between 75% and 61% throughout the year

The Southwest monsoon generally sets in the latter part of June During July and August the rainfall is the heaviest The district has, on an average, 47 rainy days throughout the year The average annual rainfall of the district is 1184 mm Which is almost uniformly distributed throughout the area The district gets some winter rains also due to the effect of Northeast monsoon

1.5 RIVER SYSTEM

The Ganga is an important river of the district, which cuts it into two halves It touches the district at Tulsipur, forming the boundary of Munger district for about 16 Kms It enters the district opposite Sultanganj where there is a granite hillock in the riverbed The Ganga then flows northwards to Bhagalpur where it takes a bend to the south to Colgong From here the river flows eastward for 13 Kms up to Patharghatta where it joined by the Kosi The river is navigable throughout the year for all types of boats

The river Chandan is the largest of the hill steams in the district It originates in the north of Deoghar in Santhal Parganas The river passes near Banka and joins the Ganga at Ghoga The Chandan Reservoir Scheme irrigates a large portion of land in the south Bhagalpur area

1.6 IRRIGATION FACILITIES

In the past the main source of irrigation was rainfall However, on account of failure of monsoon or premature cessation of rainfall the need for irrigation was felt Before the abolition of Zamindari system the Zamindars used to maintain *ahars* and *pynes* which serv

the twin purposes of irrigation as well as drainage The wells were also available for irrigation in the district In the post-independence days the Government has paid attention to improve the Irrigation facilities in this district For this, the Government has taken up and executed several schemes of irrigation throughout the district The major irrigation schemes of the district are as follows

i) Gebua Weir Scheme
ii) Souhaula Tarar Irrigation Scheme
iii) Mahmuda Irrigation Scheme
iv) Chandan-Bilasi Irrigation Scheme
v) Chandan Reservoir Project
a) Kajia Danr Irrigation Scheme, Phase-I
b) Kajia Danr Irrigation Scheme, Phase-II
c) Main Chandan Reservoir Project, Phase-I
d) Badua Reservoir Irrigation Project

Besides the major irrigation schemes, a number of medium and minor irrigation schemes have also drawn up in the district The State Government has also taken measures to construct embankments in some areas of the district to protect these areas from floods caused by the Ganga

1.7 FLORA AND FAUNA

The district has a good amount of forest resources in the Banka, Bansi and Katoria forest ranges while the woods of Banka range lie on hill slopes, those in the other two ranges lie in undulating land Among the prominent trees in these forest areas, Sal is most commonly found along with other trees like *aôaus, asan, kawa* and *mahua* Tasar worms are reared on *Asan* trees in these areas The other trees found here are *bahera, kadam, amaltas* Among the species of acacia are *babul, siris* and *sain babul* Among the fruit trees, mango and jackfruit are very common *Plum, date palm* and *jamun* are also available in these areas

Among the faunal wealth, monkeys are widely found in the district specially Hanuman Langurs Jackals are also quite often seen in these places Deer are sometimes met with, particularly the Sambhar Wild geese, duck, teal, snipe and quail are some of the birds inhabiting the district Peacocks, parrots, hawks and doves are the other birds found in these areas Sparrows, crows and vultures are also common Several kinds of fish are found in the district Among them, rohu, katla, boari and tengra are usually common Some other varieties are bachwa, jhinga and pod

1.8 MINES AND MINERALS

Both the northern and southern portion of Bhagalpur district, separated by the river Ganga, are comprised of pure alluvium The genetic formation occupies a considerable area in Chanan and Katona blocks Isolated portions of gneiss occur near Panya and Kherhi and in the Ganga at Colgong and

Patharghatta. The Patharghatta hill is composed of Damodar rocks and also has white clay and sandstone. Its eastern side contains sandstone capped by green basaltic traps comprised of the Rajmahal Trappean series.

The district is yet to be exploited in terms of its mineral resources. Deposits of chinaclay, fire clay and mica have already been found in several parts of the district. A large amount of good quality chinaclay is found in Patharghatta hill in village Madhorampur. The Fulhara mine in Katoria block produces some mica. Deposits of garnet and galeva are believed to occur in certain belts of Katoria block and those of quarty and felspar are also believed to occur in some other portions of the district, but these are not yet fully exploited.

1.9 DEMOGRAPHIC DESCRIPTION

The demographic features of the district can be described through the census data of 1991. Total population of the district according to 1991 census is 32,02,471 persons. Rural population of the district is 28,14,387 persons and urban population of the district is 3,88,084 persons. The male-female bifurcation of these population figures is encased as follows:

Table 1 POPULATION.

	POPULATION		
	PERSONS	MALE	FEMALE
TOTAL	32,02,471	17,07,506	14,94,965
RURAL	28,14,387	14,98,569	13,15,818
URBAN	3,88,084	2,08,937	1,79,147

The distribution of Scheduled Castes and Scheduled Tribes population of the district is presented here.

Table 2 SCHEDULED CASTES AND TRIBES.

	POPULATION	
	Scheduled Castes	Scheduled Tribes
TOTAL	3,33453	1,10,735
RURAL	3,05,186	1,09,564
URBAN	28,267	1,171

Literacy rate of age 7 years and above is 38.89 for the district, as a whole. The literacy rate among the male (51.32%) is much higher than that among the female (24.38%). Again, literacy rate in the urban area (66.35%) surpasses the literacy rate in the rural area (34.96%) to a large extent. The main languages spoken in the district are Hindi and Urdu. The religion practiced by the people mainly Hinduism, Muslim, Christian, Jainism, etc. Of these, the percentage of Hindu population is highest (86.01%). The Muslims (13.87%) and Christians

(0.08%) constitute comparatively less percentage of population.

1.10 ECONOMIC STATUS

Both agriculture and industry support the economy of the district. However, the main occupation of the people here is agriculture. The cultivators are fully aware of the beneficial effects of rotation of crops and thus crops are generally sown in rotation in this district. Rice is the most important crop of the district. It covers the largest proportion of the gross area sown. Wheat is the main Rabi crop. Maize is another important cereal. Sugarcane and oilseeds are the major cash crops different kinds of fruits and vegetables are also grown in this district. Potato is the most important vegetable grown in the district.

The district of Bhagalpur has been famous for its industrial potentiality since long. The chief industries of the district running for years are tassar silk, dyeing, salt, indigo, glass ware and cloth manufacture. A number of industries have also come up in the post-independence period. The household industry also plays an important role in the economy of the district. Among these, handloom industry finds a prominent place in the district of Bhagalpur. Dairy, pottery, manufacture of materials from cork, bamboo, cane leaves, etc. are also quite significant. Considerable attention has also been paid to poultry development in different community development blocks in the district. Under this scheme poultry extension centre and hatching centres are also in operation at a few centres.:

1.11 TRANSPORT FACILITY

The district has the advantage of all the modes of communication –Railways, Roadways and Waterways. In fact, after the independence, the Government has paid due attention for overall improvement of the communication facilities of the district to make it well connected by rail, road and river transport.

The roads of the district consist of Public Works Department Roads, District Board Roads, Municipal Roads and Village Roads. The State highways prevailing in the district which are maintained by the Public Works Department are Bhagalpur-Hasdiha, Bhagalpur-Sultanganj-Ghorghat Bhagalpur-Colgong, Akbarnagar-Shakhund, Sultanganj-Tarapur, Banka-Katoria, Banka-Amarpur, Banka-Dhamkore, Ghongha-Sonhaula, Pirpainti-Golda, Amarpur-Shakhund, Colgong-Sahebganj, etc. The prominent roads of the northern part of the Ganges are Naugachhia-Gopalpur-Colgong Road, the road from Gasaigaon to the junction of Bihpur-Birpur Road, Katoria-Tublidanga Road and Bihpur-Ghaghrighat Road. The district also contains considerable length of pucca roads maintained by the District Board.

The district is served by both Eastern and North-Eastern Railways. Bhagalpur lies on the broad-gauge loop line of the Eastern Railway running from Kiul to Burdwan. Important stations of the district lying on this line are Bhagalpur, Sultanganj, Sabour and Colgong. There is also a branch line running from Bhagalpur to Mandar Hill. North Bhagalpur area is served by the metre-gauge Barauni-Katihar Section of the North-Eastern Railway. The important railway stations lying on this line are Naraiapur, Thana, Bihpur, Nangachhia and Katareah. Both the northern and southern part of Bhagalpur are well connected by a regular ferry service. Steamer services from crossing the Ganges are available at Bhagalpur and Sultanganj. The Barari Ghat and Mahadeopur Ghat are the two famous ones in the district. Besides, country boats are frequently used for transport of goods along the Ganges. The district has got no regular air service yet. However, it has two landing grounds at Bhagalpur and Banka.

In the backdrop of the above information on the physical and socio-economic aspects of the entire district, our onward discussion on the survey findings would be more comprehensive.

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CHAPTER – II

DESIGN AND METHODOLOGY

2.0 The present study is concerned with a large spectrum of information on forest resources of the inventoried area To collect the necessary information on forest data, an approved manual of instructions for field inventory provided by Forest Survey of India, Dehradun has been followed for carrying out the survey. Before going into the details of survey design and methodology, let us focus into the specific objectives imparted to the study.

2.1 SURVEY OBJECTIVE

The objective of the inventory is to provide a wide range of information on different categories of parameters of forest data so as to assess the existing forest resources and changes therein In short, the survey objectives can be shortlist as follows:

i) Distribution of stems by different diameter classes and estimation of total stems and stems/ha.

ii) Estimation of total growing stock and its distribution by stratum and different diameter classes.

iii) Distribution of forest area under important land use classes and other parameters such as topography, rockiness, aspect, legal status, grazing, etc.

2.2 AREA SELECTION

The area selected for the inventory should obviously be a declared forest area. Following areas are treated as forest areas for the purpose of the present inventory.

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

2.3 MAPS USED

The latest published Survey of India topo-sheets on 1:50,000 scale has been used for the present inventory of forest resources in the undivided Bhagalpur district of Bihar State. These are enlisted as follows:

Table 3 TOPOSHEETS.

S. N.	TOPOSHEET NUMBER	SCALE
1	72 K/11, 12, 15, 16	1:50,000
2	72 O/3, 4, 7, 8, 11.	"
3	72 L/9, 10, 13, 14.	"
4	72 P/1, 2.	"

2.4 SURVEY DESIGN

The field survey was essentially a systematic sampling under which the Survey of India topo sheets of 1:50,000 scale is divided into 36 grids of 2.5' x 2.5' of latitude and longitude. In each of such grids two points were selected on the topo sheets. The selection of the first point is random and the second point is the mirror image of the first, the second point is the linked to the first one in the opposite direction at an equal distance from the grid centre. The inventory data were collected from a square plot of 0.1 hectare laid out at each of these sample points on the ground. Mention may be made that 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 metres on the ground and 0.6324 mm. (say, 0.6 mm.) on the topo sheets of scale 1:50,000.

2.5 PRECISION AND ACCURACY

Precision level for the study has been maintained to check the error limit of the data. The result of the survey would be at the precision level of 95% probability with error limit of ±10% at the State level.

