MDM4

FOREST RESOURCES

OF

RAIGARH DISTRICT

OF

MADHYA PRADESH

(Chhattisgarh)

सत्यमेव जयते

FOREST SURVEY OF INDIA

CENTRAL ZONE

NAGPUR

1989

Contents

MDMU

FOREST RESOURCES

OF

RAIGARH DISTRICT

OF

MADHYA PRADESH

(Chhattisgarh)

सत्यमेव जयते

FOREST SURVEY OF INDIA

CENTRAL ZONE

NAGPUR

1989

Contents

P R E F A C E

India's forest wealth is diminishing very fast due to the pressures of population. It has become necessary to have an accurate picture of the remaining resources and therefore, Central Zone of Forest Survey of India carried out inventory of forest resources of Raigarh district of Madhya Pradesh during March to June, 1985. This report is essentially based on the data collected during the survey. It covers two forest divisions in Raigarh district namely Raigarh forest division and Jashpur forest division. These forests formed a part of former princely states of Raigarh, Udaipur, Sarangarh and Jashpur. These forests suffered badly during the long period under princely rule due to lack of scientific forest management and proper protection. These conditions have changed now and systematic forest management has been introduced in these areas after merger of the princely states and there is considerable improvement in forest stock during the last decade as revealed from the survey done by us in 1985 and the one done by the State forest department in 1975-77.

On the basis of the inventory carried out by us the total growing stock in the district is approximately 2.926×10^6 cu.m. which works out to 60.098 cu.m. per hectare for 4868.39 sq.km. vegetated area of the district. Sal contributes nearly 46% of the total growing stock. Raigarh district has bamboos over 1020.96 sq.km. occurring along with other trees. Total growing stock of the bamboos was found to be 118810 tonnes (3.412×10^7) which works out to 116.37 tonnes per hectare. Though the results of the survey conducted in 1975 and the one conducted after a decade in 1985 are not strictly comparable on account of 1975 survey being confined to 4008 sq.km. of area and 1985 survey over the entire forest area of 6029 sq.km., there appears to be considerable improvement in the growing stock of both the trees and the bamboos in one decade. According to the 1975 survey per hectare volume of trees was only 40.928 cu.m. as against 60.098 cu.m. in 1985. Total growing stock of bamboos was 7.396×10^6 culms as compared to 3.412×10^7 culms in 1985. This is surely a good sign and the credit for such improvement goes to the Madhya Pradesh forest department for ensuring scientific management of these areas once these came under their control.

Contents

This report has been compiled by Sarvashri M.D.Singh S.T.A. and Anil Biala J.T.A under guidance of Shri S.C.Gupte, Joint Director, Forest Survey of India, Central Zone, Nagpur. Their work is appreciated.

I hope that this report would be of use to all who have interest in forest resources of the country in general and of Raigarh district of Madhya Pradesh in particular.

J.B. Lal
Director
Forest Survey of India
25-Subhash Road
Dehradun.

TABLE OF CONTENTS

CHAPTER - VI: INVENTORY RESULTS -GROWING STOCK (TREES)

Contents

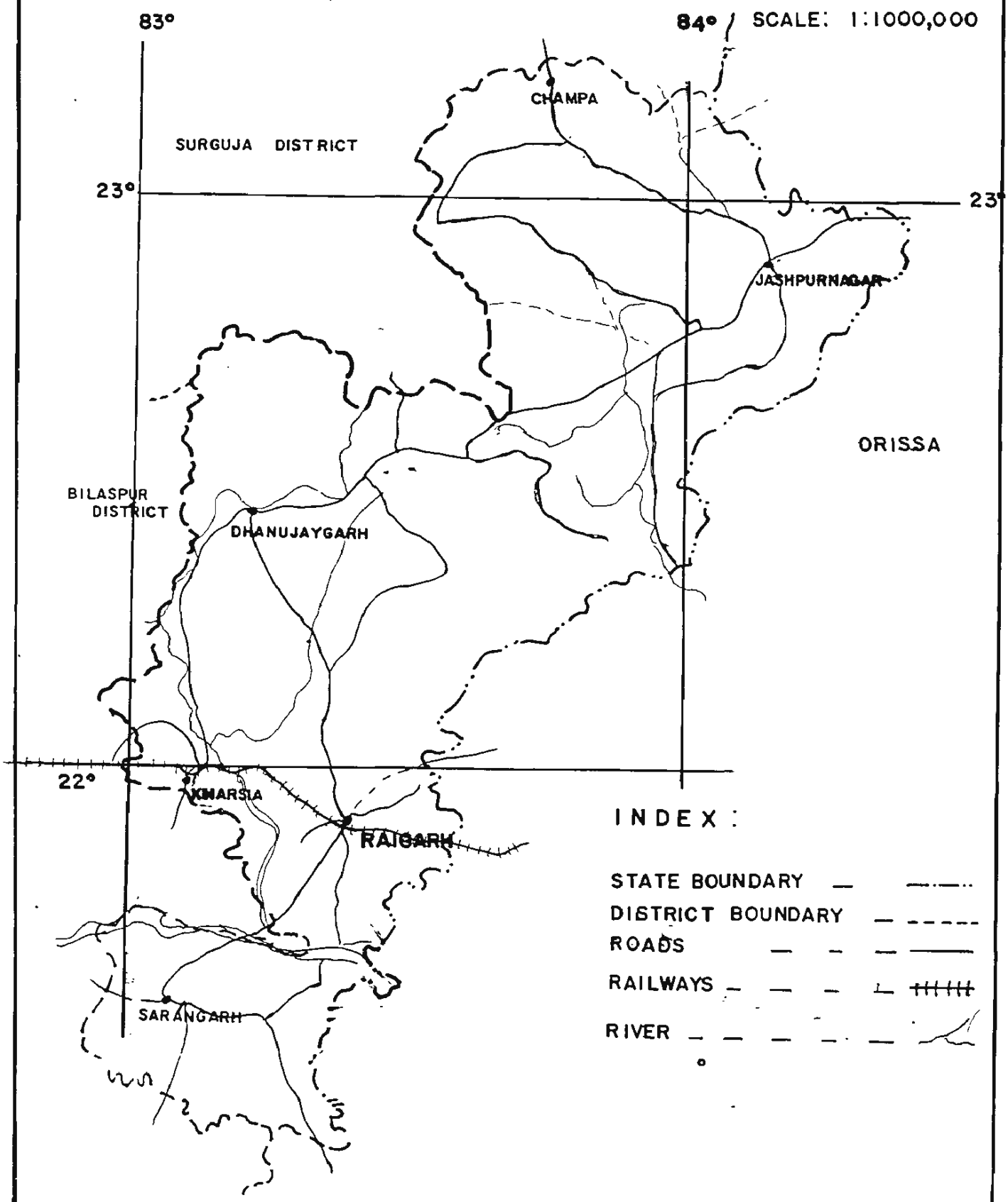
CHAPTER VII

INVENTORY RESULTS: GROWING STOCK -BAMBOO

MAP OF INDIA

Contents

ROAD MAP OF RAIGARH DISTRICT (MADHYA PRADESH)



CHAPTER I

INTRODUCTION

1.0 GENERAL:

Prior to the formation of the district, Raigarh was the capital of an important feudatory state. There are two forest divisions in this district viz. Raigarh and Jashpur divisions which were formed in 1948 by the amalgamation of the forests of the former princely states of Raigarh, Udaipur, Sarangarh and Jashpur.

During the pre-merger period, these forests suffered very much from the maltreatment caused by haphazard and unsystematic fellings. Licence and commutation systems were introduced as temporary measure but these were in existence for a very long period. As a result of this, the forest crop suffered from heavey deterioration.

After merger of these states in the Central Provinces in 1948, the earstwhile princely states of Raigarh, Udaipur, Sarangarh and Jashpur were constituted into a civil district with headquarters at Raigarh. Jashpur was given the status of a Tahsil.

Though working plans exist for forest areas of this district, the information available was not enough to give adequate idea of the forest resources of this dsitrict for which Forest Resources Survey Division, Raigarh was constituted in November 1974 under the centrally sponsored scheme which had started field work in January 1975 and covered an area of 4008 sq.km. This survey work was completed in June 1977.

After a gap of 8 years, survey of forest resources was taken up by the Forest Survey of India, Central Zone, Nagpur in the 2nd week of March 1985 and completed it in the second week of June 1985.

1.1 SITUATION AND BOUNDARIES:

Raigarh district occupies the eastern most part of Madhya Pradesh. It lies between 21° 20' and 23 ° 15' North latitude, 82° 56' and 84° 24' East longitude. It is bounded on the north by Sarguja district, on the west and south-west by Raipur and Bilaspur districts of Madhya Pradesh, on the north-east and east by Ranchi district of Bihar and east and south-east by Sundargarh and Sambalpur districts of Orissa.

1.2 ADMINISTRATIVE UNITS AND AREAS:

This district has been divided into 4 sub-divisions with headquarters at Jashpur, Dharamjaigarh, Raigarh and Sarangarh and further into 5 Tahsils with headquarters at Raigarh, Sarangarh, Gharghoda, Dharamjaigarh and Jashpur. There are 21 Police Stations in this district for maintaining the law and order. For smooth execution of the development works, 5 Block offices also exist in this district.

This district extends over a geographical area of 12983.6 sq.km. There are two forest divisions in this district viz. Raigarh and Jashpur with headquarters at Raigarh and Jashpurnagar respectively.

According to the publication of Forest department, total forest area of this district is 6029.066 sq.km. which ammounts to 46.43% of the total geographical area of the district. Division-wise forest area in sq.km. is given in the following table:

Forest Division	Reserve forest	Protected forest	Total
Raigarh	1661.45	1800.91	3462.36
Jashpur	1102.38	1464.33	2566.71
Total	2763.83	3265.24	6029.07

Out of 3462.36 sq.km. of forest area in Raigarh forest division, 1190.60 sq.km. has been transferred to the Revenue department and is not covered by any working plan. In Jashpur forest division 897.72 sq.km. is still undemarcated.

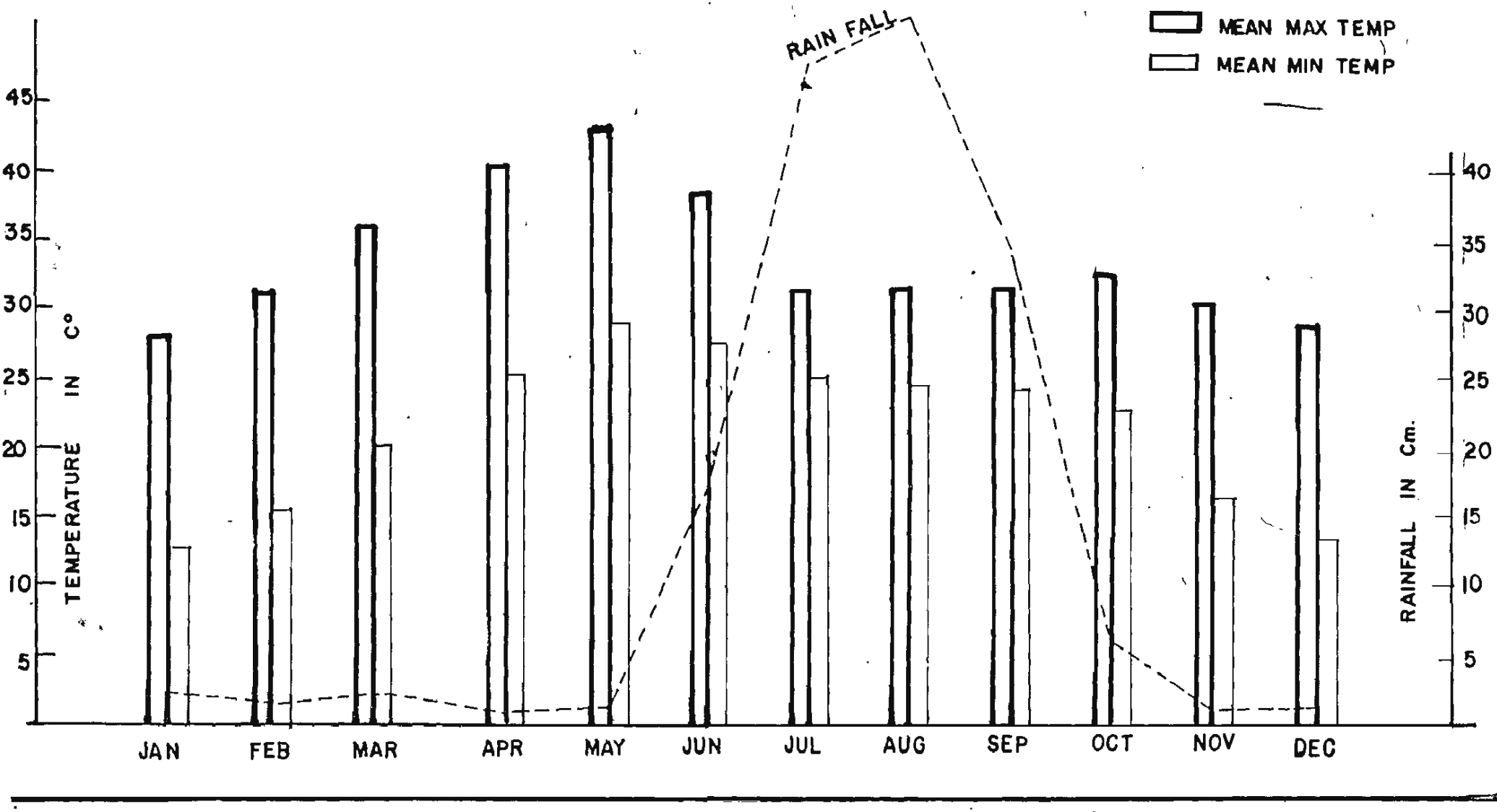
1.3 CLIMATE:

The climate of this district is characterised by a hot dry summer and well distributed rainfall in the monsoon season. The cold season from December to February is followed by the hot season from March to mid June. The period from mid June to Septermber consistutes the south-west monsoon season. The succeeding period lasting till the end of November is the post monsoon. May is the hottest month of the year and January the coldest. Wind velocity is seen to be maximum in June and minimum in December whereas the percentage of ralative humidity is the lowest in May and the maximum in August.

The average rainfall in the district is 1619.7 mm. The rainfall in the district increases from the south-west towards the norht-east and varies from 1445.8 mm. at

Contents

DIAGRAM SHOWING VARIATION IN MEAN MONTHLY TEMPERATURE & RAINFALL IN RAIGARH DISTRICT OF MADHYA PRADESH



Sarangarh to 1726.6 mm. at Jashpurnagar. About 87% of the annual rainfall in the district is received during the monsoon months from June to September - July is the rainiest month. A diagram showing variation in mean monthly temperature and rainfall in Raigarh district is appended as page no.3.

1.4 TOPOGRAPHY:

The Raigarh district has two distinct physiographic regions i.e. plain and hilly tracts. The plain region covers the maximum area of Raigarh division. Raigarh forest division lies in the catchment area of Mahanadi and is drained by a number of small rivers whereas the topography of Jashpur forest division falls in two distinct types i.e an upland region known as Uperghat and a lowland region known as Nichghat. Precipitous and steep hills separate the two regions. The north-western portion of the Uperghat is known as Khudia high land. The highest point is Bijaghat which is 3,743 feet(1140.9 m) above M.S.L. The lowest point is the place where the river Ib leaves Jashpur division and enters Orissa state. This point is 900 feet(274.3 m) above M.S.L.

1.5 DRAINAGE:

The important river system in this district is of the Mahanadi and its tributaries. Large number of small rivers and streams originate in the hills. The Mahanadi flows eastwards through the southern part of the district. The northern portion of the Mahanadi is drained by Borai, the Mand, Kelo and southern by the Lath and the Kekarli nallas. The river Ib rises above the village of Dumerkona and the surrounding hills. It drains the western portion of Uperghat, descending past Sauna in southeast direction. It turns south after meeting the sonkiari nalla. The river passes through a rocky valley where it descends by a series of cataracts through a rock bound forest. The drainage of a small portion of Khudia high land is done by the river Kanhar. The north-eastern part of the Uperghat is drained by river Sankh and its tributaries.

1.6 GEOLOGY:

A general stratigraphical sequence of the rock types found in this district is given below:

Laterite

Deccan Trap - Mainly basaltic

Lameta series - Grits, sandstones, shales.

Lower Gondwanas - Talchir, Barakar, Kamthis consisting of sandstones, shales and coal.

Cuddapahs	- Chandpur quartzites - Raipur limestones
Archeans	- Granite series -Granitic gneisses Pegmatites and quartz veins. - Iron ore series, Phyllites. Mica schists, Hornblende schists, Amphibolites, Epidiorites etc.

A major part of the district is covered by the archean rocks of the granite series comprising of granites, granitic gneisses, granodiorites with veins of pegmatites aplites and quartz. The older schistose rocks of the iron ore series consisting of mica schists, hornblende schists, amphibolites and epidiorites are distributed throughout the area. The lower Gondwana rocks lie diagonally in the central portion of Raigarh forest division.