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' x 2.5' is depicted in Diagram-2. 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 and y be the length and width of the grid and s 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'. Two random numbers, one in the range of o to

the other in the range of o to y are selected. These numbers are called x and y respectively. Half of the side of the plot (s/2) is added to x and y to get x +s/2 and y+s/2, which will be the coordinates of the centre of first plot in the grid considering the left hand bottom corner (south-west corner) of the grid as origin of the axis . The centre of second plot is located by joining the centre of first plot with the grid centre and extending this line in the opposite direction. A point at an equal distance from the grid centre in the opposite direction is marked which is the centre of second plot. After fixing the plot centre with the help of topo-sheet 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. Northwest, Southeast, Northeast and Southwest.

2.7 DATA COLLECTION

An inventory crew (team) headed by a crew leader collects the forest inventory data in the field. To demarcate a plot, a prominent reference point is selected in the vicinity of the plot centre. The field reference point met be clearly visible on the map as well as on the ground, e.g. junction of roads or rivers, prominent topographical features in hilly area such as spurs and knots, village tri-junction points, old bridges and culverts, springs, milestones etc. The data is collected and recorded in a legible manner in the codified field forms such as Plot Approach Form, Plot Description Form, Plot Enumeration Form etc. Since bamboo do not occur widely in the concerned district of Bihar, the details of this kind of data have not been tabulated. However, the details of all these forms are discussed here.

a) **Plot approach form:** It gives an account of the details regarding the approach to the plot. All the conspicuous features observed during the journey from campsite to the plot centre are recorded. Prominent reference point along with bearings is recorded which serves as an aid to reach the plot at a future date

b) **Plot description form:** The description of several parameters each as topography, soil, land use class, forest type, regeneration, crop data etc. are collected and recorded in this form for an area of 2 hectare around the centre of the plot.

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

d) **Sample tree form:** Data for trees with diameter 10 cm. and above at breast height over bark are collected from ¼ area of the total plot is 0.025 hect

area at Northwest quadrant of the plot. On each sample tree, sample tree card will be nailed. In this form, data on tree height, bark thickness, length of clear bole, shape of the tree etc. are recorded.

e) **Bamboo enumeration form:** This form is designed for enumeration of bamboo culms per clump by age and culms and soundness of culms by clump size. Separate forms are used for clump forming and non-clump forming bamboo.

f) **Bamboo weight form:** This form is maintained to determine the green weight and dry weight of bamboo. Mature bamboo are selected from each diameter class and for each species, tree 30 cms. Long pieces obtained from the top, middle and bottom portions of the utilizable culms are cut out and their green weights are recorded. These pieces are properly documented and kept in the base camp and weighed every 30 days till a constant weight is obtained. Since bamboos did not occur widely, hence the use of form (e) & (f) were very limited.

CHAPTER – III

DATA PROCESSING

The information collected in the field series as the basic input. The processing of these data and its compilation is carried out in two phases viz. **Manual Processing, Input on Computer and Processing on Computer.** Let us focus into these two ways of processing

3.1 MANUAL PROCESSING

It involves overall checking of the field forms which is done manually. The basis of such approach is to improve the accuracy and consistency of data. The following steps are incorporated under this approach.

- Proper documentation of the field information received.
- Codification of the information in the field forms which have not already been incorporated.
- Manual checking for validity of codes used in various columns of the information filled in the forms.
- Reconciliation of the discrepancies, if any, in consultation with the crew leaders and field officers.

3.2 INPUT FOR THE COMPUTER

After the manual checking is done, the information incorporated in the field forms, are fed into the computer for onward processing and final compilation of data. In fact, the following three types of inventory data are stores in the disk/floppy for this purpose.

- PLOT DESCRIPTION DATA
- PLOT ENUMERATION DATA
- SAMPLE TREE DATA

3.3 PROCESSING ON COMPUTER

On completion of preparation of input, the following operations are carried out in the computer:

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) Corrections of the data.

iv) Calculation of plot wise stem distribution.

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v) Preparation of stand and stock tables.

vi) Preparation of tables of volume distribution for different types of stratum as needed.

vii) Analysis of plot description data.

viii) Calculation of standard error.

3.4 CONSTRUCTION OF VOLUME EQUATION/TABLES

No trees were felled during the survey of this area. The local volume equations as derived in Ranchi survey were used for volume estimation of the forest resources of the present inventory. The following equations were used for volume estimation.

Table 4 VOLUME EQUATIONS.

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

Where:

V = Total under bark volume of tree including branches (in m^3).

D = Over Bark D.B.H. (O.B.) in meter.

3.5 VOLUME OF TREE ENUMERATED

With the help of local volume equation and the diameter of the enumerated trees, under bark volume of each tree was computed.

3.6 PLOT VOLUME

Volumes of all trees occurring in a plot were added to obtain plot volume.

3.7 ANALYSIS OF GROWING STOCK

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

i) Stems/ha. by species and diameter class as 10-19 cm., 20-29 cm., 30-39 cm. etc.

ii) Distribution of total stems by species and diameter classes.

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iii) Corresponding volume/ha by species and diameter classes.

iv) Total volume by species and diameter classes.

3.8 STANDARD ERROR

Statistical inference is incomplete without information on associated errors. Hence, error has been calculated for every stratum. The acceptable error is within the range of ±10% at state level.

CHAPTER – IV

RESULTS OF INVENTORY

4.0 GENERAL

Data of the inventory have been analyzed separately for each stratum with a view to highlighting the topography, soil condition, composition and distribution of tree vegetation in the district

4.1 RECORDED FOREST AREA

Inventory area comprises the undivided Bhagalpur district of Bihar State which is at present split into two districts e g Bhagalpur and Banka district Forest area is mainly in the Banka district The recorded forest area of the above district is given below

Table 5 RECORDED FOREST AREA (in Ha)

Forest Divn	District	RF	PF	Unclassed Forest	Total (ha)
BANKA	Bhagalpur	2866	42522	-	45388

The above information of recorded forest area is taken from the Annual Administration Report for the period 1989-90 to 1992-93, published from Forest, Research division, Ranchi, Bihar

4.2 INVENTORY COVERAGE

The geographical area and the extent of Forest cover of the above district is given below

Table 6 GEOGRAPHICAL AREA AND FOREST COVER

DISTRICT	GEOG AREA (KM²)	FOREST COVER (KM²) AS PER 1997 ASSESSMENT			
		DENSE	OPEN	TOTAL	PERCENTAGE
BHAGALPUR	5589	38	164	202	3.61

Source State of Forest Report 1997, Forest Survey of India, Dehradun

4.3 INVENTORIED AREA

The extent of forest area as represented by 48 plots marked on green wash area of topo sheets of the Bhagalpur district was calculated using "dot grid" method, which comes out to be 307 73 sq km Henceforth the inventoried forest ar

calculated by "dot grid" method would be taken as the total forest area of the district i e 307 73 sq. km

4.4 STRATIFICATION

Stratification is primarily based on forest composition and land use classes Stratum area is determined on proportional distribution of the forested plots falling in the respective stratum Two major forest types have been identified according to forest crop composition found in two ha area around the plot centre which are (1) Sal Forest and (2) Miscellaneous Forests Out of 48 plots surveyed in Bhagalpur district 31 plots were found to be under Sal stratum and 7 plots are under miscellaneous forest

48 plots have been distributed over 307 73 sq km forest area One plot, therefore, represents 641 1041 ha or 6 41 sq km forest area Forest area covered by 10 plots have been excluded while calculating the net forest area for growing stock estimation as those plots lie in forest land but are under barren land, Government grass land, scrub forest without any crop composition

The net forest area for growing stock estimation and its distribution among various stratum is furnished below

Table 7 ESTIMATION OF GROWING STOCK

SL. NO.	STRATUM	FOREST AREA (SQ KM) FOR GROWING STOCK ESTIMATION.
1	Sal	198 74
2	Miscellaneous	44 88
	TOTAL	**243 62**

64 11 sq km forest area has been excluded for growing stock estimation because of barren land and non-forestry use

4.5 ANALYSIS OF PLOT DESCRIPTION DATA

Plot description data were analyzed on various parameters like land-use, terrain condition, injuries to crop, regeneration status etc with the distribution of forest area with percentage.

4.5.1 DISTRIBUTION OF FOREST AREA BY LAND USE CLASSES

Table 8 DISTRIBUTION OF FOREST AREA BY LAND USE CLASSES

Code No.	Land Use	Description	No of Plots	Forest area (Ha.)	Percentage
1	Dense tree forest	Forest with canopy density 70% & above	-	-	-
2	Moderately dense tree forest	Forest with canopy density 30 to 69%	1	641	2 08
3	Open tree forest	Forest with canopy density 5 to 29%	14	8975	29 17
4	Scrub forest	Forest with canopy density less than 5%	10	6411	20 83
5	Bamboo brakes	Areas completely covered with bamboo	-	-	-
6	Shifting cultivation	Areas under current as well as previous years shifting cultivation	-	-	-
7	Young plantation of forestry species	-	-	-	-
8 to 10	Trees in line	-	1	641	2 08
11	Barren land	-	7	4488	14 59
12	Agricultural land without trees	-	-	-	-
13	Agricultural land with trees	-	-	-	-
14	Non-forest plantation	-	-	-	-
15	Habitation	-	-	-	-
16	Water bodies	-	-	-	-
18	Young crop of natural artificial regeneration	-	15	9617	31 25
		TOTAL	48	30773 .	100 00

The above table reveals that bulk of the forests are under open tree forests followed by scrub forest which accounts for 29 17% and 20 83% respectively

There is a preponderance of young plantations of forestry species to the extent of 31 25%

4.5.2 THE DISTRIBUTION OF FOREST AREA BY TOPOGRAPHY

The percentage of forest area by topography is given below

Table 9 THE DISTRIBUTION OF FOREST AREA BY TOPOGRAPHY

Code No	Topography	No of Plots	Forest Area (Ha.)	Percentage
1	Flat	-	-	-
2	Gently rolling	27	17310	56.25
3	Hilly	21	13463	43.75
4	Very hilly	-	-	-
	Unrecorded	-	-	-
	Total	48	30773	100.00

The forests of this district occupy gently rolling topography and hilly topography to the extent of 56 25% and 43 75% respectively

4.5.3 DISTRIBUTION OF FOREST AREA BY ASPECT:

The distribution of forest area by various aspect classes is given below

Table 10 DISTRIBUTION OF FOREST AREA BY ASPECT

Code No	Aspect	No of Plots	Forest Area (Ha)	Percentage
1	Northern	10	6411	20.83
2	North-Eastern	7	4488	14 58
3	Eastern	8	5129	16.67
4	South-Eastern	8	5129	16.67
5	Southern	2	1282	4 17
6	South-Western	5	3205	10 41
7	Western	2	1282	4 17
8	North-Western	6	3847	12.50
9	No aspect	-	-	-
	Unrecorded	-	-	-
	TOTAL	48	30773	100 00

The distribution of forest area in different aspect class is almost uniform

4.5.4 DISTRIBUTION OF FOREST AREA BY ROCKINESS

The distribution of forest area by rockiness classes is as under

Table 11 DISTRIBUTION OF FOREST AREA BY ROCKINESS

Code No	Rockiness	No. of Plots	Forest Area (Ha)	Percentage
1	High	-	-	-
2	Medium	5	3206	10 42
3	Low	5	3206	10 42
4	No rock	38	24361	79.16
	Unrecorded	-	-	-
	TOTAL	48	30773	100 00

The above table reveals that medium to low rockiness in Bhagalpur district to the extent of 20 84% whereas no rock area is 79 16% of the forest area

Contents

4.5.5 DISTRIBUTION OF FOREST AREA BY SOIL CONSISTENCY:

The soil of the district is found to be under following categories

Table 12 DISTRIBUTION OF FOREST AREA BY SOIL CONSISTENCY

Code No	Soil Consistency	No of Plots	Forest Area (Ha)	Percentage
1	Friable	19	12181	39.58
2	Slightly compact	29	18592	60.42
3	Compact	-	-	-
4	Cemented	-	-	-
5	No soil	-	-	-
	Unrecorded	-	-	-
	TOTAL	48	30773	100 00

The above table reveals that most of the soil is slightly compact to the extent of 60 42% whereas the friable soil cover 39 58% of the forest area

4.5.6 DISTRIBUTION OF FOREST AREA BY SOIL TEXTURE:

The distribution of district forest by soil texture is given below

Table 13 DISTRIBUTION OF FOREST AREA BY SOIL TEXTURE

CODE	SOIL TEXTURE	NO OF PLOTS	FOREST AREA (HA.)	PERCENTAGE
1	Clayey	-	-	-
2	Clayey loam	1	641	2.08
3	Loam	27	17310	56.25
4	Sandy loam	17	10899	35.42
5	Sandy	3	1923	6.25
6	No soil	-	-	-
	Unrecorded	-	-	-
	TOTAL	48	30773	100 00

The above table shows that the soil texture of the forest is predominantly loamy to the extent of 56 25% while the occurrence sandy loam is 35 42%

4.5.7 DISTRIBUTION OF FOREST AREA BY SOIL EROSION:

The extent of soil erosion in the district is given below

Table 14 DISTRIBUTION OF FOREST AREA BY SOIL EROSION

Code No	Soil Erosion	No of Plots	Forest Area (Ha)	Percentage
1	Heavy	13	8334	27.08
2	Moderate	15	9617	31.25
3	Mild	20	12822	41.67
4	No erosion	-	-	-
	Unrecorded	-	-	-
	TOTAL	48	30773	100 00

The inventory result indicates that a major portion of the forest area faces mild erosion (41 67%) The forest area effected by heavy erosion and moderate erosion is 27 08% and 31 25% respectively

4.5.8 DISTRIBUTION OF FOREST AREA BY INJURIES TO CROP:

Injuries to crop as observed during inventory is as under

Table 15 DISTRIBUTION OF FOREST AREA BY INJURIES TO CROP

Code No	Crop Injury	No of Plots	Forest Area (Ha.)	Percentage
1	Borer attack, leaf defoliator attack or damage by other rest epidemic	.	.	.
2	Top drying	.	.	.
3	Girdling and illicit felling	38	24362	79.17
4	Scaring of trees	.	.	.
5	Lopping for fodder	.	.	.
6	Wind damage or flood damage	.	.	.
7	Other injuries	.	.	.
8	No injuries	.	.	.
	Unrecorded	10	6411	20.83
	TOTAL	48	30773	100 00

The above table reveals that illicit felling is still the major cause of injury to crop

4.5.9 DISTRIBUTION OF FOREST AREA BY FIRE INCIDENCE:

Forest area affected by fire in the district is as under

Table 16 DISTRIBUTION OF FOREST AREA BY FIRE INCIDENCE

Code No	Fire Incidence	No of Plots	Forest Area (Ha.)	Percentage
1	Heavy	.	.	.
2	Moderate	5	3205	10.42
3	Light	16	10258	33.33
4	No fire	17	10899	35.42
	Unrecorded	10	6411	20.83
	TOTAL	48	30773	100 00

Light fire incidence is noticed in the district to the extent of 33 33% However, heavy to moderate fire incidence is not abundant in the district Thus, fire incidence does not seem to be a major problem in the forests of the Bhagalpur district

4.5.10 DISTRIBUTION OF FOREST AREA BY GRAZING INCIDENCE

Intensity of grazing in the district is as follows

Table 17 DISTRIBUTION OF FOREST AREA BY GRAZING INCIDENCE

Code No.	Grazing incidence	No. of Plots	Forest Area (Ha.)	Percentage
1	Heavy	10	6411	20.83
2	Moderate	19	12181	39.59
3	Light	6	3847	12.50
4	No fire	3	1923	6.25
	Unrecorded	10	6411	20.83
	TOTAL	48	30773	100.00

Heavy grazing occurs in 20.83% forest area of the district. Moderate to light grazing is preponderance (52.09%) in the district. Area free from grazing is only 6.25%.

4.5.11 DISTRIBUTION OF FOREST AREA BY PLANTATION POTENTIALITY.

The following table shows Plantation potentiality of the inventoried area

Table 18 DISTRIBUTION OF FOREST AREA BY PLANTATION POTENTIALITY

Code No.	Plantation potentiality	No. of Plots	Forest Area (Ha.)	Percentage
1	Plantable	24	15387	50.00
2	Unplantable	2	1282	4.17
3	Not Applicable	21	13463	43.75
	Unrecorded	1	641	2.08
	TOTAL	48	30773	100.00

Plantation potentiality in the forest of the project area is 50% of the district. Plantation may be mixed by plantation of suitable and quick growing species.

4.5.12 DISTRIBUTION OF FOREST AREA BY INTENSITY OF REGENERATION

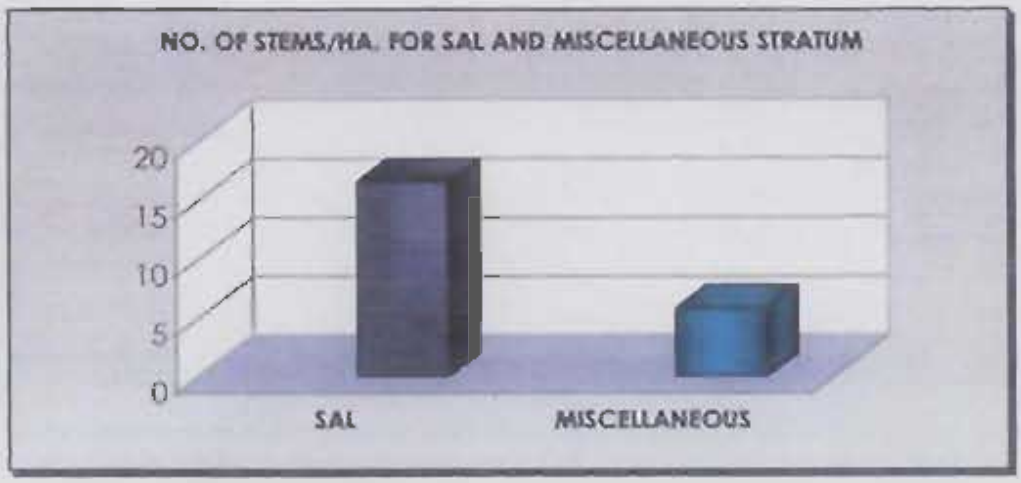
Table 19 DISTRIBUTION OF FOREST AREA BY INTENSITY OF REGENERATION.

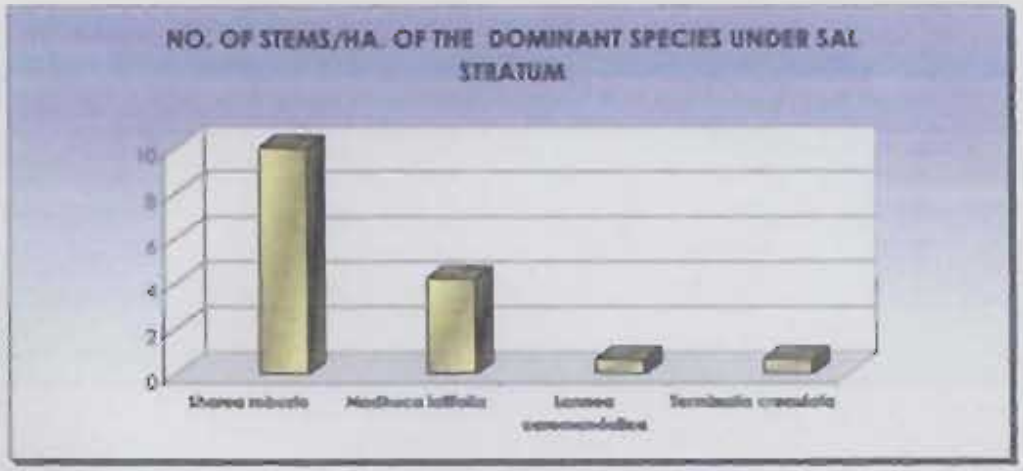
Code No.	Description (No. of seedlings in 4 m. x 4 m. square plot)	No. of Plots	Forest Area (Ha.)	Percentage
1	Adequate(8 or more seedlings)	2	1282	4.17
2	Inadequate (less than 8 seedlings)	21	13463	43.75
3	Absent (No Seedlings)	15	9617	31.25
	Unrecorded	10	6411	20.83
	TOTAL	48	30773	100.00

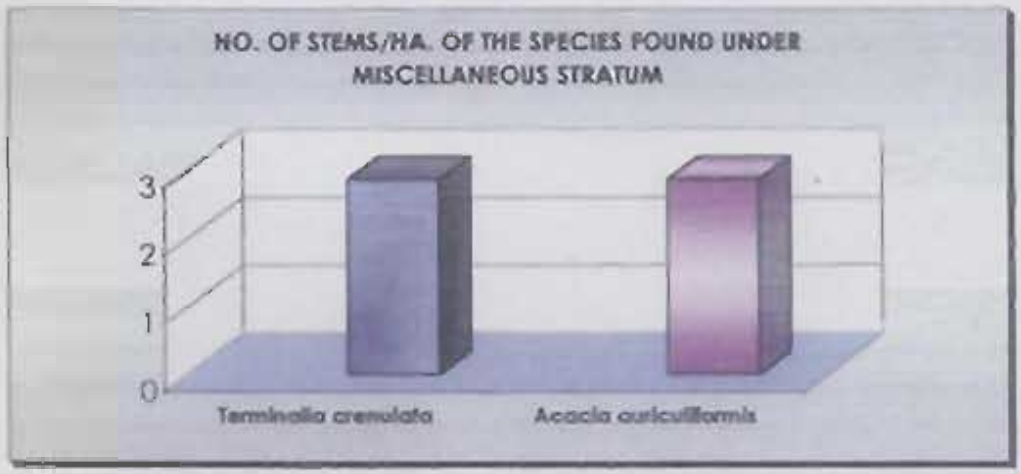
The regeneration status is poor in the district with regeneration 'Inadequate' to 'absent' is about in 75.00% of the forests.