The Cuddapah formation which consists of two groups, the Chandpur quartzites and Raipur limestones extends south-west from the southern limit of the Gondwanas down to the southern boundary of the district.

A major portion of Jashpur Tahsil is built up of granitic rocks which are an extension of granitic rocks of Ranchi district of Bihar. Lameta series comprises only a very minor proportion of the rocks exposed in the area. They occur in small discontinuous out-crop or scatterd rock fragments around the hills. Overlying the Lametas are the Deccan traps but owing to extensive weathering under tropical conditions, the trap is altered to laterite. Many small and irregular patches of Deccan traps are found in the northern part of Jashpur forest division.

1.7 SOIL:

The soil in this area varies in composition and texture depending upon the nature of the underlying rocks. The quick weathering gneisses have produced fairly deep loams in the valleys and the foot hills; and shallow loamy sands on the slopes. The Gondwana and Cuddapah sandstones, which are resistant to weathering have produced light sandy soils in the valleys and very thin soil covering on the slopes of the hills. As these soils are not only poor in their water retaining capacity but also in organic contents, vegetation on them is of poor quality and of open density. The forest soils of Jashpur division broadly divide themselves into lateritic soils of the Uperghat and sandy soils of Nichghat. The laterites are derived from atmospheric weathering of several types of rocks under tropical conditions. They are clayey or clayey laom and somewhat acidic in character. When mixed with granite soil, they are admirably suited to the growth of sal where depth is good.

Contents

The soils derived from the schists are somewhat clayey and are suited for cultivation. The gneissic soils are generally reddish sandy loams of varying pH value. In acidic area they support good quality sal whereas in the basic tract they generally carry poor quality mixed forests. The granites give rise to the best forest soils. The crop is generally sal-cum-mixed forest. The soil is generally a dark brown sandy loam. In valleys, where there is accummulation of granite soil, the crop is generally of excellent quality. Underlying rocks appear to have minor role in distribution of various forest types which are more influenced by soil depth variation and moisture holding capacity.

1.8 MINERAL WEALTH:

This district is fairly rich in mineral wealth. It has large reserves of coal, fireclays and various kinds of building materials composed of sandstones, limestones and quartzites. These are being commercially exploited. Other important minerals and ores like felspar, mica, red and yellow ochre occur in this district. Alluvial gold and lead ore are also available in small quantities.

1.9 LANDUSE PATTERN:

The extent of land (ha) put to various uses in the district as indicated in the District Statistical Book, 1981 is given below:

i)	Total geographical area	-	1291000
ii)	Forested area	-	403396
iii)	Non-cultivable land	-	195882
iv)	Pasture land	-	99626
v)	Orchard	-	50
vi)	Waste land	-	110224
vii)	Cultivable waste land	-	96454
viii)	Net cultivable area	-	551855

1.10 SOCIO-ECONOMIC CONDITIONS:

Salient features of socio-economic conditions of the people in this district are:-

i) Considerable forest area is affected by illicit fellings, heavy grazing and shifting cultivation.

Contents

ii) Nearly 50% of the population is of scheduled tribes and literacy rate amongst them is quite low.

iii) Lack of adequate employment facilities and high dependence of tribal population on agricultrue which is underdeveloped. Tribals have migrated to tea gardens and areas like Andaman and Nicobar islands in large numbers.

iv) Lack of adequate transport and communication facilities.

This district presents a picture of economic poverty. It is one of the most educationally backward district of Madhya Pradesh. Education facilities are being extended to remote areas but still percentage of literacy is quite low. People are mainly engaged in agriculture. They also collect minor forest produce like sal seeds, mahua flowers etc. from the forests.

The district is industrially backward also. Inadequate transport facilities and illiteracy seem to be the main reasons for this. A jute mill is the only large scale industry worth mentioning. The district is a leading producer of rice. There are 48 small scale industries out of which 20 are rice mills and 22 bidi factories and 6 others. Kosa cloth weaving is an important cottage industry in this district.

The following table gives some idea of the various socio-economic features of the district:-

1	Total population as per 1981 census	-	14,43,197
2.	Total population of males	-	7,19,613
3.	Total population of females	-	7,23,584
4	Urban population	-	1,21,133
5.	Rural population	-	13,22,064
6	Percentage of scheduled caste to total population	-	13.01
7.	Percentage of scheduled tribe to total population		48.51
8.	Population density(per Km^2)	-	112
9.	Percentage of male literacy	-	38.35
10.	Percentage of female literacy	-	14.08
11.	Percentage of overall literacy	-	26.18

(Source: District Statistical Book of Raigarh distt., M.P.)

Contents

1.11 INFRASTRUCTURE:

Transport and communciations are very important for a developing ecomonmy. Since this district is hilly and there are large number of small rivers and streams, it does not have good communication facilties. However, all the important towns in the district are connected by pucca roads. Howrah-Bombay railway line passes through the southern part of the district which connects it to other parts of the country. Total length of this railway line in this district is 65 km. Important towns on the railway route are Raigarh, Kharsia and Kirorimal Nagar. Other important towns like Pathalgaon, Kunkuri are connected to Jashpur-nagar and also to Bihar by road passing through Jashpur-nagar. Internal communications are, however, very poor because of the terrain and backwardness of the area. Raigarh is also connected with National Highway no. 6 by a State Highway which joins the National Highway at Saraipali, a distance of 90 km. There are about 1330 km. of pucca roads and about 650 km. of kaccha roads in the district. In addition, there are large number of forest roads which also help the communications with the interior village and transportation of forest produce.

1.12 FOREST PRODUCE AND FOREST BASED INDUSTRIES:

Sal is the principal timber species which fetches most of the revenue. Bamboos, mahua flowers, mahua seeds and tendu leaves constitute the important minor forest produce.

There is no forest based industry in the district except some saw mills and bidi manufacturing units. Most of the forest produce, major as well as minor, is exported. Jashpur forest division is not served by any railway line. Its produce is transported to the nearst railway station by road.

****

Contents

CHAPTER -II

THE FOREST

2.Ø GENERAL DESCRIPTION:

Climatically the forest of Raigarh district lies within the zone of "Northern Tropical Moist Deciduous Forests'. However, the moist localities are few and far between and dry conditions prevail over larger part of the area after the rainy season. The uneven distribution of rainfall, the topography of the ground and nature of the soil are responsible for creating dry conditions in a region of over 62" rainfall. Large part of the forest area is hilly. Therefore, water is quickly drained off. Even in the level areas, the soil being sandy is not much retentive of mositure. The effect of these factors is that a dry type of forest is met within which sal is the principal species over a large part of the area.

2.1 FOREST TYPES:

Important forest types found in this district are as follows:

1.	3C C2 e	Moist peninsular high level sal
2.	3C C2 DSI	Moist sal savannah
3.	5B C1C	Dry peninsular sal
4.	5A C3	Southern dry mixed deciduous forest

2.1.1 SAL FORESTS:

The quality of sal forest is fairly uniform in Uperghat areas where best sal forests are found. The general quality is III(6Ø'to 8Ø'). In favourable localities the quality of sal forests improves to II(8Ø'to 1ØØ') and I over(1ØØ'). In unfavourable localities and areas over 35ØØ feet above M.S.L., the sal trees are stunted and crooked corresponding to quality IV (4Ø' to 6Ø'). Sal occurs over almost 6Ø to 7Ø% of the total area of forest and is found in all the ranges except Sarangarh.

The chief associates in the top canopy are Saja (Terminalia crenulata), Salai (Boswellia serrata), Khair(Acacia catechu), Bandhan((Ougeinia oojeinensis) Harra (Terminalia chebula), Tun (Cedrela toona), Bija (Pterocarpus marsupium), Dhaura (Anogeissus latifolia), Lendia(Lagerstroemia parviflora), Mahua(Madhuca latifolia), Kusum(Schleichera oleosa), Siwan(Gmelina arborea), and Jamrasi(Elaeodendron glaucum) etc. In the lowr canopy Tendu(Diospyros melanoxylon), Achar(Buchanania lanzan), Aonla(Emblica officinals), Kakari(Flacourita romanchi) Garari(Cleistanthus collinus), and Rohan(Soymida febrifuga)etc. are found.

Contents

In the Nichghat areas general quality of sal varies between III and IV. The forests mostly belong to Dry peninsular sal type. The best growth of sal is found in deep well-drained gently sloping areas. Sal avoids areas where the soil is shallow or unretentive of moisture . Almost all the sal forest in plains of former Raigarh state and nearly 2/5th in the Udaipur state have been clear felled in the past. The existing crop in many of the areas is, therefore, young.

2.1.2 MIXED FORESTS:

In Raigarh forest division mixed forests are widely distributed in the southern part of Raigarh and Kharsia ranges and over whole of Sarangarh range. In Jashpur forest division, these are found over large areas in Kungara, Tapkara and Narayanpur ranges. These are mostly found on shallow and dry soils. In this type we get Boswellia serrata, Terminalia tomentosa, Madhuca indica, Anogeissus latifolia, Terminalia chebula, Gmelina arborea, Adina cordifolia, Lannea coromandelica, Garuga pinnata, Mitragyna parvifolia, Schliechera oleosa, Grewia tiliaefolia, Lagerstroemia parviflora, Chloroxylon swietenia etc. in top canopy. In moist localities Mangifera indica, Syzigium cumini, Terminalia arjuna etc. are also found. Scattered sal is found throughout the area.

A small patch of teak occurs in Rathan block of Sarangarh range which is probably an artificial plantation as there is no other teak area in the vicinity. The existing crop consists of scattered mature trees of IIIrd quality which have been freely regenerating themselves. Young poles and saplings and well grown healthy advance growth are now found spread over a small area.

Dendrocalamus strictus occurs in Mixed deciduous forests over large areas. Its presence in sal forest is comparatively much less. Pure crop of bamboo is, however, rarely seen.

2.1.3 GRASS LANDS:

Flat summits of Khudia highlands are covered by grasses with solitary trees and groups of sal saplings. Large herds of cattle graze over these grasslands and these are also subjected to annual fires which prevent the tree seedlings from getting established. Thus, these grasslands are a biotic sub-climax. Grasses mostly belong to the species Eragrostis, Sporobolus, Andropogon, Chrysopogon etc. which indicate overgrazed condition.

2.2 DAMAGE TO FOREST:

The damage to forest is caused mainly by human interference. Man himself is the primary source of injury to the forest either directly or indirectly through his cattle.

Contents

a) Shifting cultivation

Shifting cultivation was being practised in the hilly areas, without let or hinderance since time immemorial. Though it was prohibited by the ruling chiefs of the then states even then this practice could not be completely stopped. It continues sproadically even now.

b) Illicit felling

Illicit felling of timber is common throughout the district. In Jashpur division this is mainly done for meeting the nistar requirements where as in Raigarh division illicit felling is very common in the neighbourhood of thickly populated villages, particularly in Sarangarh, Kharsia, Raigarh and Pathalgaon ranges. Persons from these villages earn their livelihood by selling firewood, bamboos and small timber and carry out their nefarious activities in gangs.

c) Encroachment

Encroachment of forest land for the purpose of cultivation is a very serious problem. Due to meagre forest staff, this goes on unchecked. There are instances of whole villages having settled in the reserved forests.

d) Grazing

Grazing is an important factor found responsible for extensive damage to the forest growth. All the isolated blocks as well as compact blocks of this district are heavily grazed. The degraded condition of some of the forest is due to such heavy grazing.

e) Fire

Fires have caused considerable damage to the forest areas in these districts either annually or sometimes twice in the same year. Tribals resort to such practice for collecting mahuwa flowers and seeds, achar and other minor forest produce.

2.3 RIGHTS AND CONCESSIONS:

No right exists in the reserved forest but some concessions have been enjoyed by the people of this district from olden days. These concessions include collection of reasonable quantity of eidble roots, fruits leaves,creepers and thatch grass. Free grazing for the cattle is also allowed within the reserved forest boundaries upto a mile from the boundary. On payment of annual commutation and nistar fees, timber of unreserved species is allowed to be collected for buildings, agricultural implements and fuel. Other minor forest produce are also allowed to be collected. Except for

Contents

young bamboos, dry and green bamboos are removed by the people on payment of nominal fees. These concessions have caused considerable damage to the forests, as much more than what is permitted is removed by the people.

2.4 FOREST MANAGEMENT:

For management of forests in Raigarh district, two forest divisions namely Raigarh and Jashpur forest divisions were created. Raigarh forest division covers Raigarh, Gharghoda, Dharamjaigarh and Sarangarh tahsils of the district whereas Jashpur forest division is confined to Jashpur tahsil only which was formarly Jashpur state.

Forest crop of this district is very heterogenous. Some forests are on level ground whereas others are on steep slopes. Quality of the growing stock also varies from quality IV to II and density from virtually blank areas to dense forests. In some areas local demands are too excessive to meet.

Taking into consideration the above factors, following management practices are prescribed.

Forests situated on steep hills are considered as protection forests (more than 1/3rd of the total area) and are managed under Protection working circle and areas which are understocked, on precipitous slopes and those which are liable to erosion are given complete protection without any felling. In other areas only improvement fellings are prescribed.

Better quality sal forests which lie more or less in plain areas are managed under Sal conversion working circle with a coversion period of 140 years and each periodic block of 20 years. Natural regeneration and advance growth are taken advantage of in this working circle.

Remote and isolated sal areas are worked under Selection-cum-improvement working cirlce where only light fellings are prescribed in addition to removal of dead, dying and unsound trees.

Plantation working circle is created to plant up areas where existing growth is not adequate to restore vegetal cover to areas. Such areas are clear felled and planted with suitable species like teak, babul, shisham, jamun, siris etc.

Miscellaneous forests prone to erosion and poor quality mixed forests containing sal are worked under Coppice with-reserve working circle which allows reservation of large number of trees for frost protection or for restocking of open areas.

Contents

Areas not allotted to any working circle are put together in Miscellaneous working circle which includes forest villages and areas set apart for plantations etc. No work is prescribed in such areas except protection from fire and other damages.

Bamboos are worked under Bamboo working circle (overlapping). Dendrocalamus strictus grows well in mixed forests than in sal forests. Felling cycle of 4 years is prescribed for bamboos.

2.5 WILDLIFE:

Thick monsoon forests, multitude of streams and varied topography of the district provide an ideal abode for wildlife. 100 years ago there were elephants in this region but there has been very heavy destruction of wildlife in this district due to indiscriminate shooting, extension of cultivation and destruction of forests. Hunting instict of tribal population is one of the main reasons for the absence of wildlife in many areas.

Tigers(Panthera tigris) are generally found in sheltered valleys in the larger forest blocks. However, their absence is noticed in Kharsia, Pathalgaon, Tapkara and Kunjra forest ranges. Panthers are found on the fringes of forests. Bisons are seen sometimes in Marpahar block of Gharghoda range and Bijamal block of Sarangarh range. Sambhars(Cervus unicolor) are found in large number on the dry ridges in Sarangarh range, Toge and Marpahar blocks of Raigarh range.

Sloth bear (Malurus ursinus) and wild boars are found in large numbers in hilly tracts throughout the district.

Nilgai(Boselaphus tragocamslus) is found in Marpahar block of Gharghoda range and on a small plateau on Mandua pahad in Minora circle of Nagar range. Barking deer or Bherki (Cervus muntjack), Four-horned deer (Tetracerus quadricornis) and Spotted deer or Chital (Axis axis) are common in the forest on the plains and are plentiful in Taraimal block of Gharghoda range, Bijapathar, Sherband, Dahidand blocks of Udaipur range, Benhar Lamhikhar and Dhumapahari blocks of Chhal range.

There are two wildlife sanctuaries namely Badalkhol sanctuary with an area of 104.454 sq.km.near Bagicha in Jashpur forest division and Gomardah wild-life sanctuary with an area of 277.82 sq.km. near Sarargarh in Raigarh forest division. Wild life is now being preserved under the Wildlife Protection Act, 1972 and is fairly well protected.

****

Contents

CHAPTER - III

RESOURCES SURVEY METHODOLOGY.

3.0 OBJECTIVES OF THE SURVEY:

The objectives of this resources survey were :-

1. To collect information on distribution of forest with regard to various parameters such as topography, latitude, aspect, slope, soil-depth etc.

2. To collect various information on crop data including origin of crop (whether the crop is of seedd origin, coppice origin or a plantation), its composiition, height, size, quantum of regeneration,, injury to crop, fire incidence, grazing incidence, presence of weeds and grasses etc.

3. To collect information under bamboo occurrence such as species found, their density, quality, quantity and regeneration etc.

4. To estimate the areas falling under various land uses.

5. To estimate the growing stock of trees and bamboos existing in various land uses.

6. To determine the plantation potential of the land which is poorly stocked or unstocked.

7. To focus attention of the planners and forest officials on the critical aspects and condition of the forests for timely remedial measures and for future planning.