4.5.13 DISTRIBUTION OF FOREST AREA BY DEGRADATION.

Degradation status of forest is observed in the following tables.


NO. OF STEMS/HA. FOR SAL AND MISCELLANEOUS STRATUM
20
15
10
5
0
SAL
MISCELLANEOUS


NO. OF STEMS/HA. OF THE DOMINANT SPECIES UNDER SAL STRATUM
10
8
6
4
2
0
Shorea robusta
Madhuca latifolia
Terminalia crenulata


NO. OF STEMS/HA. OF THE SPECIES FOUND UNDER MISCELLANEOUS STRATUM
3
2
1
0
Terminalia crenulata
Acacia auriculiformis

Contents

Table 20 DISTRIBUTION OF FOREST AREA BY DEGRADATION

Code No	Degradation status	No of Plots	Forest Area (Ha)	Percentage
A Grazing, Fire Pollarding, illicit cutting and lopping				
11	Heavily degraded	37	23721	77.09
12	Moderately degraded	10	6411	20.83
13	Mildly degraded	1	641	2.08
14	Not degraded	-	-	-
B Other natural calamities such as land slide, glacier, flood, rain etc				
21	Heavily degraded	-	-	-
22	Moderately degraded	-	-	-
23	Mildly degraded	-	-	-
24	Not degraded	-	-	-
	Unrecorded	-	-	-
	TOTAL	48	30773	100 00

Degradation on account of biotic interference is easily discernible from the above table Heavy to moderate degradation has been noticed in the forest areas all over the district These two categories have the highest occurrence to the extent of 97 92% whereas the mildly degraded forest is 2 08% only

4.6 TREE DENSITY STUDY

The distribution of stems per ha By species and diameter classes in Sal and Miscellaneous stratum have been calculated which are given in the table No 1 1 to 1 2 (Vide Part-II of this report). The number of stems/ha by stratum is furnished below

Table 21 STRATA & STEMS/HA

STRATUM	NO OF STEMS/HA.
SAL	16.452
MISCELLANEOUS	5 714

4.6.1 TREE DENSITY

(a) **Sal Stratum**

The following observation can be made for this stratum from Table No 1 1 (vide Part-II of this report) of the stems/ha table of this stratum

i. The number of stems/ha is 16 452 only This reflects the very gloomy picture of forest area of the district Concentration of trees in the lower diameter classes i e 10-19 cm is maximum which accounts for 86 28% of the total trees of this stratum followed by 11 76% and 1 96% in 20-29 cm and 40-49 cm diameter classes respectively

ii. It is also observed that no trees is present above 50 Cm diameter classes.

iii The number of stems/ha with percentage of important dominant species are given below

Table 22 STEMS PER HA OF IMPORTANT SPECIES IN SAL STRATUM

SPECIES NAME	NO OF STEMS/HA.	PERCENTAGE
Shorea robusta	10.000	60.78
Madhuca latifolia	4.194	25.49
Lannea coromandelica	0.645	3.92
Terminalia crenulata	0.645	3.92

(b) **Miscellaneous stratum.**

The following observations can be drawn for this stratum from table No 1 2 vide Part-II of this report

i Number of stems/ha is 5 714 only which is rather very insignificant and perhaps illicit cutting has destroyed the forest completely

ii. 100% trees are concentrated in 10-19 cm diameter classes

iii Only two species are observed to occur in the forest The number of stems/ha with percentage for those species are furnished below

Table 23 PERCENTAGE AND STEMS /HA

SPECIES	NO OF STEMS/HA.	PERCENTAGE
Terminalia crenulata	2.857	50.00
Acacia auriculiformis	2.857	50.00

4 7 TOTAL STEMS

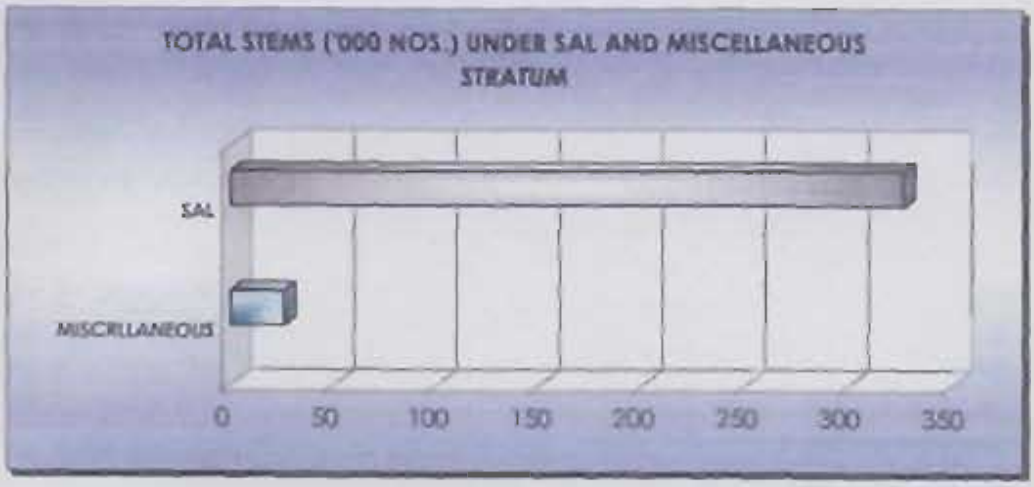
The total number of stems in different stratum by species and diameter classes in different strata are given below

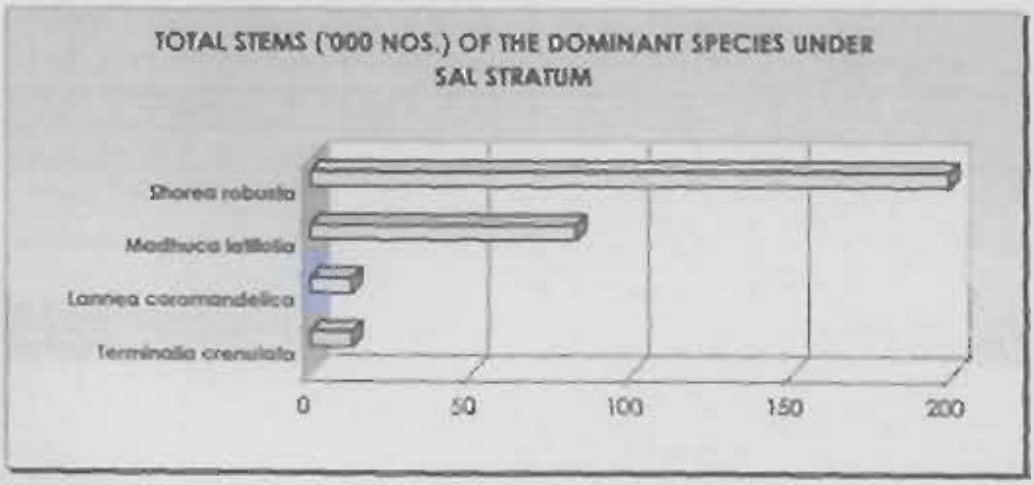
Table 24 TOTAL STEMS

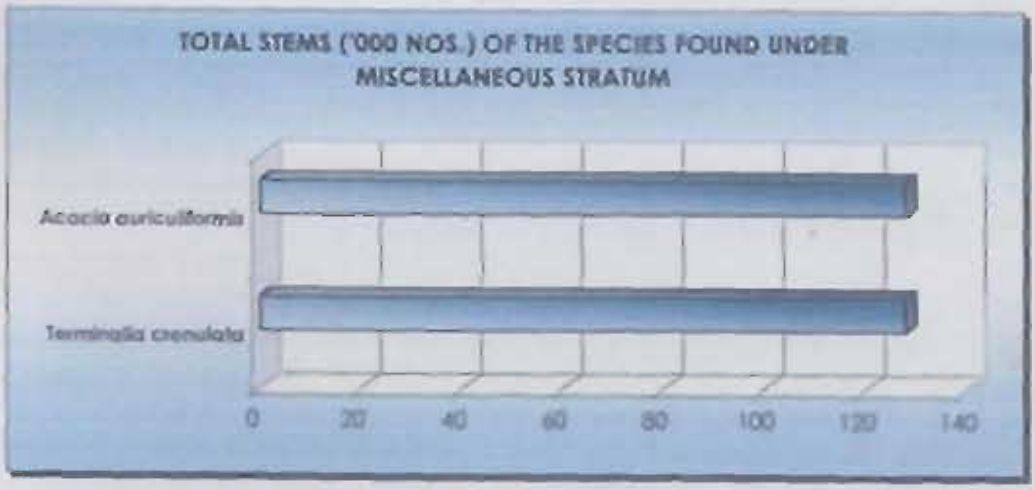
STRATUM	TOTAL STEMS (in '000 Nos)
Sal	327
Miscellaneous	26
TOTAL	353

Thus, total number of stems in undivided Bhagalpur district is estimated as 0 353 million only

Total number of stems for some of the dominant species in different stratum are summarised below


TOTAL STEMS ('000 NOS.) UNDER SAL AND MISCELLANEOUS STRATUM
SAL
MISCELLANEOUS
0
50
100
150
200
250
300
350


TOTAL STEMS ('000 NOS.) OF THE DOMINANT SPECIES UNDER SAL STRATUM
Shorea robusta
Madhuca latifolia
Lannea coromandelica
Terminalia crenulata
0
50
100
150
200


TOTAL STEMS ('000 NOS.) OF THE SPECIES FOUND UNDER MISCELLANEOUS STRATUM
Acacia auriculiformis
Terminalia crenulata
0
20
40
60
80
100
120
140

Contents

(a) Sal stratum

Table 25 SAL STRATUM

SPECIES	TOTAL STEMS ('000 NO)
Shorea robusta	199
Madhuca latifolia	83
Lannea coromandelica	13
Terminalia crenulata	13

(b) Miscellaneous stratum

Table 26 MISCELLANEOUS STRATUM

SPECIES	TOTAL STEMS ('000 NO)
Terminalia crenulata	13
Acacia auriculiformis	13

4 x VOLUME STUDIES

Distribution of volume/ha by species and diameter classes in different strata have been estimated and given in Table No 3 1 and 3 2 (Vide Part – II of this report) Those are summarized below

Table 27 STRATUM WISE VOLUME PER HA

STRATUM	VOLUME (M^3)/HA
Sal	2 012
Miscellaneous	0 416

(a) **Sal stratum:**

Salient features of this stratum is given below

I. The volume/ha is only 2 012 m^3 *Madhuca latifolia and Shorea robusta* are the main volume contributing species in this stratum

II Volume is mostly concentrated in 10-19 cm , 20-29 cm and 40-49 cm diameter classes to the extent of 38 62%, 31 06% and 30 32% respectively

III The volume contributing species with volume/ha and percentage are given below