3.1 AREA CONSIDERED FOR SURVEY:

For the purpose of this inventory, the forest area falling in Raigarh district of Madhya Pradesh was considered. In order to decide forest areas, the recent Survey of India toposheets, preferably of 1:50,000 scale and in case of their non-availability, 1" = 1 mile toposheets were used. All those areas which are demarcated by double dotted forest boundaries on these toposheets and are having green wash within or outside such boundaries, were taken as forest areas for undertaking this inventory.

3.2 INVENTORY DESIGN:

A common inventory design for the whole organisation was evolved in consultation with the Central Statistical Organisation (Govt. of India) for undertaking

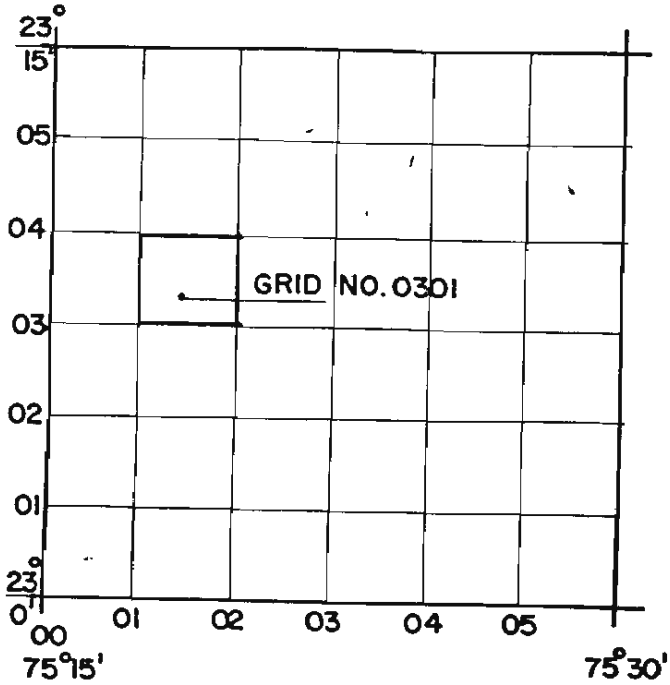
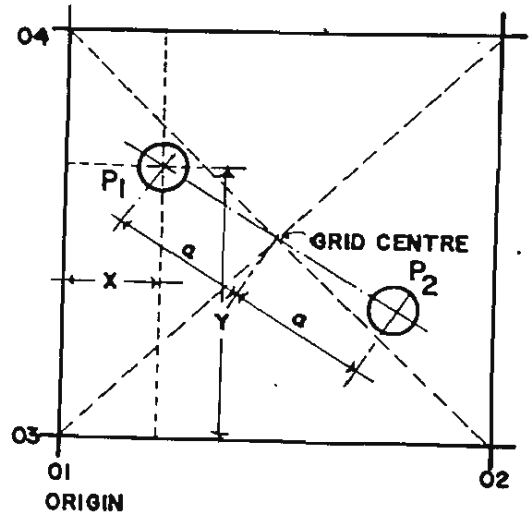


DIAGRAM-1
DIAGRAM SHOWING IDENTIFICATION OF GRIDS ON 1:50,000 OR 1:63,360 SCALE TOPOSHEETS

DIAGRAM-2
DIAGRAM SHOWING LAY-OUT OF PLOT IN 2 1/2'X 2 1/2' GRID

'X' & 'Y' ARE THE DISTANCES ALONG 'X' & 'Y' AXES WITH SW CORNER AS THE ORIGIN



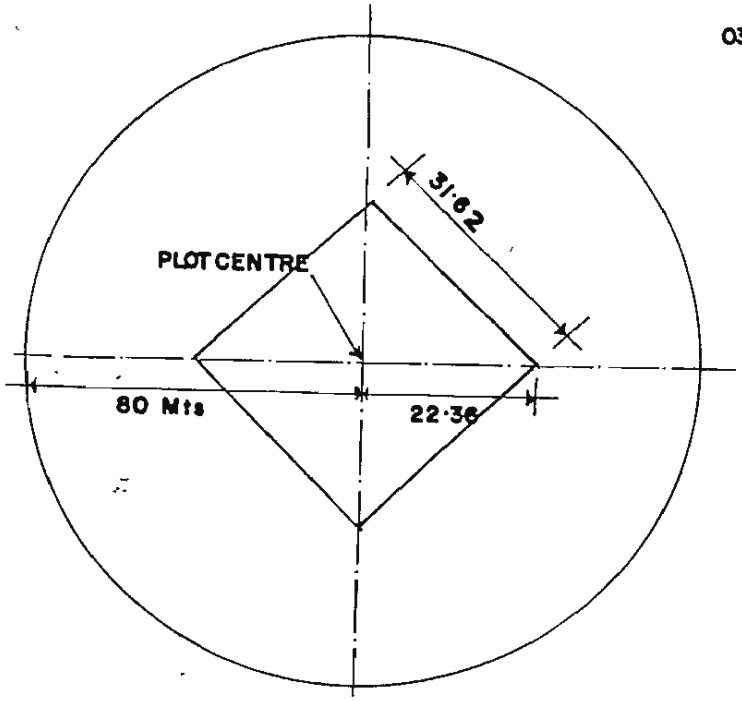


DIAGRAM-3
DIAGRAM SHOWING LAY-OUT OF PLOT

Contents

inventory work in various parts of the country. The design envisaged the survey of two randomly selected plots each of Ø.1 ha area in each grid of 2 1/2'x 2 1/2' (latitudes and longitudes) on the toposheet of 1:5Ø,ØØØ or 1:63,36Ø scale. A grid bounded by 2 1/2'x2 1/2' latitudes and longitudes covers about 2Ø Sq.km. area in which Ø.2 ha area is actually sampled. Thus the sampling intensity of the survey comes to Ø.Ø1%. The method of marking the plot centre on the map within grid is as follows :-

Two sides (X - axis and Y - axis) of a grid were measured in millimeters. The length of these sides was divided by Ø.6324 mm (side of Ø.1 ha. square plot) in case the map was on 1:5Ø,ØØØ scale, or by Ø.499Ø mm in case the map was on 1:63,36Ø scale. The quotient so obtained was rounded up. Let the numbers (quotient) for X axis be x and that of Y axis be y. Actually the number x gives the no. of plots that may fall along X axis and number y gives the no. of plots that may fall along Y axis. The product x X y gives the total number of sample plots that may exist in a grid of 2 1/2'x 2 1/2'. Out of these plots (x X y), one plot has to be selected on the basis of random number and the second one with the help of the first plot which will be explained in next para. For the selection of 1st plot, one set of three random numbers were selected from random number table. If the random number selected for X axis was less than x (quotient for X axis), then it was retained and if the random number was more than x, then it was divided by x and the remainder was retained. Similar exercise had to be done for Y axis also by taking next 3-digit set of random numbers. The figure (remainder) so obtained was multiplied by the side of the plot i.e. Ø.6324 mm in case of 1:5Ø,ØØØ scale map and by Ø.499Ø mm in case of 1:63,36Ø scale map so as to get the actual coordinates of the 1st plot. The plot no. 1 of all the grids was marked on the map taking south west corner of respective grids as origin. The distance along X axis was measured towards east and along Y axis towards north. Thus the centre of plot 1 was marked on the map at the crossing of the two coordinates.

For marking the centre of second plot of each grid, the plot centre of 1st plot and centre of 2 1/2'x2 1/2' grid were joined and the line extended to the same distance in opposite direction beyond grid centre. The point so reached was the plot centre of the second plot. The location of second plot is thus linked with the first plot. The layout of 2 1/2'x 2 1/2' grid and the plots are shown in diagrams 1, 2, and 3 on the preceeding page. All such plots were marked on the toposheets. The plots so marked are to be visitedd only when they fall in forest areas i.e. the area coveredd by green wash or by double dotted forest boundaries on 1:5Ø,ØØØ scale or 1:63,36Ø scale mapsheets.

Contents

3.3 LOCATION OF PLOT ON THE GROUND:

As stated earlier, the survey is confined to the forest areas only as decided on the basis of forest boundaries and green wash shown on the toposheets. The plot has to be visited when it falls in some forest area. All the forested plots of the survey area i.e Raigarh district of Madhya Pradesh, duly marked on toposheets, were allotted to various crews. The crews had drawn up their programme of halts at some convenient places in order to tackle maximum plots from those camps. The plots marked on the toposheet had to be exactly located on the ground with the help of some conspicuous features which could be identified on the map as well as on the ground. Usually the following features were selected for this purpose:

1. Bench Mark.
2. Triangulation point.
3. Village or road trijunction.
4. Old bridges and culverts.
5. Old temples, mosques and churches.
6. Crossing of rail tracks with roads, streams, rivers etc.
7. Confluence of rivers or streams and junction of roads.
8. Prominent bends in roads, rivers or streams.
9. Old ponds and wells.
10. Springs.
11. Prominent topographical features in hilly region such as spurs, knolls etc.
12. Mile stones or kilometer stones on the road side.
13. Pillars of international, inter state or inter-district boundaries and those forest areas etc.
14. Prominent bends of boundary etc.

After locating any of the above reference points on the ground as well as on the map, the bearing and distance from reference point to the plot centre were marked. This distance has to be traversed at the bearing calculted for the plot using Silva Compass and distance measuring nylon rope/tape etc. While using compass the magnetic declination as indicated on the concerned toposheet was also taken into account. Similarly, for distance measurement the slope correction was applied to cover the actual horizontal distance of the plot measured from the map.

On reaching the plot centre, a square plot was laid out by taking distance of 22.36 m. in all four directions (north, south, east and west) from the plot centre. Thus an exact plot of 0.1 ha. area (having each side of 31.62 m. and diagonal of 44.72 m.) was laid out horizontally after making corrections for the slopes measured with the help of Blumleiss hypsometer along 4 semidiagonals (north, south, east, west).

Contents

3.4 FORMAT FOR DATA COLLECTION:

After laying out the plots in the field, various data were collected in the following field forms in codified manner (except in Plot Approach Form wherein information was collected in descriptive manner) as described in the field manual issued to the crews for the purpose of data collection. This facilitated the transfer of data on punch cards, consistency checking of collected data and finally in procesing the data on electronic computer at a later stage. The various field forms used in this survey are:-

1. Plot Approach form.
2. Plot Description form,
3. Plot Enumeration form.
4. Sample Tree form.
5. Bamboo Enumeration-Cum-Clump Analysis form.
6. Bamboo Weight form.

1. Plot Approach form.

As the title indicates, the form is a record of approach to the plot centre from the field camp of a crew. It is filled in by the Crew Leader as he proceeds from his camp to some conspicuous feature called reference point existing near by the plot. The distance and bearing from this well defined reference point to the plot centre were also recorded on it. The exact location of plot centre i.e. bearing and distance from two trees to the plot centre is also mentioned together with the time of departure from camp, time taken in various studies and time of arrival in the camp. This form helps the check crew or any other person to relocate the plot easily when required. The data on this form is recorded in descriptive manner with a neatly drawn sketch showing the location of reference point and the plot centre.

2. Plot Description form.

This form is designed for recording qualitative description of 2 ha area around the plot centre. The information regarding administrative units, legal status, land use, topography, soil, vegetation, bamboo regeneration, biotic influence, accessibility and plantation potential etc. were recorded. The data was recorded in codified manner and was transferred to punch cards for further computer analysis. The stratification of area and classification of growing stock was done on the basis of these descriptions only.

3. Plot Enumeration form.

In this form, all the trees with dia 10 cm. and above and all the bamboo clumps occuring in all 0.1 ha sample

Contents

plots were recorded by species. This was meant for computing total growing stock existing in all such sample plots and finally in whole of the survey area which was estimated on the basis of these plots. This form helps in distributing the growing stock in terms of stems and volume by various parameters like species, diameter class, forest types etc.

4. Sample Tree form.

Detailed information regarding the species, diameter at breast height (over bark), height of tree, clear bole, bark thickness, dominance and defects etc. of all the trees occurring in north west quadrant of all the plots, were recorded in this form. On the basis of these parameters (i.e. height, diameter and clear bole), we get volume of the plots which further enables us to estimate the total growing stock of the area falling under various strata.

5. Bamboo Enumeration-Cum-Clump Analysis form.

In this form, the data of individual culms occurring in the selected clumps bearing S.No. 1,9,17,25,33 ..... etc. (i.e. the first and every eighth clump appearing in Plot enumeration form was recorded. Thus, the information about age, soundness, size and condition etc. of the culms of the above clumps was obtained and analysed in various columns of this form. This information gave the position of total bamboo stock by clump sizes occurring under various conditions.

6. Bamboo Weight form.

This form was designed for collecting data to determine the green weight of bamboos of different species and sizes and further for establishing relationship between green weight and dry weight of bamboo culms. The data was recorded in respect of two selected culms from each dia.class i.e. 2 to 5 cm, 5 to 8 cm and 8 cm and above and the green weight of three 50 cm long sub-samples, each taken from the bottom, the middle and the top portions of the culms were recorded. Further, these three samples were dried in air and finally in the oven in order to remove their entire moisture contents and to get their air dry weight. This facilitated to establish relation between the green weight and the dry weight of culms by species and sizes to know the total growing stock of bamboos in terms of weight.

3.5 FIELD WORK:

The field work of Raigarh district of Madhya Pradesh was completed during the period from March 1985 to June 1985 keeping the Base camp at Pathalgaon. The entire field work of this district was completed from this Base camp only. There were eight crews deployed on this this work, each consisting of one Jr. Technical Assistant as

Contents

Crew Leader, one Dy.Ranger and two Fieldmen. One vehicle was provided between two parties to undertake the field work.

3.6 FIELD CHECKING:

During the course of field work, the checking of the surveyed plots was done by the Dy.Director Incharge of the survey and by the Sr. Technical Assistant. About 10% of the total number of plots tackled by various crews were checked and mistakes found (if any) during the checking were rectified in the field forms.

3.7 MAPS AND PLOTS:

The Survey of India toposheets, which were used during the inventory work and the number of plots falling in each of them have been mentioned below for the entire survey area of Raigarh district, indicating the scale of map and year of survey of the sheet.

S.No.	Toposheet No.	Scale of map.	Year of survey of toposheet.	No. of plots inventoried by F.S.I.
1.	64 K/14	1:50,000	1977-78	3
2.	64 K/15	"	"	1
3.	64 M/12	"	1969-70	37
4.	64 M/16	"	1969-70	35
5.	64 N/1	"	1967-68	2
6.	64 N/2	"	1967-69	30
7.	64 N/3	"	1967-68	32
8.	64 N/4	"	"	34
9.	64 N/5	"	"	2
10.	64 N/6	"	1968-69	24
11.	64 N/7	"	"	47
12.	64 N/8	"	"	26
13.	64 N/9	"	1967-68	14
14.	64 N/10		"	6
15.	64 N/11	"	1968-69	25
16.	64 N/12	"	1967-68	16
17.	64 N/13	"	"	32
18.	64 N/14	"	1967-69	23
19.	64 N/15	"	1967-68	17
20.	64 N/16	1:50,000	1967-68	1
21.	64 O/1	"	1978-80	2
22.	64 O/2	"	1978-79	17
23.	64 O/3	"	"	20
24.	64 O/5	"	1979-80	16
25.	64 O/7	"	"	9
26.	64 O/9	"	"	9
27.	73 A/4	"	"	10
28.	73 B/1		1977-79	44
29.	73 B/2	"	1978-79	14

Contents

30.	73 B/3	"	1967-68	2	
31.	73 B/5	"	1978-79	11	
			Total ..	561	Plots

3.8 CONSISTENCY CHECKING AND FORWARDING OF FIELD FORMS TO DATA PROCESSING UNIT:

After completion of field work, the field forms pertaining to inventory of 561 plots of Raigarh district of Madhya Pradhesh were manually checked in the zonal office as per field manual and coding instructions meant for the purpose. Inconsistency noticed in these forms was removed after discussing the specific point with the concerned Crew Leader. All these field forms were finally forwarded to the Data Processing Unit of the Headquarter office at Dehradun on 6th August, 1985 for computer analysis and processing the data for deriving various kinds of informations to meet the objectives of the survey.

****

Contents

CHAPTER - IV

DATA PROCESSING.

4.0 SAMPLING DESIGN:

Grids were marked at 2 1/2'x2 1/2' interval in the green wash area of the Survey of India toposheets pertaing to Raigarh district of Madhya Pradesh. Two plots were laid in each grid. The first plot was laid out at random and the second was linked to the first in the opposite quadrant at an equal distance from the grid centre. The plots were square in shape, each having an area of 0.1 ha.

4.1 DATA:

The basic data of the inventory survey was collected in the Plot description form. Plot enumeration form, Bamboo enumeration form, Sample tree form and Bamboo weight form. Data on felled trees was not collected.

The field forms were precoded so that the field data could be easily transferred on to the punch cards. There were 2155 field forms which required punching of the following number of cards under each card design.

	Card design	No. of cards.
1.	Plot description	561
2.	Plot enumeration	1409
3.	Sample tree	2654
4.	Bamboo enumeration	82
5.	Bamboo weight data	42
	Total	4748

4.2 DATA PROCESSING:

The data processing involved the following operations:-

i) Manual processing.

The field forms received in the Machine Data Management Unit of Forest Survey of India, Dehradun were checked with the list supplied by the central zone. Entries of the field forms were made in the register, regarding the number of field forms relating to each map-sheet, grid and plot. The total number of cards required to be punched under each card design were also estimated and recorded in

the register for future references, job numbers, card design and left hand zeros, wherever missing were filled up in the field forms to avoid mistake during punching.

Each entry in the field forms was checked for consistency. The main checks applied were the range check for the maximum and minimum value of the codes and logical check for inter-relation between the entries for two and or more fields.

Listing taken out of the data loaded on the magnetic tape/disk were checked to ensure complete loading and proper sequence of data.

Sample statistics were calculated and checked with the computer output to see if the calculations on computer were correct. These involved volume of enumerated tree from local volume equation, plot volume and standard error etc.

Intermediate and final computer output were checked for consistency and relevance of results. Area tables were prepared manually.

ii) Processing on unit record machine.

The data of field forms were punched on cards with the help of punching machine. The punched data cards were verified using card verifier to detect punching mistakes. The verified cards were sorted out for proper input to the computer.

iii) Processing on electronic computer.

The punched, verified and sorted data on cards were loaded on magnetic tapes/disks and listings of the loaded data were taken out to check if the data have been laoded completely in the desired sequence.

Volume of each enumerated tree was estimated with the help of local volume equation used for the species.

Contribution of the volume of each enumerated tree towards per hectare volume was derived and stored in a tree/plot volume file for further processing.

Growing stock tables by species and diameter class under each crop composition were prepared from tree/plot volume file. Standard error of the estimated growing stock in each crop composition (forest type) was calculated.

The data of this survey was processed on System - 332 of National Forest Computer Centre of Forest Research Institute and Colleges, Dehradun.

Contents

The computer has the following configurations.

1.	Memory	256 K bytes
2.	Card reader	1
3.	Tape drives	2
4.	Disk drives	2
5.	Line printer	1
6.	Terminals	4

4.3 AREA:

Area figure relating to the forest area were not available from interpreted aerial photographs. Figures for forest area were supplied by the zonal office from "Sankshepika -1984 " : a publication issued by the Forest Department of Madhya Pradesh. From the total number of sample plots falling in this area, weightage of each sample plot was calculated. This factor was used to derive area by different land use classes. The total area was classified by land use pattern and is given in Table no. 5.1. T.

The area falling in land use dense tree forest, moderately dense forest, open forest, young plantations of forestry species and young crop of natural and aritificial regeneration was considered as tree vegetated cover and was classified by crop composition (forest types) on the basis of the number of sample plots in each separate estimate for two crop compositions viz. Sal and Miscellaneous only. As the number of plots in Teak and Salai crop composition are 3 and 9 respectively, which are less in number so the same were merged with Miscellaneous forest and is given in Table 5.2 T.

The area under each crop composition (forest type) was classfied by topography(Table 5.3T), slop classes (Table 5.4T),soil-depth (Table 5.5T),top height (Table 5.6T), size classes (Table 5.7 T), canopy layers (Table 5.8T), govt. forest land utilisation pattern (Table 5.9T) and estimated plantable area in govt. forest land (Table 5.10T). However, it may be noted that in many cases the above area tables are based on a few sample plots, therefore, these tables should be considered as indicative only and used with due caution.

4.4 SAMPLE TREE VOLUME:

Felled tree data was not collected so sample tree volumes were obtained by submitting height and diameter of sample tree data in the general volume equations of the species taken from Balaghat and Mandla districts of Madhya Pradesh and a sample tree volume file was created.

Contents

4.5 LOCAL VOLUME EQUATIONS:

The estimated sample tree volume and its transformed form is considered as dependent variable and the diameter or its transformed form as independent variable for the regressions.

The following types of regression functions were tries for each species:

1. $V = a + b D^2$
2. $V = a + bD + c D^2$
3. $V = a + bD + c D^2 + d D^3$
4. $V = a + bvD + C D^2$
5. $V = a + b D$
6. $V = a + b D + c D$
7. $V/D^2 = a + b/D^2$
8. $V/D^2 = a + b/D + c/D^2$
9. $V/D^2 = a + b/D^2 + c/D + d.D$
10. $\text{Log } V = a + b \text{ Log } D$

One of the equations from these is selected for each species on the basis of -

a) Standard error of the estimate
b) Co-efficient of determination
c) Apllicability of the equation to the entire range of the data.

The following local volume equations were selected on the above criteria for different species as under:

1. Adina cordifolia(19) R^2

   $V = 0.00845 + 1.97513, D$ 0.88180

2. Anogeissus latifolia (115)

   $V = 0.31277 + 5.08978 D - 1.85236 \sqrt{D}$ 0.95623

3. Boswellia serrata(63)

   $V = -0.18564 + 3.38452 D$ 0.97938

R^2

4. Diospyros melanoxylon (102) 0.49955

$V/D^2 = 10.42632 - 1.35447/D + 0.08654/D^2$

or $V = 0.08654 - 1.35447\ D + 10.42632\ D^2$

5. Lagerstroemia parviflora(31)

$V = 0.06209 - 1.30416\ D + 10.41337\ D^2$ 0.98826

6. Lannea coromandelica(58)

$V = -0.11751 + 2.86874\ D$ 0.96823

7. Mitragyna parvifolia(19)

$V = -0.11127 + 1.11343\ D + 2.30514\ D^2$ 0.88170

8. Ougeinia dalbergioides(31)

$V/D^2 = 5.16668 - 0.01070/D^2$

or $V = -0.01070 + 5.16668\ D^2$ → 0.20555

9. Pterocarpus marsupium(65)

$V/D^2 = 8.06901 - 0.04659/D^2$ → 0.54428

or $V = -0.04659 + 8.06901\ D^2$

10 Shorea robusta(889) 0.94356

$V = 0.05823 - 1.22994\ D + 10.51982\ D^2$

11. Terminalia crenulata(205) 0.36006

$V/D^2 = 19.94708 + 0.17367/D^2 - 2.91710/D - 16.01855\ D$

or $V = 0.17367 - 2.91710\ D + 19.94708\ D^2 - 16.01855\ D^3$

12. Rest of species(988) 0.98021

$V = 0.04935 - 1.02608\ D + 8.89721\ D^2$

(N.B. Figures in bracket against the name of each species denote the number of trees on which the equations are based).

4.6 ENUMERATED TREE VOLUME:

Volume of each enumerated tree was estimated from the breast height over bark diameter of the tree and the local volume equation used for the species. The estimated tree volumes were converted to per hectare volumes and stored in tree/plot volume file with speices code, tree diameter, parameters of Plot description form, per hectare stems and

Contents

volume in the sample plot. The file helped in the tabulation of results by species and diameter for different crop compositions (forest types).

4.7 PLOT VOLUME:

The estimated volume of each enumerated tree in a plot when added up over the whole plot provided the plot volume. It was converted to per hectare and stored in the tree/plot volume file. The per hectare plot volumes were used to estimate volume under different classes of desired parameters. Average volume/ha (cub.m.) was calculated in different classes of topography, slope percentage, soil depth, canopy layer, top height and size class under each crop composition (forest types). These are given in relevent paras of Chapter VI on Growing Stock. As there were only 9 plots in Salai and only 3 plots in Teak stratum, they were merged with the Miscellaneous forest type for the purpose of calculating average vol/ha and the plot volumes were also used to estimate the sampling error of growing stock.

4.8 STAND TABLES:

The elements of tree/plot volume file were utilised to classify the trees by species, diameter and crop composition etc. Estimates of the number of stems per hectare and total stems by species and diameter classes were obtained for each crop composition. These are given in relevant paras of Chapter VI dealing with Growing stock Tables 6.1T(A) and B to 6.2T (A) and B.

The number of stems per hectare and total stems over all forest types were also derived which are given in Table no. 6.5T of the next Chapter.

4.9 STOCK TABLES:

Estimates of volume per hectare and total volume by species and diameter classes were obtained for each crop composition from the tree/plot volume file. These are given Table 6.3T (A) and (B) to 6.4 T(A) and B of the next Chapter. Estimate of volume per hectare and total volume by species and diameter classes over both the forest types combined were also derived and are given in Table 6.6T.

4.10 SAMPLING ERROR:

The sampling was considered as systematic cluster sample having two sample plots in each cluster. In order to estimate sampling error the sample plots were considered to constitute simple random sample of unequal clusters because in many cases only one plot was enumerated from a grid. As such the ratio method of estimation is used and the sampling error is estimated as follows:

Estimate of variance of $\hat{R}$

$$Y\ R = \frac{N - n}{N - n\ \ x^{-2}} \sum_{i=1}^{n} \frac{(yi - \hat{R}\ xi)^2}{n - 1}$$

$$= \frac{1}{n(n-1)} \sum_{i=1}^{n} (yi - R\ \hat{xi})^2$$

(Ignoring the finite population correction factor)

$$= \frac{1}{n\ (n - 1)\ x^{-2}}$$

Where n = total number of clusters in the sample
yi = the total of per hectare volume in the ith grid.

$$\bar{X} = \frac{\sum_{i=1}^{n} xi}{n}$$ = Average number of plot per grid

$$\hat{R} = \frac{\sum_{i=1}^{n} yi}{\sum_{i=1}^{n} xi}$$ = Estimate of average volume per hectare overall clusters.

Estimate standard error (S.E.) of $\hat{R}$

S.E. =

$$S.E\ \% = \frac{S.E.}{R} \times 100$$

Standard error has been estimated for area and growing stock in each crop composition and are given in Table no.6.7T.

****

Contents

CHAPTER - V

INVENTORY RESULTS - AREA

5.0 AREA:

The forest resources information of Raigarh district of Madhya Pradesh has been compiled on the basis of randomly selected 561 plots falling all over the forest areas of the district as revealed from Survey of India's topographic sheets. However, for this report we have relied on the figures given by the M.P. Forest Department in their publication like '30 YEARS OF FORESTRY' and Sankshepika'(Abstract) published by the Conservator of Forests, Bilaspur Circle of Madhya Pradesh. The total geographical and forested areas of the district are 12983.6 and 6029.066 Sq.km. respectively. The forested areas divided by the total number of sample plots falling in the entire forest area give the weight of each sample plot which comes to 10.75 Sq.km. Further, break up of the areas under different land uses, crop compositions, topography classes, slope classes, soil depth classes, height classes, size classes, canopy layers etc. was worked out giving due weightage to the sample plots falling under various locality factors as observed during the course of field work. These are discussed below in details.

5.1 FOREST AREA BY LAND USE CLASSES:

Table no. 5.1.T produced below gives a picture of how the forest land of Raigarh district is being used. It clearly indicates that about 45% area of the total forest land is under moderately dense forests with canopy density 30-70% and about 25% area under open forest having crown density between 5-30%. Dense forests with crown density of 70% and above were not found in Raigarh district during the couse of survey. Only 0.3% area of the forest land was under young plantations having diameter between 2-10 cm. About 10.5% area of the forest land was estimated to be under young crop of natural or artificial regeneration with diameter below 2 cm. Such crop cannot be considered as an established one. About 2% of forest land was found under scrub consisting of inferior tree growth mainly of defective and stunted trees with canopy density less than 5%, associated with bushy growth.

In all 5010 Sq.km.(83%) area of total forest land was under vegetation including scrub and 0.5% inaccessible areas which actually could not be visited by our field parties but considered as forested on the basis of indications on the toposheets.

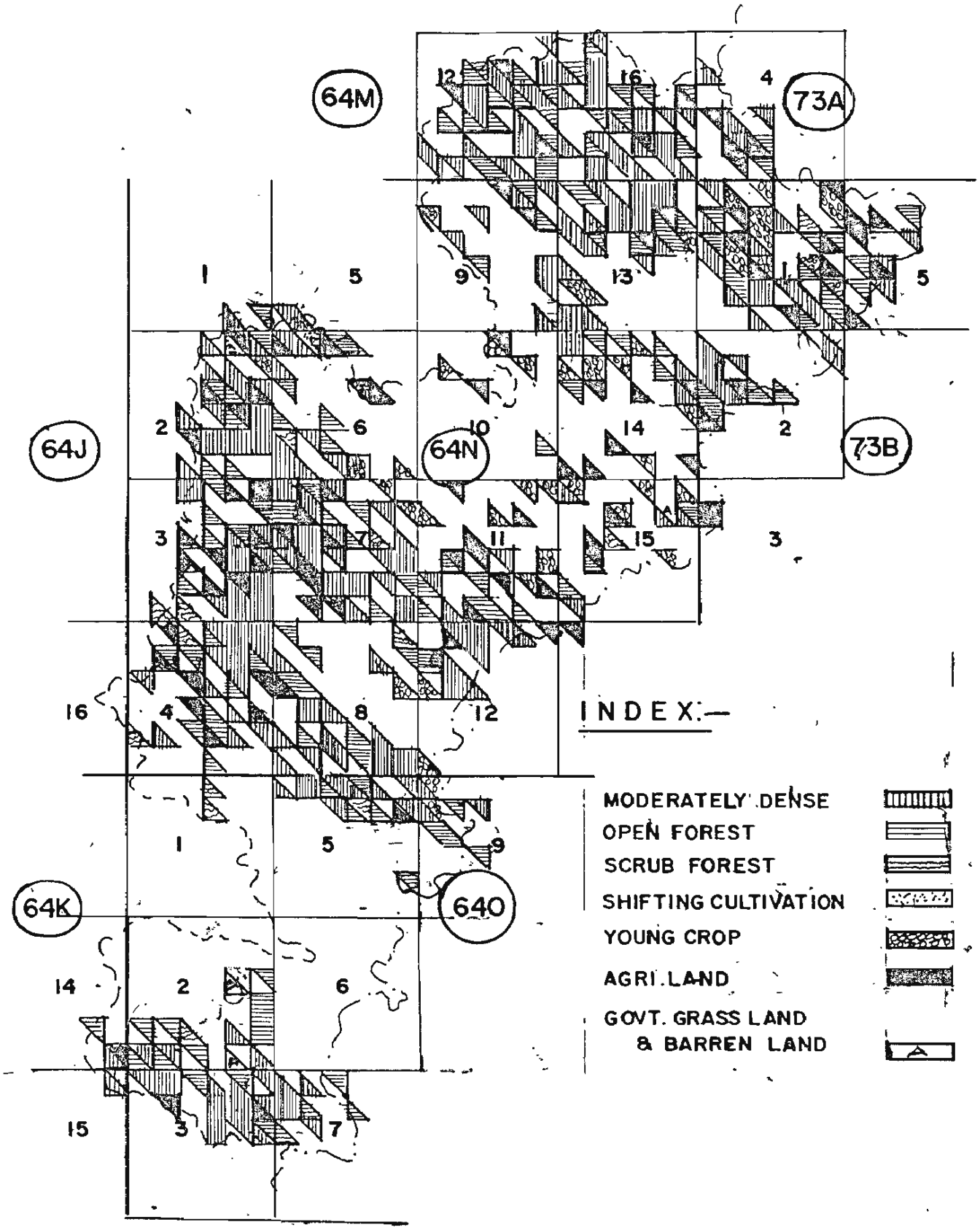
The rest 17% area of the forest land is devoid of any vegetation. Such areas are mainly(16%) under cultivation and habitation together with some barren lands in patches.

Contents

LAND USE MAP OF RAIGARH DISTRICT

NO: 5.1M

SCALE: 1:1,000,000



Contents

Table no. 5.1 T

Distribution of total forest areas by land use classes

S. No.	Land use classes	No. of sample plots	Area in Sq.km.	% Area
1	Moderately dense forest	254	2729.74	45.2
2.	Open forest	138	1483.09	24.6
3.	Young plantation	2	21.49	0.3
4.	Shifting cultivation	2	21.49	0.3
5.	Scrub forest	10	107.48	2.0
6.	Agricultural land with or without trees	87	934.99	15.5
7.	Habitation	2	21.49	0.3
8.	Barren lands	3	32.24	0.5
9.	Water bodies	1	10.75	0.2
10.	Young crop of natural or artificial regeneration	59	634.07	10.5
11.	Inaccessible	3	32.24	0.5
	Total	561	6029.07	100%

A map no. 5.1M on the preceeding page has been prepared based on the location of sample plots falling under various land uses in Raigarh district. The map indicates that both the main tree forests, namely moderately dense and open are distributed unevenly all over the forest land and as such there is no specific area under particular land use in the district. However, it shows that open to moderately dense forests are mainly confined to northern and central parts of the district.

5.2 AREA BY CROP COMPOSITION:

For the purpose of working out distribution of vegetated areas under different categories viz., crop composition, topography classes, slope classes, soil-depth classes, top height classes, size classes and canopy layers, the sample plots bearing vegetated only such as dense forest, moderately dense forest, open forest, young plantations and young crop of natural or artificial regeneration have been taken into consideration which collectively form an aggregate of 453 plots distributed over a forest area of 4868.39 Sq.km. Remaining 108 plots representing 1160.49 Sq.km. of forest area of the district have been kept out of the description upto the paragrah 5.8.