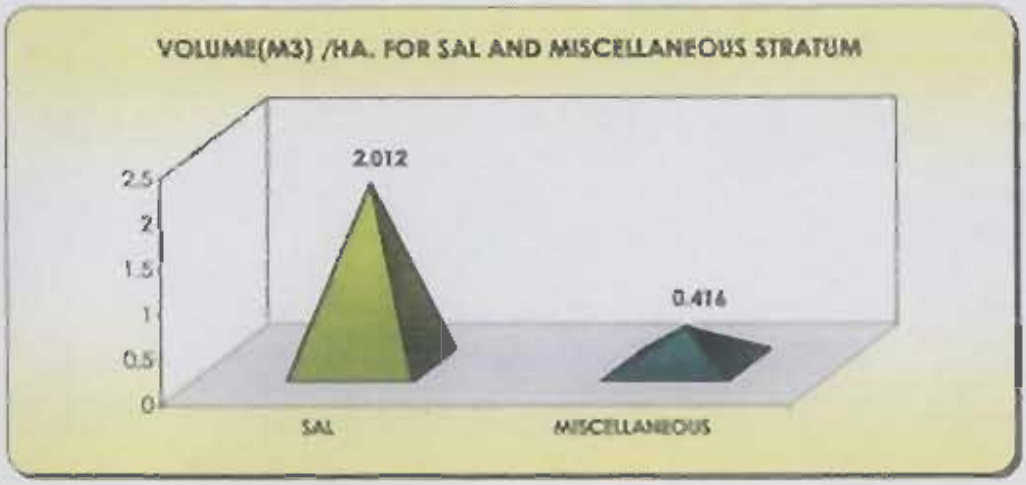
Table 28 SPECIESWISE VOLUME PER HECTARE SAL STRATUM

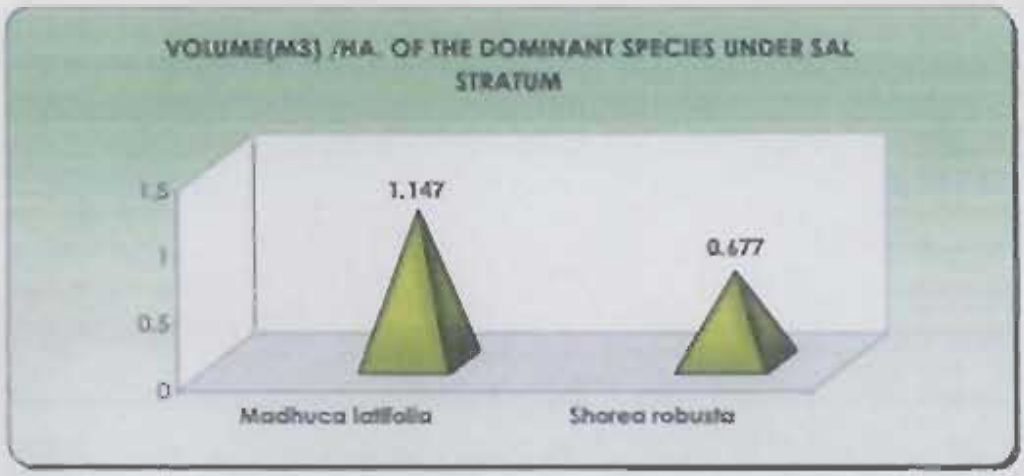
SPECIES	VOLUME (M^3)/HA	PERCENTAGE
Madhuca latifolia	1.147	57.01
Shorea robusta	0.677	33.65

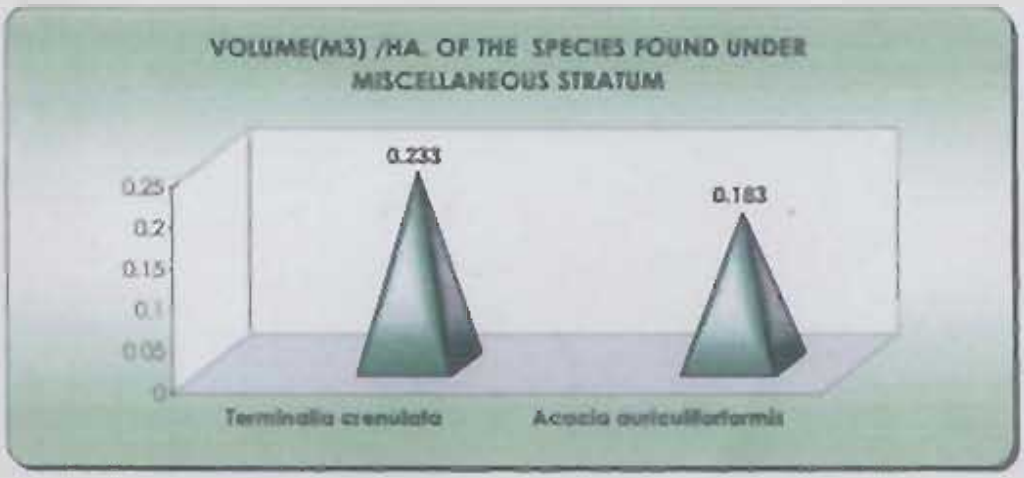
(b) Miscellaneous stratum

The following observation could be drawn for this stratum

Contents


VOLUME(M3) /HA. FOR SAL AND MISCELLANEOUS STRATUM
2.012
0.416
2.5
2
1.5
1
0.5
0
SAL
MISCELLANEOUS


VOLUME(M3) /HA. OF THE DOMINANT SPECIES UNDER SAL STRATUM
1.147
0.677
1.5
1
0.5
0
Madhuca latifolia
Shorea robusta


VOLUME(M3) /HA. OF THE SPECIES FOUND UNDER MISCELLANEOUS STRATUM
0.233
0.183
0.25
0.2
0.15
0.1
0.05
0
Terminalia crenulata
Acacia auriculiformis

Contents

i. Volume/ha is only 0.416 m^3, which shows very poor yield in this stratum. This is due to illicit cutting.

ii. All the volume is only from 10-19 cm diameter classes.

iii. The volume/ha with percentage for the two species are given hereunder.

Table 29 SPECIESWISE VOLUME PER HECTARE, MISCELLANEOUS STRATUM.

SPECIES	VOLUME (M^3)/HA	PERCENTAGE
Terminalia crenulata	0.233	56.01
Acacia auriculiformis	0.183	43.99

4.9 TOTAL VOLUME

The total volume in Sal and Miscellaneous stratum by species and diameter classes are given in table No. 4.1 and 4.2 (Vide Part II of this report). Those are summarised below.

Table 30 TOTAL VOLUME

STRATUM	TOTAL VOLUME ('000 M^3)
Sal	39.9
Miscellaneous	1.9
Total	41.8

Thus, total volume in this district is 0.042 million m^3 only.

Total volume for some of the dominant species in different stratum are summarised below.

(a) Sal stratum.

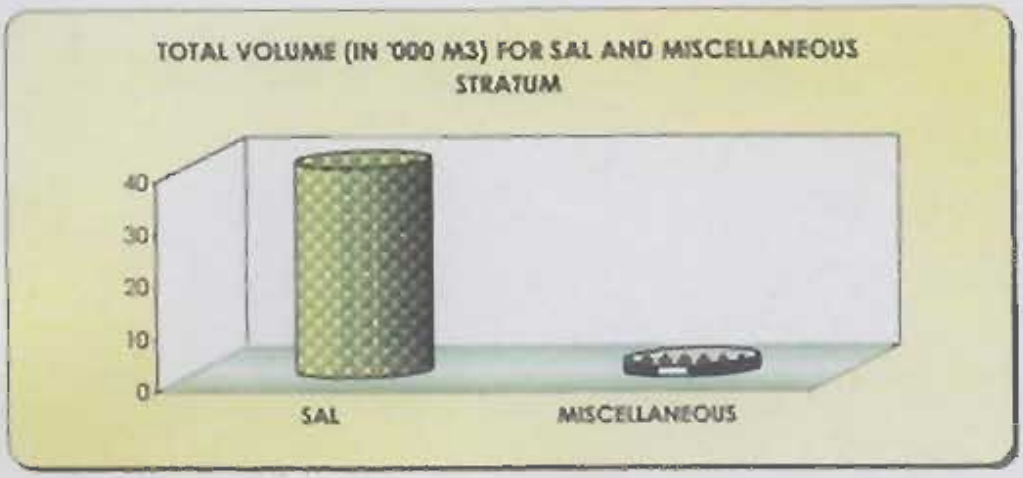
Table 31 SAL STRATUM, TOTAL VOLUME

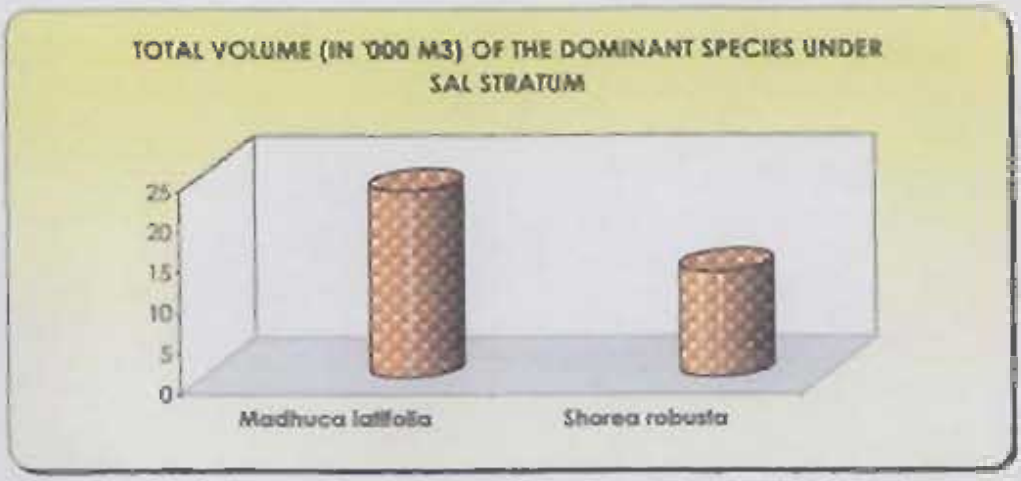
SPECIES	TOTAL VOLUME ('000M^3)
Madhuca latifolia	23
Shorea robusta	13

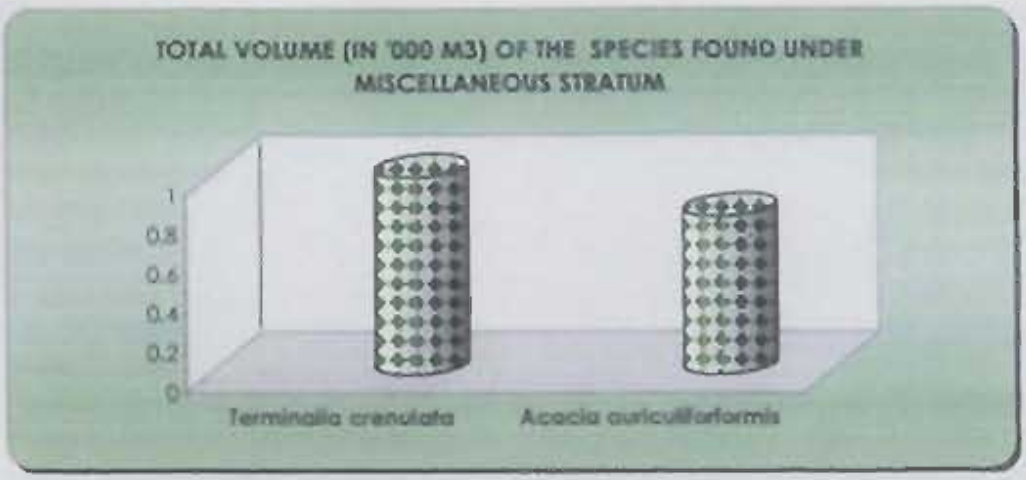
(b) Miscellaneous Stratum

Table 32 TOTAL VOLUME, MISCELLANEOUS STRATUM

SPECIES	TOTAL VOLUME ('000M^3)
Terminalia crenulata	1.00
Acacia auriculiformis	1.00


TOTAL VOLUME (IN '000 M3) FOR SAL AND MISCELLANEOUS STRATUM
40
30
20
10
0
SAL
MISCELLANEOUS


TOTAL VOLUME (IN '000 M3) OF THE DOMINANT SPECIES UNDER SAL STRATUM
25
20
15
10
5
0
Madhuca latifolia
Shorea robusta


TOTAL VOLUME (IN '000 M3) OF THE SPECIES FOUND UNDER MISCELLANEOUS STRATUM
1
0.8
0.6
0.4
0.2
0
Terminalia crenulata
Acacia auriculiformis

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4.10 STANDARD ERROR.

The standard error percentage (i e S E%) has been estimated by ratio method for individual strata which are furnished below

Table 33 S.E % IN EACH STRATUM

STRATUM	S E %
Sal	19 8
Miscellaneous	32 4

For the entire district it is 25 6%

It is worthwhile to mention that for larger area, i e , at the State level, the error percentage is expected to be within ± 10% precision limit

CHAPTER-V

SUMMARY AND CONCLUSIONS

6.1 SUMMARY

1 The forest area surveyed in Bhagalpur and Banka districts is 307 73 Sq km which is 5 51% of the geographical area of the districts

2 The forest area has been categorised into 2 strata e g Sal and Miscellaneous Forest 198 74 sq km forest area is under Sal Stratum whereas 44 88 sq km forest area is Miscellaneous Stratum Forest area of 64 11 sq km has been excluded for growing stock estimation as these forest area is mostly barren land and used for non-forestry purposes

3 Per hectare estimated stems and volume in various strata have been computed as follows

Table 34 NO OF STEMS & VOLUME IN EACH STRATA

STRATUM	NO OF STEMS/HA	VOLUME (M^3)/HA
Sal	16 452	2 012
Miscellaneous	5 714	0 416

4 Total number of stems in the district is 0 327 million in Sal stratum where as it is only 0 026 million in Miscellaneous stratum

5 Total volume in Sal Stratum is 0 0399 million m^3 whereas in Miscellaneous stratum it is 0 0019 million m^3 only

6 Out of total forest area in the district, moderately dense tree forests constitute 2 08% and open tree forest area constitutes 29 17% of the district forest area Scrub forests constitute 20 83% forest area whereas there is no dense tree forest in the district

7 The regeneration status is poor in the district with inadequate to absent regeneration in about 75 00% of the forests

8 Light fire incidence is noticed in the district to the extent of 33 33% However, heavy to moderate fire incidences are not abundant in the district

9. Extent of forest area subjected to heavy grazing is 20.83% Moderate to light grazing is found in 52.09% of the district forests.

10. Plantable area is 50.00% in the forest area of the district. Plantation may be raised by plantation of suitable and quick growing species.

11. Heavy to moderate degradation due to biotic interference has been noticed in the forest areas all over the district to the tune of 97.92% whereas mildly degraded forest is 2.08%.

8.2 COMPARISON WITH PAST SURVEY RESULTS

Earlier survey was carried out in the district of Santhal Parganas and adjoining areas of Bhagalpur District falling under Banka Sub-division during the period October 1981 to January 1982. The present inventory area comprises of Bhagalpur district only, which is at present split into Bhagalpur and Banka districts. The findings of the previous survey only of Bhagalpur district were compared with the present inventory in terms of Stems/ha. and volume/ha. in different diameter classes and strata. These forests have vanished rapidly over the past 2 or 3 decades due to increase of population and high demand of forest produce by the local people and has become a heavy burden on the available forest resources. The following tables will indicate the degree of recession of forest in the district and local people are to be made self sufficient in their needs. Forestry programmes are required to be implemented for raising firewood trees in private and community land and crop is to be improved through silviculture operations and protections.

(a) Number of stems/ha by diameter class:

Table 36 NUMBER OF STEMS/HA BY DIAMETER CLASS

Stratum – Sal			Stratum – Miscellaneous		
Dia. Class(cm.)	No. of stems/ha		Dia. Class(cm.)	No. of stems/ha	
	1981-82	1994-95		1981-82	1994-95
10-19	26.153	14.194	10-19	19.999	5.714
20-29	4.231	1.935	20-29	6.154	-
30-39	1.538	-	30-39	4.615	-
40-49	0.769	0.323	40-49	-	-
50-59	-	-	50-59	0.769	-
60-69	-	-	60-69	-	-
70-79	-	-	70-79	-	-
80-89	0.385	-	80-89	-	
90-99	-	-	90-99	-	
100+	-	-	100+	-	
TOTAL	33.076	16.452		31.537	5.714

A close study of the above tables reveals a comparative picture of the changes of stems/ha in different diameter classes and in Sal and Miscellaneous Stratum over one and half decade The percentage decreases in terms of Stems/ha in Sal and Miscellaneous Stratum stand at 50 26% and 81 88% respectively Study of the above table shows that stem density was very poor in both the strata over in the year 1981-82 which has further deteriorated due to indiscriminate removal of forest produce by the local people The widespread practice of shifting cultivation in forestland has been the major causes of recession of forest cover and depletion of its resources This picture is reflected in all the diameter classes and in both the strata

(b) Volume/ ha by diameter class

TABLE 36 VOLUME/ HA BY DIAMETER CLASS

Stratum – Sal			Stratum – Miscellaneous		
Dia Class(cm)	Volume (m^3)/ha		Dia Class(cm.)	Volume (m^3)/ha	
	1981-82	1994-95		1981-82	1994-95
10-19	2.249	0.777	10-19	1 589	0.416
20-29	1.338	0 625	20-29	2.139	-
30-39	1 269	-	30-39	4 118	-
40-49	1 005	0 610	40-49	-	-
50-59	-	-	50-59	1.800	-
60-69	-	-	60-69	-	-
70-79	-	-	70-79	-	-
80-89	2 265	-	80-89	-	-
90-99	-	-	90-99	-	-
100+	-	-	100+	-	-
TOTAL	8 127	2 012	TOTAL	9 646	0 416

Here also a sharp decline is observed in both Sal and Miscellaneous Stratum in terms of Volume/ha in course of one and half decade The percentage of decrease in the above two strata stands at 75 24% and 95 68% in Sal and Miscellaneous Stratum respectively It clearly indicates a very gloomy picture Forestry development activities need to be intensified in order to improve the growth of forest crop Blank plantable areas are to be identified and planted with quick growing species Administrative machinery alone is not sufficient and people's participation in forestry activities including large-scale afforestation is a must in protecting and developing the forest resources of the district

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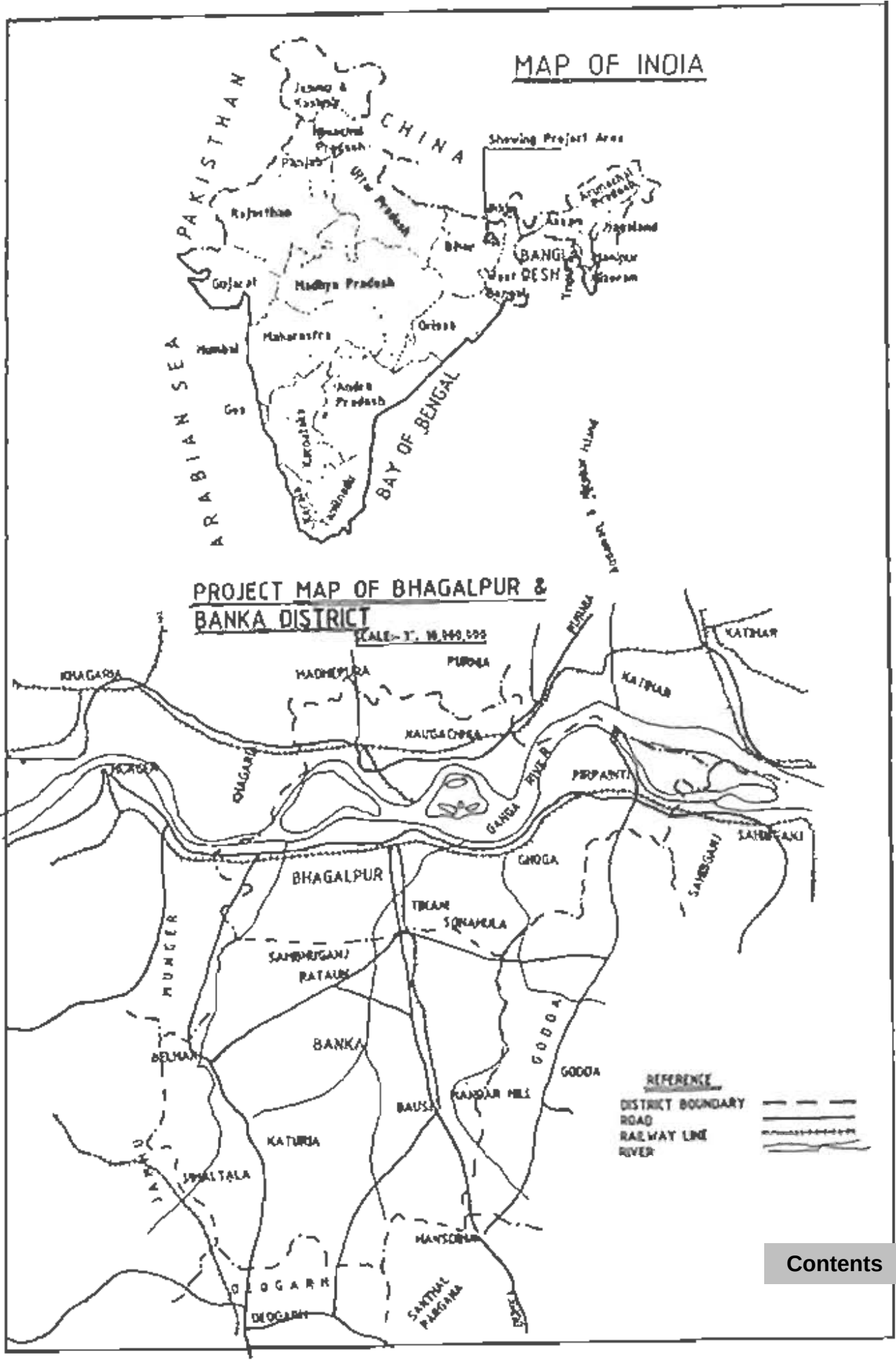
8 Annual Administrative Report, 1989-90 to 1992-93, published from Forest Research Division, Ranchi, Bihar