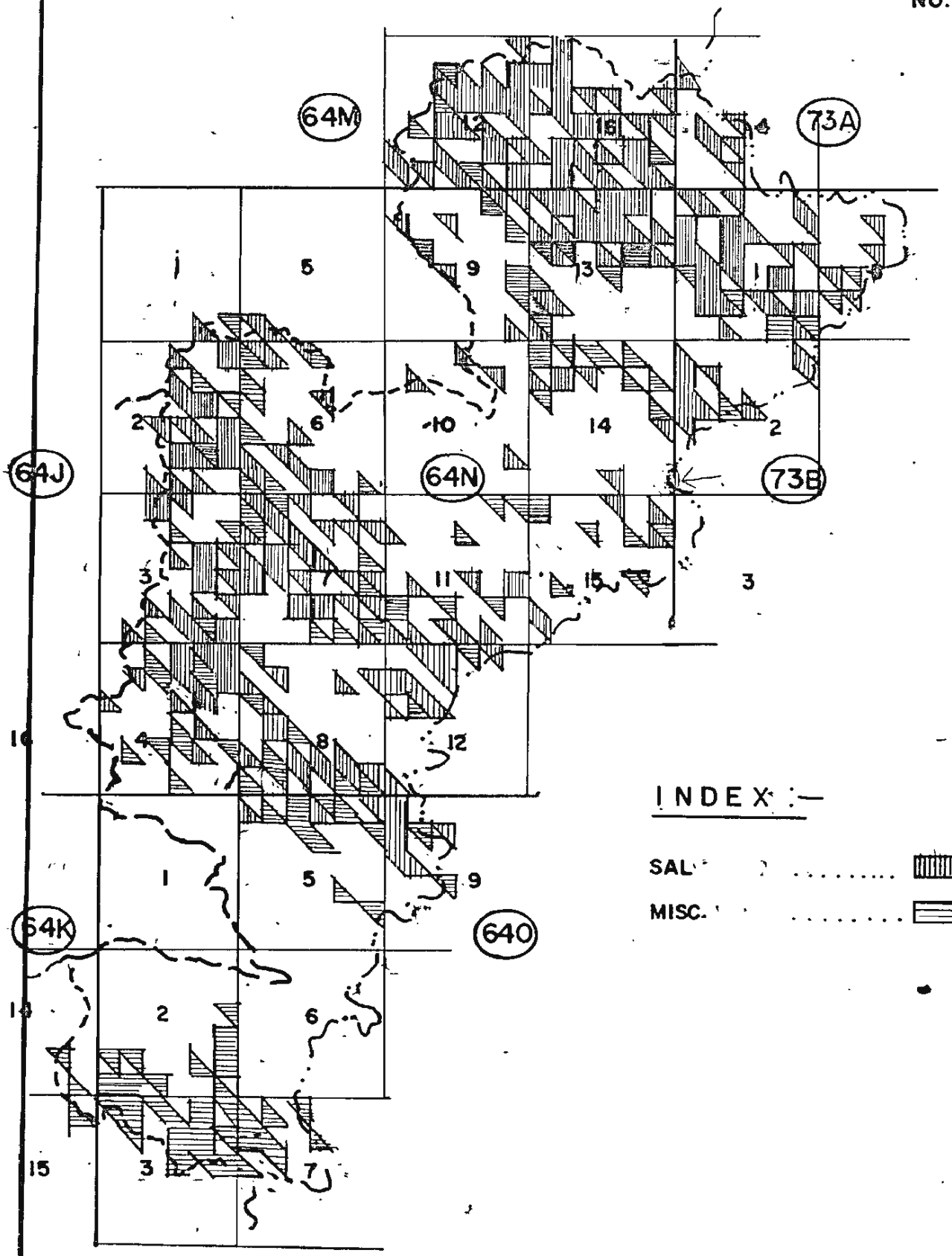
The forest of Raigarh district were classified into two main strata namely Sal and Miscellaneous. Table no. 5.2T produced below gives areas and percentage of tree forests

Contents

DISTRIBUTION OF CROP COMPOSITIONS IN RAIGARH DISTRICT

SCALE : 1:1,00,000

NO: 5·2M



Contents

under these two forest types. The table indicates that 66.4% of vegetated area is under Sal forest and remaing 33.6% is under Miscellaneous forest wherein no species were found in dominant position to form their own forest type. However, salai i.e Boswellia serrata, one of the leading species of Miscellaneous stratum, contributes about 2% to the total vegetated area. Besides salai, some teak(0.2%) mostly plantation at young stage, was also noticed. These two types were merged with Miscellaneous stratum because their individual occurrence is insigificant.

Table No. 5.2 T

Break up of tree vegetated area under different crop compositions

Sl. No.	Crop composition	No. of plots.	Area in sq.km.	Percentage
1.	Sal forest	301	3234.85	66.4
2.	Misc. forest	152	1633.54	33.6
	Total:	453	4868.39	100

A map no. 5.2 M appended as page no. 32 indicates the location of sample plots falling in these two strata in various parts of Raigarh district. The map indicates that the northern part of the district has mainly Sal forest whereas the southern most part has exclusively Miscellaneous forest. The central part of the district has predominently Sal forest with patches of Miscellaneous forest in between.

5.3 AREA BY CROP COMPOSITION AND TOPOGRAPHY:

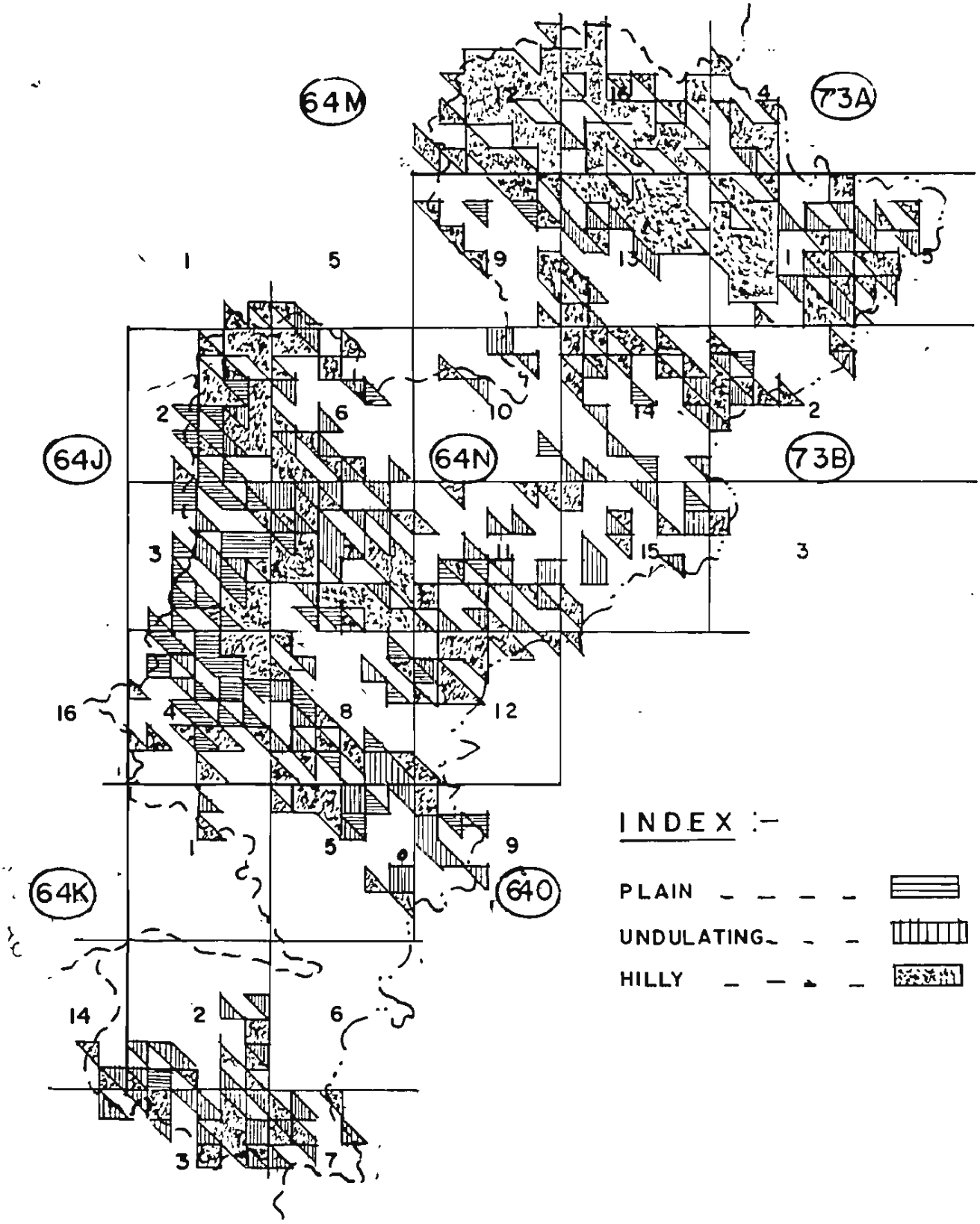
Table no. 5.3 T produced below gives distribution of vegetated forest area under different forest types by topographic classses as revealed from the number of sample plots falling in each category of topography. The vegetated area has been classified under flat lands, gently rolling and hilly terrain. The table indicates that major part of vegetation (66.6%) exists on hilly terrain whereas 23% exists on undulating(i.e.gently rolling) ground and the rest 10.4% exists on flat lands. Both the strata behave in a similar way with regard to their occurrence under various topography classes. No vegetation exists on very hilly terrain. The flat and undulating lands shows decline of vegetation due to biotic interference as compared to hilly areas.

Contents

TOPOGRAPHY MAP OF RAIGARH DISTRICT

NO: 53M

SCALE : 1 : 1,000,000



Contents

Table No. 5.3 T

Break up of tree vegetated area under different crop compositions by topography classes.

(Area in Sq.km.)

Sl. no.	Crop composition	Topographyhy classes				
		Flat	Gently rolling	Hilly	Very hilly	Total
1.	Sal forest	408.39 (38)	655.57 (61)	2170.89 (202)	-	3234.85 (301)
2.	Misc. Forest	96.72 (9)	462.12 (43)	1074.70 (100)	-	1633.54 (152)
	Total:	505.11 (47)	1117.69 (104)	3245.59 (302)	-	4868.39 (453)

Note: The figures in bracket denote number of sample plots.

A map no. 5.3 M has been prepared to indicate the location of various topographic classes where forest is found. It shows that northern part of the district has hilly terrain whereas the central part is largely flat and undulating with some scattered hills. The vegetation mostly occurs on hilly and undulating lands.

5.4 AREA BY CROP COMPOSITIONS AND SLOPE CLASSES:

Table no. 5.4T produced below gives distribution of vegetated area under different slope classes. The table indicates that about 33% vegetation exists on flat lands with slope less than 10%. However, the major part of vegetation i.e. 65% exists on moderate slopes (10-60%). The rest 2% vegetation is on slopy areas with slope 60-100%. Both the strata show similar trend with regard to their existence under various topography classes.

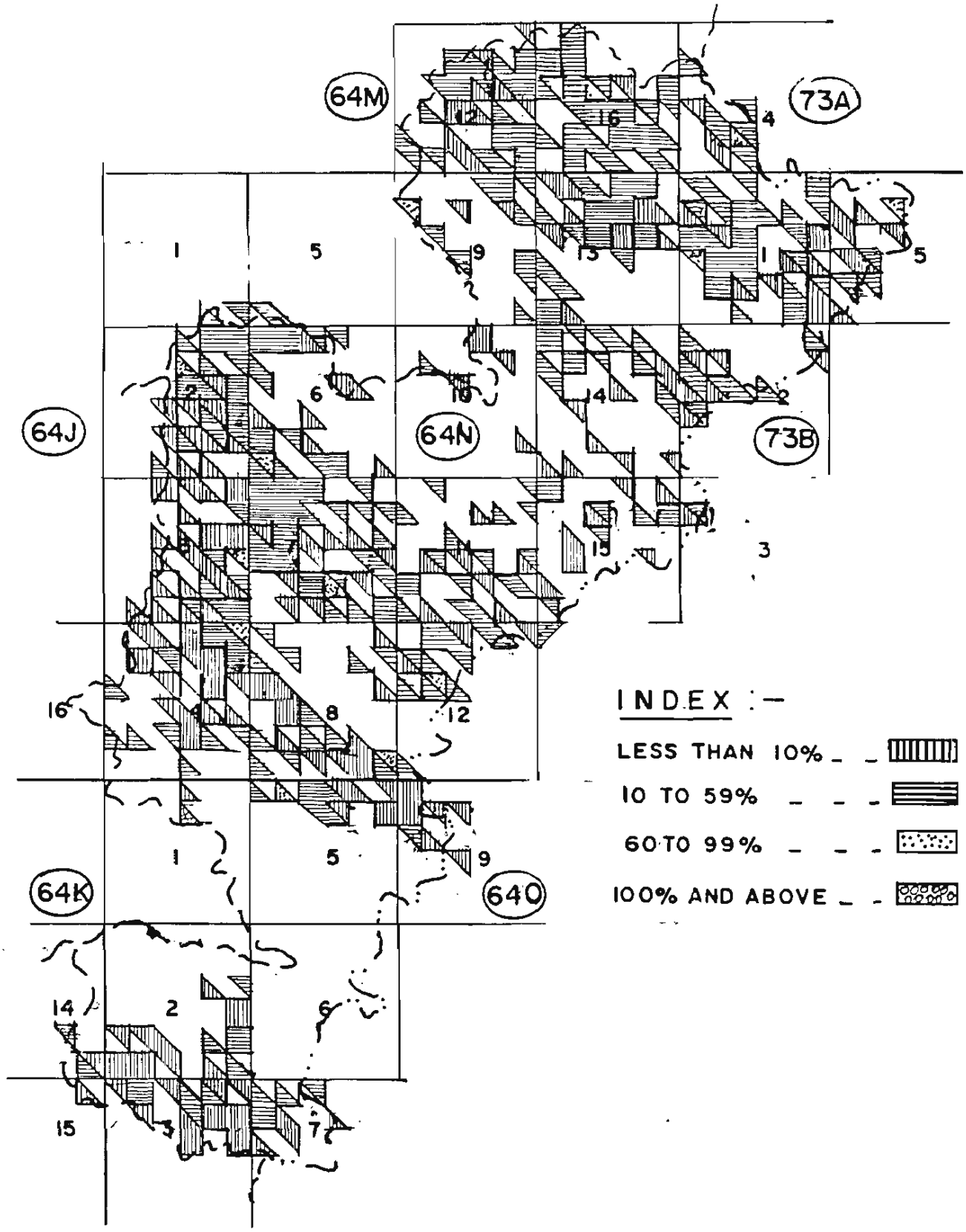
A map no. 5.4M was prepared to indicate the location of various slope classes of the terrain throughout the forest area .The map indicates that the northern part of the district has moderate slopes of 10- 60% whereas the central and southern parts have gentle slope of less than 10% with some patches of moderate slopes of 10-60%.

Contents

DISTRIBUTION OF SLOPE PERCENTAGES IN RAIGARH DISTRICT

NO: 5.4M

SCALE: 1:1,000,000



Contents

Table No. 5.4 T.

Break up of tree vegetated area under different crop compositions by slope classes (Area in Sq.km.)

Crop composition.	Slope classes					
	0-10%	10-60%	60-100%	100% above.	Not recorded.	Total
Sal forest	1031.71	2106.41	85.98	-	10.75	3234.85
Misc. forest	537.35	1053.21	21.49	-	21.49	1633.54
Total:	1569.06 (146)	3159.62 (294)	107.47 (10)	-	32.24 (3)	4868.39 (453)

5.5 AREA BY CROP COMPOSITION AND SOIL DEPTH:

Table no.5.5T indicates the distribution of various forest types supported by the soils having different depths, such as very shallow (15 cm), shallow (15-30 cm), medium (30-90 cm) and deep (over 90 cm). About 59% of the vegetation is supported by medium soils, 12% by shallow soils and the rest 29% by deep soils. The Sal forest occurs more over deep and medium soil whereas Miscellaneous forest is supported largely by medium to shallow soils.

Table No. 5.5 T.

Break up of tree vegetation area under different crop compositions by soil depth classes.

(Area in Sq.km.)