MAP OF INDIA
PAKISTHAN
CHINA
Showing Project Area
Rajasthan
Bihar
Gujarat
Madhya Pradesh
Orissa
Maharashtra
Andra Pradesh
Goa
ARABIAN SEA
BAY OF BENGAL
PROJECT MAP OF BHAGALPUR & BANKA DISTRICT
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MADHEPURA
PURNIA
KATIHAR
KATPLAR
KAHALGAON
BHAGALPUR
GANGA RIVER
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GHOGA
TIKAR
SONAHULA
SAMBHUGANJ
RATAUR
BANKA
BELHAR
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REFERENCE
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FOREST SURVEY OF INDIA
INVENTORY DESIGN

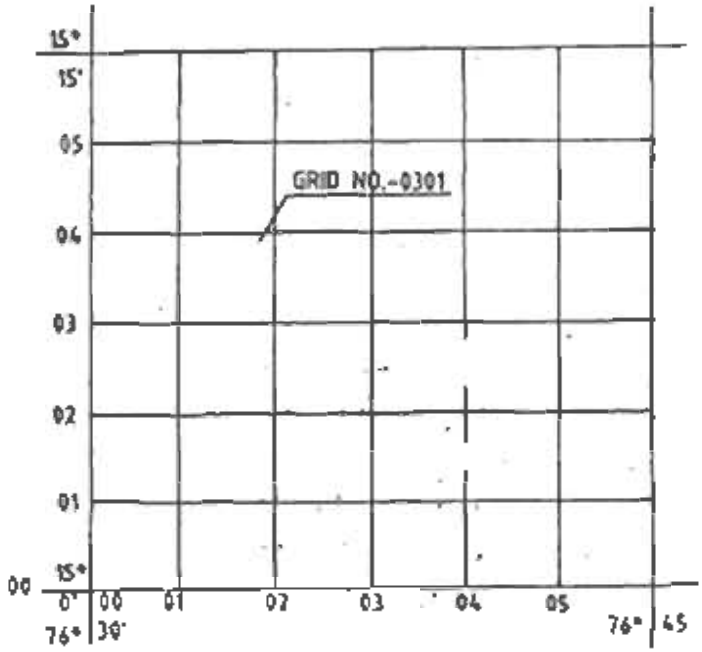
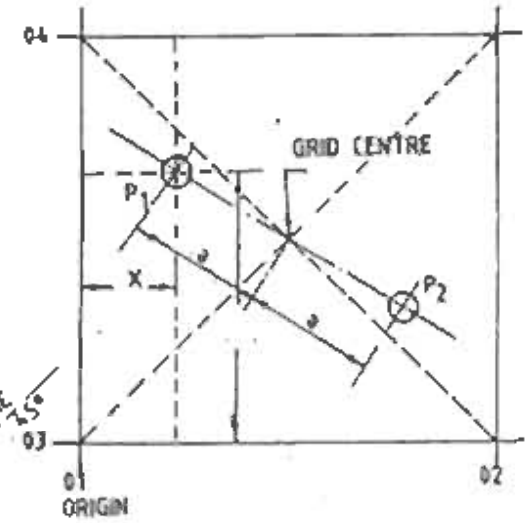


DIAGRAM-1

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 1/2 X 2 1/2 GRID 'X' & 'Y' ARE THE DISTANCES ALONG 'X' & 'Y' AXES WITH S W CORNER AS THE ORIGIN.



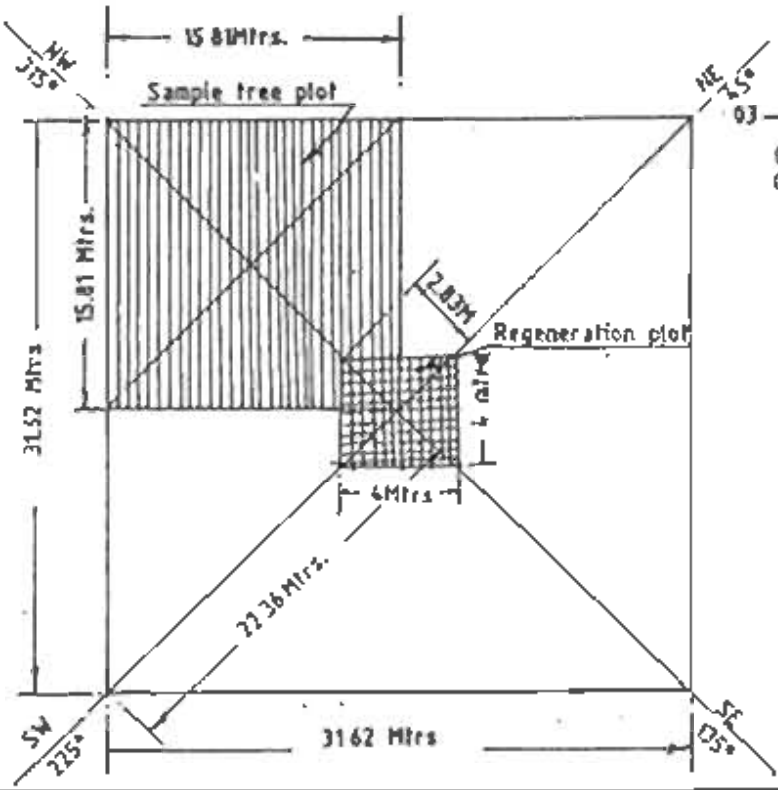
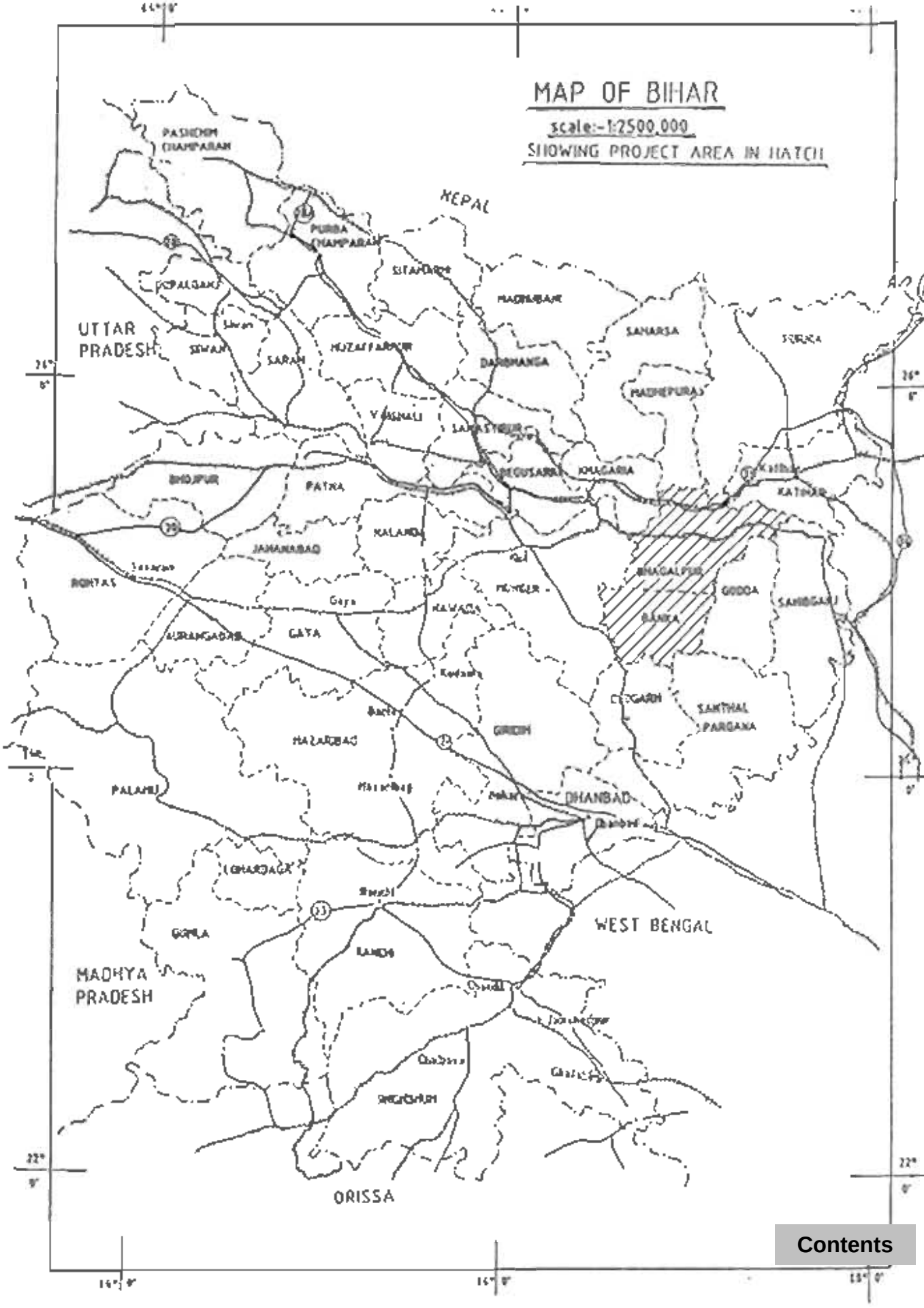


DIAGRAM-3

DIAGRAM SHOWING LAY OUT OF PLOT

Contents


MAP OF BIHAR
scale:-1:2500,000
SHOWING PROJECT AREA IN HATCH
NEPAL
UTTAR PRADESH
WEST BENGAL
MADHYA PRADESH
ORISSA
PASHCHIM CHAMPARAN
PURBA CHAMPARAN
SITAMARHI
MADHUBANI
SAHARSA
SUPAUL
ARARIA
KATIHAR
MADHEPURA
DARBHANGA
MUZAFFARPUR
VAISHALI
SAMASTIPUR
BEGUSARAI
KHAGARIA
BHAGALPUR
BANKA
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SAHIBGANJ
SANTHAL PARGANA
GIRIDH
DHANBAD
BOKARO
HAZARIBAG
RANCHI
PALAMU
GARHWA
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SIMDEGA
SARAN
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GOPALGANJ
BHOJPUR
PATNA
JAHANABAD
ROHTAS
GAYA
AURANGABAD
KAIMUR
PURNEA
KATIHAR

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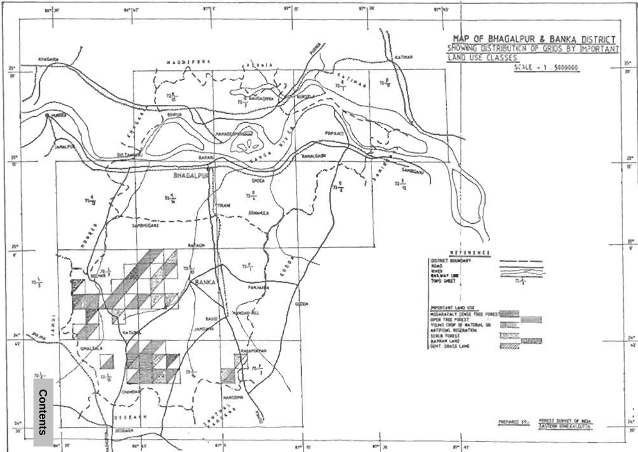
MAP OF BHAGALPUR & BANKA DISTRICT
SHOWING DISTRIBUTION OF GRIDS BY IMPORTANT LAND USE CLASSES
SCALE - 1 : 5000000
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ROAD
RIVER
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SCRUB FOREST
BARREN LAND
GOVT. GRASS LAND
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MADHEPURA
PURNIA
KATIHAR
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SULTANGANJ
BIHPUR
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PIRPAINTI
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GHOGA
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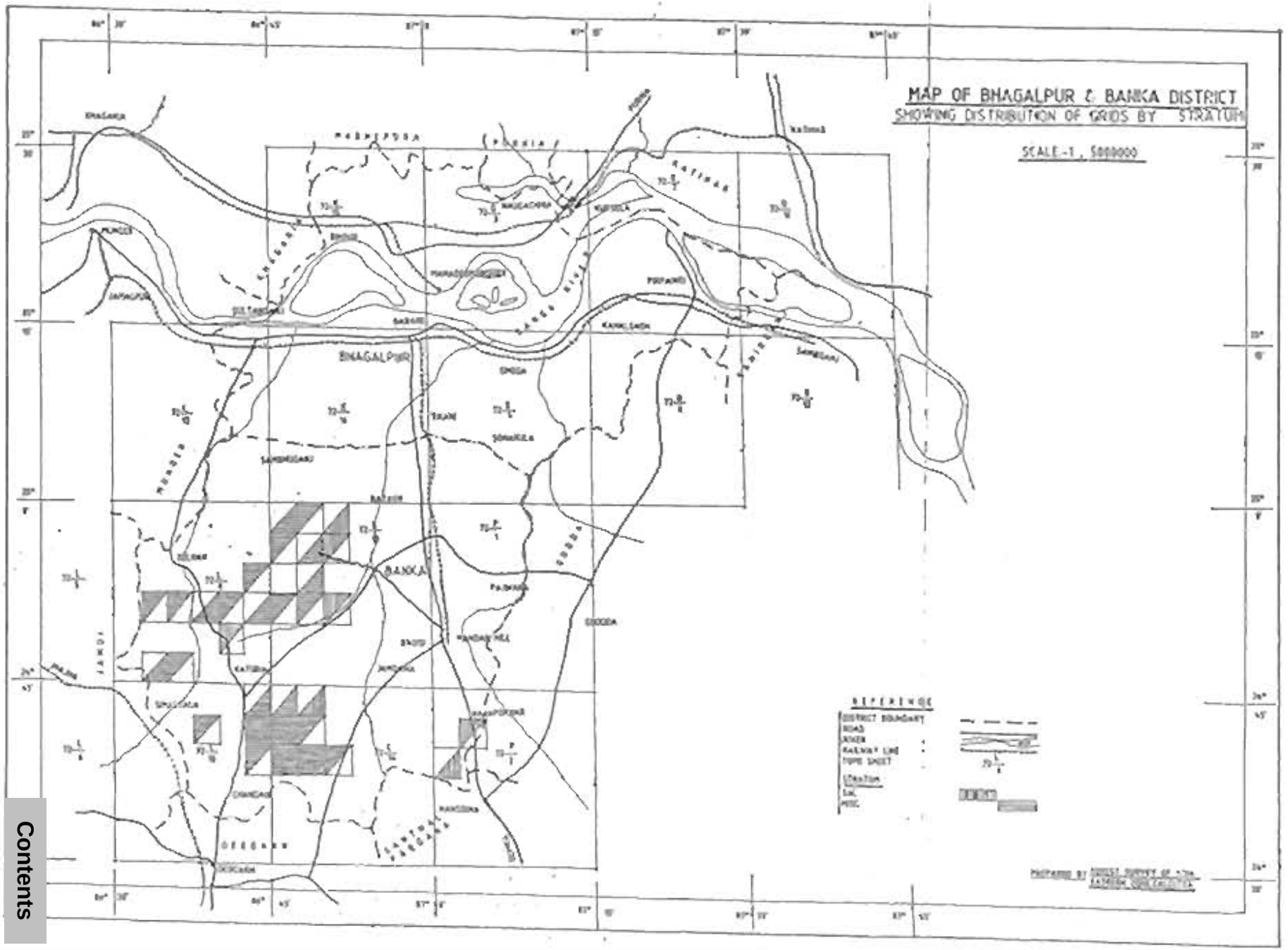
MAP OF BHAGALPUR & BANKA DISTRICT
SHOWING DISTRIBUTION OF GRIDS BY STRATUM
SCALE-1, 5000000
BHAGALPUR
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PART-II

STATISTICAL TABLES.

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TABLE NO I I

STEMS PER HACTARE(NO) BY SPECIES AND DIAMETER CLASSES(IN CM)

DISTRICT- BHAGALPUR 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
Buchanania lanzan	143	323	000	000	000	000	000	000	000	000	000	323
Lannea coromandelica	509	645	000	000	000	000	000	000	000	000	000	645
Madhuca latifolia	561	2 903	968	000	323	000	000	000	000	000	000	4 194
Semecarpus anacardium	798	000	323	000	000	000	000	000	000	000	000	323
Sesbania bispinosa	800	323	000	000	000	000	000	000	000	000	000	323
Shorea robusta	802	9 355	645	000	000	000	000	000	000	000	000	10 000
Terminalia crenulata	866	645	000	000	000	000	000	000	000	000	000	645
TOTAL		14 194	1 935	000	323	000	000	000	000	000	000	16 452
PERCENTAGE		86 27	11 76	00	1 96	00	00	00	00	00	00	100 00

TABLE NO 1 2

STEMS PER HACTARE(NO) BY SPECIES AND DIAMETER CLASSES(IN CM)

DISTRICT- BHAGALPUR 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
Terminalia crenulata	858	2 857	000	000	000	000	000	000	000	000	.000	2 857
Acacia Auriculiformis(A06)	A06	2 857	000	000	000	000	000	.000	000	000	.000	2.857
TOTAL		5 714	000	000	000	000	000	000	000	000	.000	5.714
PERCENTAGE		100 00	00	00	00	00	00	00	00	00	.00	100 00

TABLE NO 2 1

TOTAL STEMS(IN M3) BY SPECIES AND DIAMETER CLASSES(IN CM)

STRATA- SAL DISTRICT BGAGALPUR

SPECIES NAME	CODE	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100+	TOTAL
Buchanania lanzan	143	6419	0	0	0	0	0	0	0	0	0	6419
Lannea coromandelica	599	12818	0	0	0	0	0	0	0	0	0	12818
Madhuca latifolia	551	57694	19238	0	6419	0	0	0	0	0	0	83351
Semecarpus anacardium	798	0	6419	0	0	0	0	0	0	0	0	6419
Sesbania bispinosa	800	6419	0	0	0	0	0	0	0	0	0	6419
Shorea robusta	802	185921	12818	0	0	0	0	0	0	0	0	198739
Terminalia crenulata	866	12818	0	0	0	0	0	0	0	0	0	12818
TOTAL		282089	38475	0	6419	0	0	0	0	0	0	326983

TABLE NO 2.2

TOTAL STEMS(IN M3) BY SPECIES AND DIAMETER CLASSES(IN CM)

STRATA--MISCELLANEOUS DISTRICT- BGAGALPUR

SPECIES NAME	CODE	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100+	TOTAL
Terminalia crenulata	866	12822	0	0	0	0	0	0	0	0	0	12822
Acacia Auriculiformis(A06)	A06	12822	0	0	0	0	0	0	0	0	0	12822
TOTAL		25644	0	0	0	0	0	0	0	0	0	25644

TABLE NO.3 1

VOLUME(IN M3) PER HECTARE BY SPECIES AND DIAMETERCLASSES(IN CM)

DISTRICT- BHAGALPUR 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
Buchanania lanzan	143	010	000	000	000	000	000	000	000	000	000	010
Lannea coromandelica	509	039	000	000	000	000	000	000	000	000	000	039
Madhuca latifolia	561	184	353	000	610	000	000	000	000	000	000	1 147
Semecarpus anacardium	798	000	095	000	000	000	000	000	000	000	000	095
Sesbania bispinosa	800	010	000	000	000	000	000	000	000	000	000	010
Shorea robusta	802	500	177	000	000	000	000	000	000	000	000	677
Terminalia crenulata	866	033	000	000	000	.000	.000	000	000	000	000	033
TOTAL		777	625	000	610	000	000	000	000	000	.000	2 012

TABLE NO 3.2

VOLUME(IN M3) PER HECTAPE BY SPECIES AND DIAMETERCLASSES(IN CM)

DISTRICT- BHAGALPUR 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
Terminalia crenulata	866	.233	000	000	000	000	000	000	000	000	000	233
Acacia Auriculiformis(ACE	943	183	000	000	000	000	000	000	000	000	.000	183
TOTAL		416	000	.000	000	000	000	000	000	000	000	416

TABLE NO 4 1

TOTAL VOLUME(IN M3) BY SPECIES AND DIAMETER CLASSES(IN CM)

STRATA- SAL DISTRICT- BHAGALPUR

SPECIES NAME	CODE	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100+	TOTAL
Buchanania lanzan	143	198	0	0	0	0	0	0	0	0	0	198
Lannea coromandelica	509	775	0	0	0	0	0	0	0	0	0	775
Madhuca latifolia	581	3658	7015	0	12123	0	0	0	0	0	0	22794
Semecarpus anacardium	798	0	1888	0	0	0	0	0	0	0	0	1888
Sesbania bispinosa	800	198	0	0	0	0	0	0	0	0	0	198
Shorea robusta	802	9937	3517	0	0	0	0	0	0	0	0	13454
Terminalia crenulata	866	655	0	0	0	0	0	0	0	0	0	655
TOTAL		15419	12420	0	12123	0	0	0	0	0	0	39962

TABLE NO.4.2

TOTAL VOLUME(IN M3) BY SPECIES AND DIAMETER CLASSES(IN CM.)

STRATA-:MISCELLANEOUS DISTRICT: BHAGALPUR

SPECIES NAME	CODE	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100+	TOTAL
Terminalia crenulata	866	1045	0	0	0	0	0	0	0	0	0	1045
Acacia Auriculiformie(A06)	A06	821	0	0	0	0	0	0	0	0	0	821
TOTAL		1866	0	0	0	0	0	0	0	0	0	1866