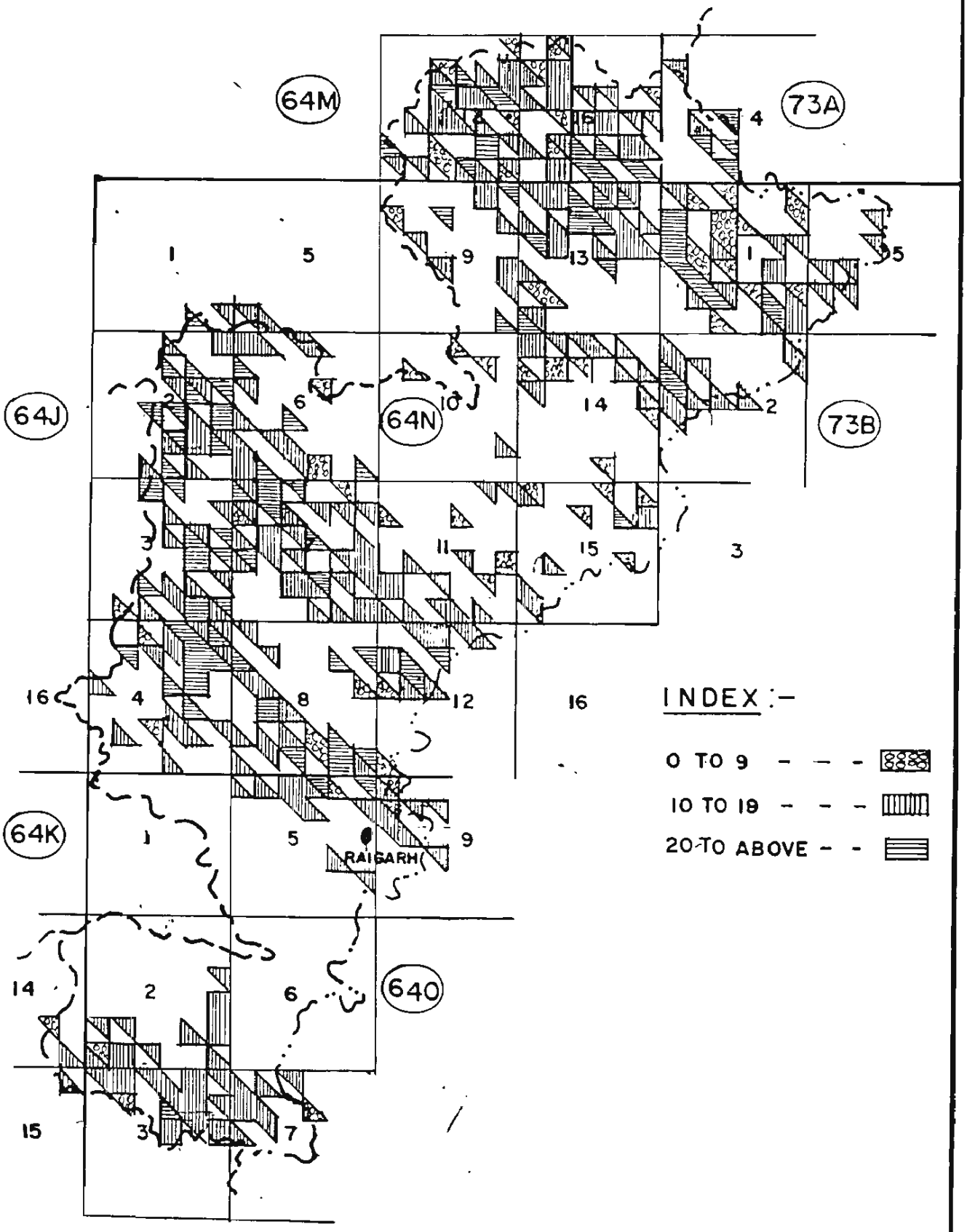
Sl. No.	Crop composition	Soil depth					
		Very shallow	Shallow	Medium	Deep	Not recorded.	Total
1.	Sal forest	32.24 (3)	204.19 (19)	1762.51 (164)	1235.91 (115)	- -	3234.85 (301)
2.	Misc. forest	32.24 (3)	322.41 (30)	1106.93 (103)	161.21 (15)	10.75 (1)	1633.54 (152)
	Total:	64.48 (6)	526.60 (49)	2869.44 (267)	1397.12 (130)	10.75 (1)	4868.39 (453)

Contents

DISTRIBUTION OF TOP HEIGHT CLASSES IN RAIGARH DISTRICT

NO: 5.6M

SCALE: 1:1,000,000



Contents

5.6 AREA BY CROP COMPOSITIONS AND TOP HEIGHT:

Table no. 5.6T below gives distribution of vegetated area by top height classes. The table indicates that 5% of the total vegetation is at very young stage with top height 1.5 m, 15% with top height 6-10 m, 27% with top height 11-15 m, 40% with top height 16-20 m and about 13% of vegetation is having top height above 20 m. Major vegetated area i.e. 67% is under medium sized crop with top height between 10-20 m. About 20% of vegetated area is under regeneration crop with height below 10 m.

Table No. 5.6 T

Break up of tree vegetated area by crop compositions and top height classes.

(Area in Sq.km.)

Crop composition	Top height classes in meters						Total
	1-5	6-10	10-15	16-20	21-25	26-30	
Sal forest	193.45 (18)	494.36 (46)	612.58 (57)	1364.87 (122)	505.11 (47)	64.48 (6)	3234.85 (301)
Misc. forest	53.74 (5)	214.94 (20)	709.30	579.93 (49)	53.74 (5)	21.49 (2)	1633.64 (152)
Total	247.19 (23)	709.30 (66)	1321.88 (123)	1945.20 (181)	558.85 (52)	85.97 (8)	4868.39 (953)

Map no. 5.6M on the preceeding page, has been prepared representing various top height classes i.e.(0-10 m, 10-20 m and 20 m and above). The map indicates that there is no specific area under particular top height class in the vegetation of Raigarh district. The crop is very much heterogenous in this regard. Almost all the top height classes are represented in a locality mixed together through out the entire vegetated area. Both the strata show similar behaviour in this regard.

5.7 AREA BY CROP COMPOSITIONS AND SIZE CLASSES:

Table no. 5.7T gives the distribution of vegetation by crop composition and size classes namely -regeneration crop (below 10 cm dia.), pole crop (10-20 cm dia.), small timber(20-30 cm dia.),big timber (over 30 cm dia.) and mixed

Contents

size crop (which has no marked dominance of any size class). The table indicates that about 13% crop is at regeneration stage, 26% at pole stage, 16% under small timber, 8% under big timber and the rest 37% crop is of mixed sizes wherein no dominance of any particular size was noticed. The over all position of the crop indicates that most of the crop is young having below 30 cm dia. at breast height with low density which is not suitable for exploitation. The distribution of various size classes in both the strata is almost similar.

Table No. 5.7 T

Break up of tree vegetated area under different crop compositions by size classes.

(Area in Sq.km.)

Crop composition	Size classes.					
	Regeneration.	Pole crop	Small timber	Big timber	Mixed size classes.	Total
Sal forest	505.11 (47)	752.29 (70)	548.10 (51)	290.17 (27)	1139.18 (106)	3234.85 (301)
Misc. forest	128.97 (12)	537.34 (50)	247.18 (23)	75.23 (7)	644.82 (60)	1633.54 (152)
Total	634.08 (59)	1289.63 (120)	795.28 (74)	365.40 (34)	1784.00 (166)	4868.39 (453)

5.8 AREA BY CROP COMPOSITIONS AND CANOPY LAYERS:

The table no. 5.8 T gives distribution of vegetated area by crop composition and forest canopy varying from no sotrey to multi-storyed forest. The table indicates that about 12% crop has no storey as it is at very young stage where the canopy formation has not yet taken place. 32% Area has one-storyed forest and the rest 56% vegetated area has two-storyed forest, out of which Sal contributes 70% and Miscellaneous forest 30%. The Miscellaneous forest is equally divided into one storeyed and two storyed forest whereas Sal forest has better growth resulting in predominantly two storeyed forest.

Contents

Table No. 5.8 T

Break up of tree vegetated area under different crop compositions by canopy layers.

(Area in Sq.km.)

Crop composition	Canopy layers				
	No storey	One storyed forest	Two storyed forest	Three or more storyed forest.	Total
Sal forest	451.38 (42)	881.25 (82)	1880.73 (175)	21.49 (2)	3234.85 (301)
Misc. forest	128.97 (12)	687.80 (64)	816.77 (76)	-	1633.54 (152)
Total	580.35 (54)	1569.05 (146)	2697.50 (251)	21.49 (2)	4868.39 (453)

5.9 GOVT. FOREST LAND UTILISATION PATTERN:

As discussed earlier in Chapter III on Methodology regarding the forest area considered for the purpose of this survey, forest areas including government forest and private forest land(if any) revealed from Survey of India toposheets were taken into account. Land use pattern of the total forest area has already been discussed in para 5.1 of this Chapter.

Now, table no.5.9T produced below indicates how the government forest land is being used in Raigarh district.

During the survey 551 plots, out of a total, 561 sample plots, have fallen in govt. forest land. The remaining plots representing 107.47 Sq.km of forest area were found to be located outside the govt. forest land.

Contents

Table No. 5.9 T

Government Forest Land Utilisation Pattern.

S.No.	Land class utility in govt. forest land	Area (Sq.km)	No. of sample plots
1.	Moderately dense forest (density 30 - 70%)	2729.74	254
2.	Open forest (density 5 - 30%)	1483.09	138
3.	Scrub forest (density 0-5%)	107.47	10
4.	Shifting cultivation	21.49	2
5.	Young plantation of forestry species	21.49	2
6.	Barren lands	32.24	3
7.	Agricultural land without trees in surround.	42.99	4
8.	Agricultural land with trees in surround.	795.28	74
9.	Habitation	10.75	1
10.	Water bodies	10.75	1
11.	Young crop of natural or artificial regeneration	634.07	59
12.	Inaccessible areas	32.24	3
Total		5921.60	551

5.10 PLANTABLE AREA IN GOVT. FOREST LAND:

For the purpose of estimating the plantable area in Raigarh district, the forest areas which have crop density below 0.3 or those areas which are devoid of any vegetal cover, were taken into consideration. Table no. 5.10 T gives the estimate of plantable area of the govt. forest which has either poor vegetation or where the vegetation is absent. Such areas include land uses like open forest, scrub forest, shifting cultivation, agricultural crop land with or without trees in surround and barren lands etc. The plantability of the plot and its surround has been estimated also on the basis of various factors like soil depth, slope, altitude of the terrain etc. The well stocked areas such as dense forest with canopy density above 30% or where the stocking of trees/bamboos is better even though the crop is young - such forest areas have been kept out from the estimation of plantability because such vegetated areas do not require further planting or rehabilitation. Accordingly, it was estimated that out of total 5921.60 Sq.km. area of the govt. forest land in Raigarh district, about 2482.56 Sq.km. (42%) is plantable. The rest 3439.04Sq.km. (58%) is well stocked and as such does not require any planting. The plantable areas are scattered here and there over the entire forest area of the district.

Contents

Table No. 5.10 T

Estimated plantable area in govt. forest land.

S.No.	Land use	No. of plots	Area (Sq.km.)
1.	Vegetated forest land (open forest + scrub + shifting cultivation).	150	1612.05
2.	Agricultural crop land with or without trees.	78	838.27
3.	Barren lands	3	32.24
	Total:	231	2482.56

5.11 SOIL EROSION:

Data relating to soil erosion was collected from 2 ha. area around sample plot in Raigarh district. On the basis of occular estimation it has been found that about 88% forest land is affected by mild soil erosion. About 10% area is affected by moderate soil erosion and only 2% forest area is affected by heavy soil erosion. Mild soil erosion has taken place almost in every part of the forest land. Moderate and heavy soil erosion has taken place mostly in central part of the district in patches where vegetal cover is fast depleting owing to heavy illicit felling. However, Soil conservation division of the State Forest Department has undertaken the task of soil conservation on large scale and the steps taken in this direction will certainly yield positive results by checking the depletion of precious top soil.

5.12 REGENERATION STATUS:

An assessment of regeneration of commercially important species was made during the inventory work. It was done by counting the number of seedlings of commercial species found in 16 Sq.m. area around the plot centre. The commercially species taken into consideration for this purpose were Acacia catechu, Adina cordifolia, Albizzia species, Dalbergia latifolia, Dalbergia sissoo, Diospyros melanoxylon, Eucalyptus species, Garuga pinnata, Gmelina arborea, Lagerstroemia parvifolia, Lannea coromandelica, Mitragyna parviflora, Ougeinia dalbergioides, Pterocarpus marsupium, Shorea robusta, Syzigium cumini, Schleichera oleosa, Terminalia crenulata, Terminalia belerica, Terminalia chebula, Terminalia arjuna and Tectona grandis.

Contents

The survey reveals that only 1% of the vegetated area has adequate regeneration of commercially important species. 44% area has inadequate regeneration and the rest 55% area does not have any regeneration of commercially important species. Areas with some regeneration though not adequate are located all over the forest area and as such there is no specific region/locality where absence or inadequacy of regeneration can be pin pointed.

5.13 FIRE INCIDENCE:

Data regarding fire incidence was collected from the vicinity of the sample plots. On the basis of survey results about 16% of the vegetated forest area suffers from annual fires. About 61% area was found to have only occasional fire and the rest 23% of vegetated areas was not subject to any fire incidence. The areas having fire incidence were found to be scattered all over the forests of the district. The reason of fire is mostly local. The local people burn the surface to clear the weeds, dry leave etc. to facilitate thier collection of various minor forest produce like mahua flowers, sal seeds etc.

5.14 GRAZING INCIDENCE:

The inventory results indicate that 31% area of forest is affected by heavy grazing, 32% by medium grazing and 20% area by light grazing. Only 8% area of forest is left unaffected by grazing. Such areas are mostly located away from habitation i.e. mainly in remote forest areas where terrain has steep slopes without approach. The northern part of the district is more affected by grazing. The medium and light grazing was noticed every where through out the forest area.

5.15 BAMBOO OCCURRENCE:

The forest of Raigarh district has very little bamboo. There are no areas in Raigarh district where bamboo brakes/ pure bamboo or even dense bamboo is found. However, scattered bamboo clumps of Dendrocalamus strictus were found in 21% area of the forest land overlapping with other tree vegetation. Such bamboo occurrence is mostly confined to central part of the district.

5.16 COMPARISON OF AREA RESULTS WITH INVENTORY RESULTS OF THE STATE'S SURVEY:

Earlier the State Forest Department had conducted resources survey in Raigarh district during 1975-77. The state's survey was confined to 4008 Sq.km. area of the forest only, bounded by the latitudes 21° 22.5' to 23° 3' and longitudes 82° 57'to 83° 48' thereby leaving a considerable area of 2021 Sq.km.of the district bounded by the longitude

Contents

83° 48'to 84° 22 1/2'.The unsurveyed part of the forest falls in Survey of India toposheet no. 73 A/4, 73B/1,2,3,5, which is located in eastern part of the district under Jashpur forest division. On the other hand the survey work by the Forest Survey of India was conducted in whole of the Raigarh district having geographical and forest area of 12983.6 and 6029.066 Sq.km. respectively. 81 sample plots, as per the survey design adopted by Forest Survey of India, were found to be falling in the forest area left uncovered by the State Survey Unit. Out of these 60 sample plots were found to be under vegetation. All the results related to the areas have been projected by our survey on the basis of complete forest area of the district i.e. 6029.066 Sq.km. The results of the survey of Forest Survey of India about the area figures are therefore not comparable with the results of the survey conducted by the State Forest Department earlier.

****

Contents

CHAPTER - VI

INVENTORY RESULTS - GROWING STOCK(TREES)

6.0 GENERAL:

The results about the growing stock of trees have been discussed in this chapter. The growing stock of trees has been classified into two strata, namely Sal and Miscellaneous. Bamboo, however, does not form a separate stratum as it was found along with trees in a few localities of central part of the district in sparse and scattered form. The growing stock of bamboos has been discussed separately in Chapter VII. The vegetated forest area in Sal stratum was estimated to be 3234.85 Sq.km and that in Miscellaneous was 1633.54 Sq.km.(total vegetated area being 4868.39 Sq.km). The distribution of growing stock i.e total no.of stems and stems per hectare, total volume and volume per hectare for each species under various diameter classes for both strata has been given in tables at the end of this chapter. However, salient features of each of these tables are described in following paragraphs.

6.1 TOTAL NUMBER OF STEMS AND STEMS/HA; STRATUM -SAL:

The distribution of various species in each diameter class by total no. of stems and stems/ha for Sal stratum (which covers 3234.8 Sq.km. area in the district), has been given in table no. 6.1T(A) and 6.1T(B). In this stratum Shorea robusta (Sal) has lion's share of 34812008 stems out of the total 72898500 stems estimated for this stratum as a whole. Thus, Sal alone constitutes about 48% of the growing stock and occupies Ist place in the stock table of this stratum. Other prominent species in order of their numerical contribution to Sal stratum, are Terminalia crenulata (saja)with 6034031 stems , Diospyros melanoxylon (tendu) with 2831855 stems, Anogeissus latifolia(dhauda) with 2526886 stems, Pterocarpus marsupium (bija) with 1764463 stems and Lannea coromandelica (mode) with 1012933 stems.

Per hectare contribution of various species is indicated in table 6.1T (B). According to it, 225.354 trees per hectare were found in this stratum, out of which sal alone contributes 107.306 trees/ha, saja - 18.653 trees/ha , tendu - 8.754 trees/ha.,dhauda 7.811 trees/ha, bija 8.455 and mode 1.717 trees/ha.

The occurrence of above important species from lower dia. class to higher dia. class is in descending order. Sal figures almost in every size class but other species do not have their representation in higher dia. class beyond 60 cm dia. A large group of miscellaneous species in which there was no dominance of a particular species, was noticed constituting about 30% of the growing stock with 21543883

Contents

stem out of a total of 72898500 stems in Sal stratum. There are some species (not mentioned separately in the stock tables) which are represented even in higher diameter classes but grouped under miscellaneous species. Such species are Madhuca latifolia, Terminalia belerica and various Ficus species etc. which are normally found in big sizes.

6.2 TOTAL NO. OF STEMS AND STEM/HA; STRATUM-MISC.:

Table no. 6.2 T(A) and 6.2T(B) give distribution of growing stock existing under various dia. classes in Miscellaneous stratum which occupies 1633.54 Sq.km. of vegetated forest area in Raigarh district. The distribution reveals that in all 30993402 stems of various species falling under different dia. classes are estimated to occur in this stratum which works out to 189.731 trees per ha. Other prominent species are Terminalia crenulata, Anogeissus latifolia, Diospyros melanoxylon and Boswellia serrata. None of the above species is significant enough to form its own forest type individually and hence such areas and the vegetation have been classified under Miscellaneous stratum. Sal, however, has some existance (5%) in this stratum also. The representation of almost all species including sal is upto 50-60 cm dia. class.

The Miscellaneous stratum is slightly poor with regard to the existance of vegetation (stems per ha) in comparison to Sal stratum. In Sal stratum there are 225.354 trees/ha whereas in Miscellaneous stratum there are 189.731 trees/ha only. As regards the representation in higher dia. classes, it is noticed that Sal stratum is richer than Miscellaneous stratum in context of better representation of species in higher dia. classes.

6.3 TOTAL VOLUME AND VOLUME/HA ;STRATUM - SAL:

Table no. 6.3T(A)and 6.3T(B) give distribution of total volume and volume per ha of the growing stock found in Sal stratum under various dia. classes of the important and dominant species. Unimportant species whose individual contribution towards volume is insignificant have been merged together under a broader species class, denoted as 'Miscellaneous'. The table 6.3 T(A) indicates that in all 21511617 cu.m. of volume was estimated to be existing under various dia. classes in Sal stratum. Sal alone contributes 12782680 cu.m. which is 59% volume of the total volume estimated in this stratum. The other leading species with regard to volume are, Terminalia crenulata with 1426479 cu.m. of volume followed by Pterocarpus marsupium with 703009 cu.m, Diospyros melanoxylon with 672814 cu.m. Anogeissus latifolia with 665820 cu.m.and Boswellia serrata with 627226 cu.m. In terms of stems, Sal has only 48% of total growing stock whereas in terms of volume it shares 59% of the total growing stock in this stratum. It clearly indicates that an average stem of sal yields more volume than an average stem of any

Contents

other speices present in this stratum. In other words, sal has comparatively more representation in higher dia. classes.

Per hectare volume in Sal stratum was estimated to be 66.5 cu.m. out of which sal contributes 39.516 cu.m./ha. bija 2.173 cu.m./ha, tendu 2.080 cu.m. /ha dhauda 2.058 and Salai 1.939 cu.m./ha. Though number of stems decreases from lower diameter classes to higher diameter classes their respective volume per ha. was found to be increasing upto 60 cm dia. classes and afterwards it decreases in higher dia. classes because the number of trees in higher dia.classes is very less.

6.4 TOTAL VOLUME AND VOLUME/HA; STRATUM -MISCELLANEOUS:

Table no. 6.4 T(A) and 6.4T(B) give distribution of total volume of the growing stock occurring under various dia. classes in Miscellaneous stratum is Raigarh district. In all 7746324 cu.m. volume of growing stock was estimated to be present in this stratum out of which salai (Boswellia serrata) shares 1388912 cu.m. (18%).

Other important species of Miscellaneous stratum are saja with 708256 cu.m, sal with 586022 cu.m., dhauda with 5417055 cu.m. and tendu with 487408 cu.m.

Per ha volume in Miscellaneous stratum was estimated to be 47.42 cu.m. out of which salai contribute 8.502 cu.m./ha, saja 4.336 cu.m. , Sal 3.587 cu.m., dhauda 3.316 cu.m.and tendu 2.984 cu.m. per ha. Sal stratum is found to be richer than the Miscellaneous stratum not only in number of stems but also in the volume. Miscellaneous stratum has yielded 47.420 cu.m./ha only where as Sal stratum yields 66.500 cu.m. of volume per ha. In this stratum also the no.of stems in each diameter class as well as their volume follow the same trend as described under Sal stratum i.e. volume increases upto 60 cm diameter class and decreases beyond that as there are very few trees in higher diameter classes.

6.5 COMBINED GROWING STOCK : STEMS:

Table no.6.5T gives distribution of combined growing stock in terms of total stems found in different dia. classes of each species in whole of the vegetated area (4868.39 Sq.km) covering both the strata. The table indicates that in all 103891872 stems of different species and of various sizes were found in the entire vegetated area of Raigarh district.

Average number of stems per hectare was found to be 213.401. Important species occur in the following order in the entire vegetated area of the district.

Contents

Order	Species	Total no. of stems.	Percentage
I	Shorea robusta (Sal)	36400368	35.04
II	Terminalia crenulata (Saja)	8237664	7.93
III	Diospyros melanoxylon(Tendu)	4761406	4.58
IV	Anogeissus latifolia(Dhauda)	44667398	4.30
V	Boswellia serrata (Salai)	2668757	2.57
VI	Pterocarpus marsupium(Bija)	2619605	2.53
VII	Lannea coromandelica(Mode)	2372389	2.28
VIII	Lagerstroemia parviflora (Lendia)	1761448	1.69
IX	Ougenia dalbergioides(Tinsa)	1179889	1.14
X	Adina cordifolia (Haldu)	612587	0.59
XI	Mitragyna parvifolia(Mundi)	415820	0.40
XII	Miscellaneous species	38394560	36.96
	Total ..	103891872	100%

Since sal is found in both the strata, it alone shares about 35% of the total growing stock in terms of stems and as such the composition of forest of Raigarh district can be said to be predominantly of sal.

As described earlier, it is only sal which has its representation in all dia. classes. Other species do not have their representation in dia.classes beyound 60 cm dia. except for small representation of Boswellia serrata and the miscellaneous species like Madhuca latifolia, Terminalia belerica etc.

6.6 COMBINED GROWING STOCK : VOLUME:

Table no. 6.6 T gives distribution of total growing stock of the entire vegetated forest area of both the strata covering 486839 Sq.km. area in terms of volume found in various dia. classes in Raigarh district. The total growing stock of all the species was found to be 29257936 cu.m. The average per hectare volume was estimated to be 60.098 cu.m. for all the species. Out of this total volume, sal alone

contributes 13368703 cu.m. which is the highest individual species contribution which comes to nearly 46% of the total growing stock in terms of volume. The species are listed below in order of their volumetric contribution to the growing stock of Raigarh district:

Order	Species	Volume(cu.m.)	Percentage.
I	Shorea robusta (Sal)	13368703	45.69
II	Terminalia crenulata(Saja)	2134734	7.29
III	Boswellia serrata (Salai)	2016038	6.89
IV	Anogeissus latifolia(Dhauda)	1207524	4.13
V	Diospyros melanoxylon (Tendu)	1160223	3.96
VI	Pterocarpus marsupium(Bija)	1020515	3.49
VII	Lannea coromandelica(Mode)	395649	1.35
VIII	Lagerstroemia parviflora (Lendia)	285237	0.97
IX	Ougenia dalbergioides(Tinsa)	202110	0.69
X	Adina cordifolia (Haldu)	135836	0.46
XI	Mitragyna parvifolia(Mundi)	66344	0.24
XII	Misc. species	7265023	24.84
	Total:	29257936	100%

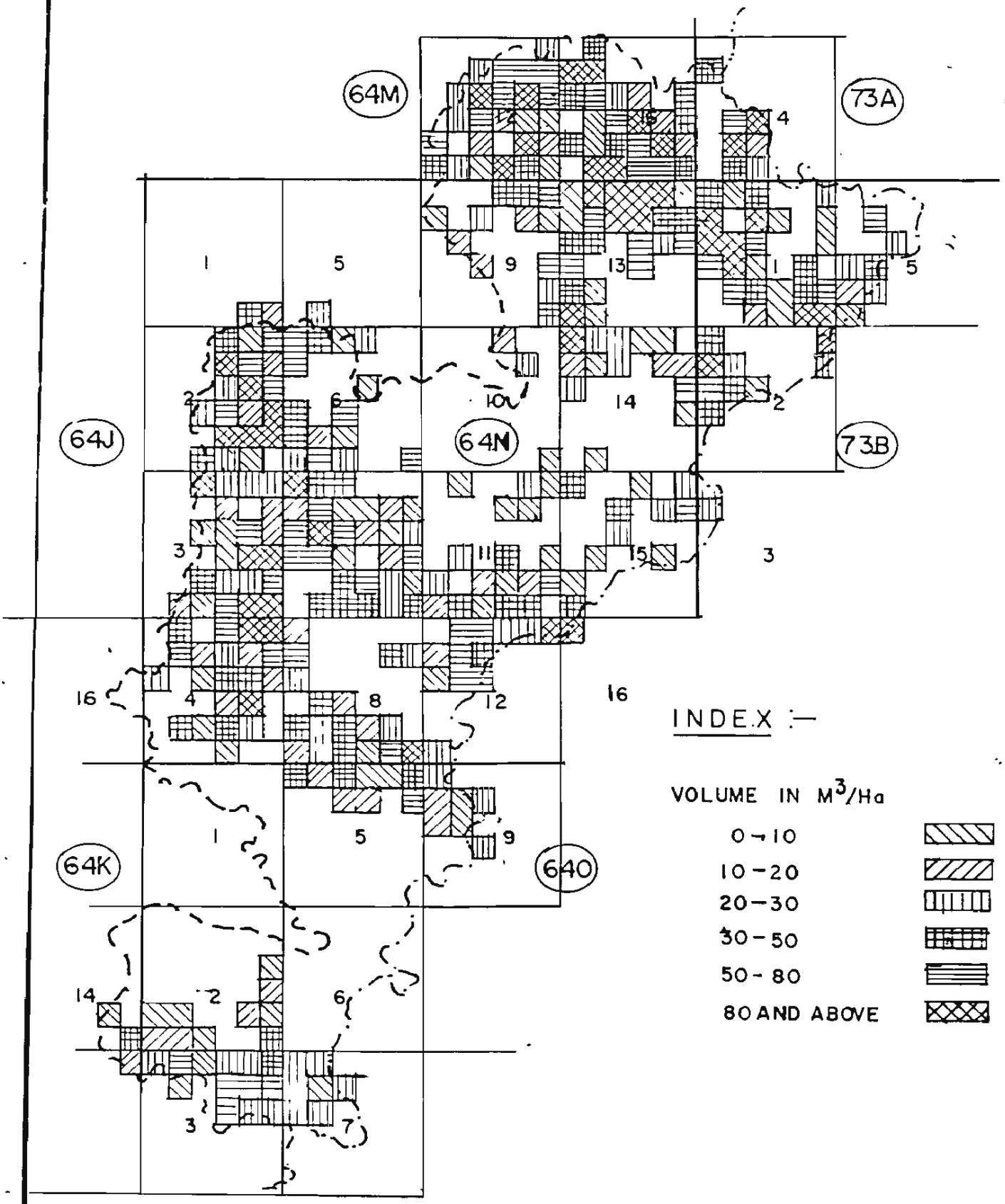
The order of some species is changed from their numerical representation in the volumetric representation. This happened due to the fact that some species, though found more in number yield less volume. Such species have higher representation in lower dia. classes in comparison to those which have yielded morevolume inspite of lesser numbers of stems. It may be noted that sal has only about 35% contribution to the total number of stems but contributes nearly 46% of the total volume because of its higher average volume per stem as compared to other species.

Contents

NO: 6-6M

VOLUME MAP OF RAIGARH DISTRICT

SCALE : 1:1,000,000



Contents

Map no.6.6M shows per hectare volume over the plots surveyed by the organisation. It depicts that forest crop is very heterogenous in this district with respect to distribution of per hectare volume. However, forest areas in northern and western parts of the district have many plots having volume of more than 80 cu.m./ha.

6.7 STANDARD ERROR:

Standard error for estimation of total vegetated area, total volume and volume/ha. has been calculated and reproduced below for both the strata Sal and Miscellaneous identified in Raigarh district. The standard error for Miscellaneous stratum is slightly higher for all the three parameters (i.e. area, total volume & volume/ha.) in comparison to Sal stratum, the reason being that the number of sample plots falling in Miscellaneous stratum is much less (152 plots) as compared to Sal stratum (301 plots). However, the standard error in estimation of area and growing stock in both strata is under permissible limits.

Table No. 6.7 T

Standard error for Area and growing stock.

Crop composition.	Area in ha	S.E. %	Vol/ha	S.E. %	Total volume (000 M)	S.E. %
Sal forest	323485 (301)	4.2	66.5 (297)	4.5	21511.6	6.2
Misc.forest	163354 (152)	7.4	47.4 (149)	6.9	7746.3	10.1
Total	486839 (453)	3.7	60.1	3.7	29257.9	5.2

6.8 MEAN VOLUME/HA BY TOPOGRAPHY UNDER CROP COMPOSITIONS:

Table no. 6.8 T below gives the mean volume by topography classes for both the strata. The table indicates that the mean volume/ha is more on hilly terrain than on flat or undulating terrain. It was already pointed out in previous chapter that the condition of forest in hilly areas is better than that in plain areas because in such areas, there is lot of biotic interference which results in much deterioration of forests and less mean volume. This condition prevails in both the strata.

Table No. 6.8 T

Mean vol/ha. by topography under different crop compositions

Crop composition.	Flat	Gently rolling	Hilly	Very hilly.
Sal forest	62.79 (38)	41.41 (61)	74.94 (198)	-
Misc. forest	22.53 (9)	39.61 (43)	53.19 (97)	-

6.9 MEAN VOLUME/HA BY SLOPE CLASSES UNDER DIFFERENT CROP COMPOSITIONS:

Table no.6.9T produced below gives the mean volume per ha by slope classes. The table indicates that the mean volume per ha in slopy areas having slope percentage 60-100%, is more in both the strata in comparison to plain or undulating areas having less slopes. Since the slopy areas are away from habitation/cultivation, there is less biotic interference and as such some good forest is retained resulting in better mean volume.

Table No. 6.9 T

Mean vol/ha. by slope classes under different crop compositions

Crop composition.	Less than 10%	10% to 60%	60% to 100%	100% and above.
Sal forest	54.45 (96)	70.32 (195)	135.04 (6)	-
Misc. forest	34.74 (50)	53.42 (97)	73.62 (2)	

6.10 MEAN VOLUME/HA BY SOIL DEPTH UNDER DIFFERENT CROP COMPOSITIONS:

Table no. 6.10 T produced below gives mean volume per hectare of the crop by soil depth classes. The table indicates that the crop having medium soil depth has greater mean volume/ha in comparison - to crop with other soil depths. Crop on very shallow soil has least mean volume/ha in both the strata.

Contents

Table No. 6.10T

Mean volume/ha by soil depth classes.

Crop composition.	Soil depth			
	Very shallow	Shallow	Medium	Deep
Sal forest	16.92 (2)	32.95 (18)	70.03 (162)	67.64 (115)
Misc. forest	9.20 (3)	35.99 (28)	53.16 (103)	37.00 (15)

6.11 MEAN VOLUME/HA BY CANOPY LAYERS UNDER DIFFERENT CROP COMPOSITIONS:

Table no. 6.11 T produced below gives mean volume/ha of the crop by canopy layers in both the strata. The table indicates that the two storyed forests in both the strata have better mean volume/ha in comparison to one storeyed or no storey forests. No storey forests are mostly young regeneration not capable of yielding much volume and one storeyed forests are also mostly pole crop or small timber which yield less volume.

Table No. 6.11 T

Mean volume/ha. by canopy layer under different crop composition.

Crop composition	No storey	Single storeyed	Two storeyed
Sal forest	22.22 (44)	41.64 (80)	89.26 (173)
Misc. forest	11.97 (12)	33.46 (64)	65.49 (73)

6.12 MEAN VOLUME/HA BY TOP HEIGHT CLASSES UNDER DIFFERENT CROP COMPOSITIONS:

Table no. 6.12 T produced below gives mean volume obtained under various top height classes of vegetation in both the strata. The table indicates that the mean volume in case of Sal forest is the highest in top height class 21-25m. whereas in case of Miscellaneous forest the mean volume is highest in the top height class of 26-30 m. In case of Sal stratum the mean volume was found to be more in 21-25 m. class than the succeeding higher diameter class. This

Contents

perhaps happened due to the fact that the crop having 26-30m. top height had large number of trees of smaller diameter and correspondingly less volume as volume depends on the height as well as diameter of the trees.

Table No. 6.12 T
Mean volume/ha. by top height classes.

Crop composition.	Top height classes					
	1 - 5M	6 - 10M	11-15M	16-20M	21-25M	26-30M
Sal forest	7.54 (18)	28.35 (44)	41.06 (55)	79.84 (127)	114.03 (47)	101.69 (6)
Misc. forest	1.58	17.15 (5)	35.11 (20)	69.86 (65)	103.00 (52)	142.51 (5)

(2

6.13 MEAN VOLUME/HA BY SIZE CLASSES UNDER DIFFERENT CROP COMPOSITIONS:

Table no.6.13T produced below gives mean volume of the crop under various size classes in both the strata. The table indicates that in both the strata the mean volume was found to be in ascending order from regeneration size class to big timber. Since diameter is the main factor affecting volume, the big size timber has yielded highest mean volume. In the mixed size crop of both the strata the volume has gone slightly down due to the presence of small sized timber in this class in comparison to big timber but in the mixed size class the mean volume was found to be more than the mean volume of other size classes except big sized class. The mean volume in all the classes of Sal stratum was found to be more than the corresponding size classes of Miscellaneous stratum.

Table No. 6.13 T
Mean volume/ha. by size classes.

Crop composition.	Regeneration	Pole crop	Small timber	Big timber	Mixed size class.
Sal forest	22.68 (47)	55.85 (68)	75.74 (51)	85.52 (27)	83.80 (104)
Misc.forest	11.97 (12)	29.51 (48)	44.53 (23)	81.85 (71)	66.24 (59)

Contents

6.14 COMPARISON OF RESULTS OF GROWING STOCK WITH THE INVENTORY RESULTS OF STATE'S SURVEY:

As stated earlier in Chapter V, a resources survey was conducted by the State Forest Department during 1975-77 in the forest area of 4008 Sq.km. in Raigarh district out of which 3503 Sq.km. of forest areas was found to be vegetated. On the other hand, Central Zone of Forest Survey of India, has conducted resources survey during 1984, in whole of the forest area i.e. 6029.066 Sq.km. out of which 4868.39 Sq.km. was found to be forested. Since areas in both the surveys were different, the results are not comparable. In the previous survey the total growing stock was estimated to be 14727312 cu.m. yielding 40.928 cu.m./ha of volume and on the basis of present survey the total volume of the growing stock is estimated to be 29257936 cu.m. yielding 60.098 cu.m./ha Sal being the dominant species contributed 36% stems earlier and has now shown almost the same contribution of 35% in terms of stems and 46% in terms of volume in the subsequent survey.

During the survey conducted by the State Forest Department, the number of stems per ha was found to be 192.673 and during the subsequent survey no. of stems per hectare was found to be 213.401. On the basis of above data compiled on two different occasions it can be safely presumed that the forests of Raigarh district have shown considerable improvement during the period of 8 years.

****

Table No. 6.1T (A)

STAND AND STOCK TABLES - RAIGARH DISTRICT

STRATUM - SAL Plot No. 301 Area- 3234.85 (Sq.km.) Stem('000')

Species description	Diameter classes (in c.m.)											
	10-15	15-20	20-25	25-30	30-35	35-40	40-50	50-60	60-70	70-80	80+	Total
Adina cordifolia	152.485	10.892	10.892	10.892	10.892	0.000	10.892	0.000	0.000	0.000	0.000	206.943
Anogeissus latifolia	1023.825	664.397	402.995	304.969	76.242	54.459	0.000	0.000	0.000	0.000	0.000	2526.886
Boswellia serrata	141.593	152.485	174.268	163.376	152.485	87.13	54.459	32.675	0.000	0.000	0.000	958.474
Diospyros melanoxylon	1296.118	653.505	490.129	185.160	108.918	76.242	10.892	10.892	0.000	0.000	0.000	2831.855
Lagerstroemia parviflora	359.428	87.134	98.026	10.892	0.000	0.000	0.000	0.000	0.000	0.000	0.000	555.479
Lannea coromandelica	642.613	152.485	152.485	54.459	0.000	10.892	0.000	0.000	0.000	0.000	0.000	1012.933
Mitragyna parviflora	54.459	43.567	10.892	10.892	0.000	0.000	0.000	0.000	0.000	0.000	0.000	119.809
Ougeinia dalbergioide	446.562	119.809	43.567	21.783	0.000	0.000	0.000	0.000	0.000	0.000	0.000	631.721
Pterocarpus marsupium	544.587	381.211	304.969	250.510	152.485	87.134	21.783	21.783	0.000	0.000	0.000	1764.463
Shorea robusta	13658.254	7395.496	4944.855	3169.500	2417.969	1437.711	1078.283	392.103	141.593	54.459	21.783	34712.008
Terminalia crenulata	2810.072	1601.087	893.124	402.995	196.052	87.134	32.675	10.892	0.000	0.000	0.000	6034.031
Miscellaneous species	12797.809	4356.699	2025.866	1002.041	577.263	337.644	196.052	152.485	10.892	43.567	43.567	21543.883
All species total	33927.801	15618.766	9552.070	5587.473	3692.304	2178.350	1405.036	620.830	152.485	98.026	65.350	72898.500

Table No. 6.1T (B)

STAND AND STOCK TABLES

STRATUM - SAL NO. OF PLOTS - 301 AREA -3234.85 SQ.KM. STEM/HA.

Species description	Diameter classes (in c.m.)											
	10-15	15-20	20-25	25-30	30-35	35-40	40-50	50-60	60-70	70-80	80+	Total
Adina cordifolia	0.471	0.034	0.034	0.034	0.034	0.000	0.000	0.000	0.000	0.000	0.000	0.640
Anogeissus latifolia	3.165	2.054	1.246	0.943	0.236	0.168	0.000	0.000	0.000	0.000	0.000	7.811
Boswellia serrata	0.438	0.471	0.539	0.505	0.471	0.269	0.168	0.101	0.000	0.000	0.000	2.963
Diospyros melanoxylon	4.007	2.020	1.515	0.572	0.337	0.236	0.034	0.034	0.000	0.000	0.000	8.754
Lagerstroemia parviflora	1.111	0.269	0.303	0.034	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.717
Lannea coromandelica	1.987	0.471	0.471	0.168	0.000	0.034	0.000	0.000	0.000	0.000	0.000	3.131
Mitragyna parviflora	0.168	0.135	0.034	0.034	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.370
Ougeinia dalbergioides	1.380	0.370	0.135	0.067	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.953
Pterocarpus marsupium	1.684	1.178	0.943	0.774	0.471	0.269	0.067	0.067	0.000	0.000	0.000	5.455
Shorea robusta	42.222	22.862	15.286	9.798	7.475	4.444	3.333	1.212	0.438	0.168	0.067	107.306
Terminalia crenulata	8.687	4.949	2.761	1.246	0.606	0.269	0.101	0.304	0.000	0.000	0.000	18.653
Miscellaneous species	39.562	12.468	6.263	3.098	1.785	1.044	0.606	0.471	0.034	0.135	0.135	66.599
All species total	104.882	48.283	29.529	17.273	1.414	6.734	4.343	1.919	0.471	0.303	0.202	255 354

Contents

Table No. 6.2T(A)

STAND AND STOCK TABLES- RAIGARH DISTRICT

STRATUM- MISCELLANEOUS NO. OF PLOTS- 152 AREA - 1633.54 SQ.KM STEMS('000')

Species description	Diameter classes (in c.m.)											
	10-15	15-20	20-25	25-30	30-35	35-40	40-50	50-60	60-70	70-80	80+	Total
Adina cordifolia	175.414	87.707	32.890	21.927	0.000	32.890	43.853	10.963	0.000	0.000	0.000	405.645
Anogeissus latifolia	997.665	405.644	252.157	131.560	54.817	43.853	32.890	21.927	0.000	0.000	0.000	1940.514
Boswellia serrata	87.707	274.084	285.047	285.047	350.827	153.487	241.194	21.927	0.000	10.963	0.000	1710.283
Diospyros melanoxylon	883.215	438.534	296.010	208.304	109.634	21.927	21.927	0.000	0.000	0.000	0.000	1929.550
Lagerstroemia parviflora	767.435	197.340	120.597	65.780	10.963	21.927	21.927	0.000	0.000	0.000	0.000	1205.969
Lannea coromandelica	624.911	339.864	208.304	131.560	21.927	32.890	0.000	0.000	0.000	0.000	0.000	1359.456
Mitragyna parviflora	153.487	65.780	43.853	10.963	10.963	0.000	10.963	0.000	0.000	0.000	0.000	296.011
Ougeinia dalbergioides	252.157	131.560	87.707	21.927	10.963	0.000	21.927	21.927	0.000	0.000	0.000	548.168
Pterocarpus marsupium	383.717	120.597	142.524	43.853	76.743	54.817	21.927	10.963	0.000	0.000	0.000	855.142
Shorea robusta	635.875	317.937	252.157	197.340	142.524	109.634	21.927	10.963	0.000	0.000	0.000	1688.357
Terminalia crenulata	1030.355	438.534	306.974	142.524	109.634	76.743	43.853	43.853	0.000	0.000	10.963	2203.634
Miscellaneous species	9625.824	3705.614	1721.247	811.288	537.204	230.230	120.597	54.817	21.927	10.963	10.963	16850.676
All species total	15567.961	6523.195	3749.467	2072.074	1436.199	778.398	602.985	197.340	21.927	21.927	21.927	30993.402

Table No. 6.2 T(B)

STAND AND STOCK TABLES - RAIGARH DISTRICT

STRATUM MISCELLANOUS NO.OF PLOTS - 152 AREA - 1633.54 SQ.KM. STEMS/HA.

Species description	Diameter classes (in c.m.)											
	10-15	15-20	20-25	25-30	30-35	35-40	40-50	50-60	60-70	70-80	80+	Total
Adina cordiforla	1.074	0.537	0.201	0.134	0.000	0.201	0.268	0.067	0.000	0.000	0.000	2.483
Anogeissus latifolia	6.107	2.483	1.544	0.805	0.336	0.268	0.201	0.134	0.000	0.000	0.000	11.879
Boswellia serrata	0.537	1.678	1.745	1.745	2.148	0.940	1.477	0.134	0.000	0.067	0.000	10.470
Diospyros melanoxylon	5.101	2.685	1.812	1.275	0.671	0.134	0.134	0.000	0.000	0.000	0.000	11.812
Lagerstroemia parviflora	4.698	1.208	0.738	0.403	0.067	0.134	0.134	0.000	0.000	0.000	0.000	7.383
Lannea coromandelica	3.826	2.081	1.275	0.805	0.134	0.201	0.000	0.000	0.000	0.000	0.000	8.322
Mitragyna parviflora	0.940	0.403	0.268	0.067	0.067	0.000	0.067	0.000	0.000	0.000	0.000	1.812
Ougeinia dalbergioides	1.544	0.805	0.537	0.134	0.067	0.000	0.134	0.134	0.000	0.000	0.000	3.356
Pterocarpus marsupium	2.349	0.738	0.872	0.268	0.470	0.336	0.134	0.067	0.000	0.000	0.000	5.235
Shorea robusta	3.893	1.946	1.544	1.208	0.872	0.671	0.134	0.067	0.000	0.000	0.000	10.336
Terminalia crenulata	6.309	2.685	1.879	0.872	0.671	0.470	0.268	0.268	0.000	0.000	0.067	13.490
Miscellaneous species	58.926	22.685	10.537	4.966	3.288	1.049	0.738	0.336	0.134	0.067	0.067	103.154
All species total	95.302	39.933	22.953	12.685	8.792	4.765	3.691	1.208	0.134	0.134	0.134	189.731

Contents

Table No. 6.3 T(A)

STAND AND STOCK TABLE - RAIGARH DISTRICT

STRATUM - SAL NO. OF PLOTS- 301 AREA - 3234.85 SQ.KM. VOL.('000') M^3

Species description	Diameter classes(in c.m.)											
	10-15	15-20	20-25	25-30	30-35	35-40	40-50	50-60	60-70	70-80	80+	Total
Adina cordifolira	10.067	1.147	1.951	2.968	4.197	0.000	9.965	0.000	0.000	0.000	0.000	30.294
Anogeissus latifolia	86.474	131.890	144.442	171.601	66.545	64.868	0.000	0.000	0.000	0.000	0.000	665.820
Boswellia serrata	8.234	30.381	62.788	95.744	129.168	107.346	98.954	94.612	0.000	0.000	0.000	627.226
Diospyros melanoxylon	100.209	114.308	154.015	95.951	84.592	78.714	15.596	29.430	0.000	0.000	0.000	672.814
Lagerstroemia parviflora	23.396	13.238	29.736	5.109	0.000	0.000	0.000	0.000	0.000	0.000	0.000	71.479
Lannea coromandelica	36.781	21.056	46.763	27.868	0.000	9.124	0.000	0.000	0.000	0.000	0.000	141.591
Mitragyna parviflora	3.244	6.306	2.905	4.686	0.000	0.000	0.000	0.000	0.000	0.000	0.000	17.141
Dugeinia dalbergioides	30.731	18.690	10.716	7.673	0.000	0.000	0.000	0.000	0.000	0.000	0.000	67.810
Pterocarpus marsupium	43.187	80.416	118.147	144.721	125.313	100.226	38.683	52.314	0.000	0.000	0.000	703.009
Shorea robusta	921.361	1300.782	1629.106	1694.918	1918.418	1584.406	1752.253	1003.585	538.121	270.836	168.891	12782.680
Terminalia crenulata	256.138	320.796	313.149	224.493	154.091	89.504	84.723	19.585	0.000	0.000	0.000	1426.479
Miscellaneous species	737.417	636.612	567.775	437.893	386.414	314.173	278.34	320.424	38.963	178.785	408.469	4305.273
All species total	2257.239	2675.622	3081.493	2913.625	2868.738	2348.360	2242.521	1519.950	577.084	449.622	577.361	21511.617

Table No. 6.3 T(B)

STAND AND STOCK TABLES - RAIGARH DISTRICT

STRATUM - SAL NO. OF PLOTS - 152 AREA - 1633.54 SQ.KM. VOL/HA. (M^3)

Species description	Diameter classes(in c.m.)											
	10-15	15-20	20-25	25-30	30-35	35-40	40-50	50-60	60-70	70-80	80+	Total
Adina cordifolia	0.031	0.004	0.006	0.009	0.013	0.000	0.031	0.000	0.000	0.000	0.000	0.094
Anogeissus latifolia	0.267	0.408	0.447	0.530	0.206	0.201	0.000	0.000	0.000	0.000	0.000	2.058
Boswellia serrata	0.025	0.094	0.194	0.296	0.399	0.332	0.306	0.292	0.000	0.000	0.000	1.939
Diospyros melanoxylon	0.310	0.353	0.476	0.297	0.262	0.243	0.048	0.091	0.000	0.000	0.000	2.080
Lagerstroemia parviflora	0.072	0.041	0.092	0.016	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.221
Lannea coromandelica	0.114	0.065	0.145	0.086	0.000	0.028	0.000	0.000	0.000	0.000	0.000	0.438
Mitragyna parviflora	0.010	0.019	0.009	0.014	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.053
Dugenia dalbergioides	0.095	0.058	0.033	0.024	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.210
Pterocarpus marsupium	0.134	0.249	0.365	0.447	0.387	0.310	0.120	0.162	0.000	0.000	0.000	2.173
Shorea robusta	2.848	4.021	5.036	5.240	5.930	4.898	5.417	3.102	1.664	0.837	0.522	39.516
Terminalia crenulata	0.792	0.992	0.968	0.694	0.476	0.277	0.151	0.001	0.000	0.000	0.000	4.410
Miscellaneous species	2.280	1.968	1.755	1.354	1.195	0.971	0.860	0.991	0.120	0.553	1.263	13.309
All species total	6.978	8.271	9.526	9.007	8.868	7.260	6.932	4.699	1.784	1.390	1.785	66.500

Contents

Table No.6.4 T(A)
STAND AND STOCK TABLES - RAIGARH DISTRICT

STRATUM - MISCELLANEOUS NO.OF PLOTS - 152 AREA - 1633.54 SQ.KM VOLUMES'000' (M^3)

Species description	Diameter classes (in c.m,)											
	10-15	15-20	20-25	25-30	30-35	35-40	40-50	50-60	60-70	70-80	80+	Total
Adina cordifolia	10.638	12.156	7.469	7.177	0.000	17.983	36.979	13.140	0.000	0.000	0.000	105.542
Anogeissus latifolia	83.221	74.232	84.941	75.714	48.087	52.893	51.426	71.191	0.000	0.000	0.000	541.705
Boswellia serrata	4.717	51.487	120.029	170.800	306.434	184.574	449.193	65.675	0.000	53.904	0.000	1388.812
Diospyros melanoxylon	66.122	78.513	94.860	109.345	81.558	23.715	33.296	0.000	0.000	0.000	0.000	487.408
Lagerstroemia parviflora	45.267	31.280	39.966	34.435	9.017	24.961	28.824	0.000	0.000	0.000	0.000	213.758
Lannea coromandelica	36.441	51.921	59.556	59.529	16.685	29.926	0.000	0.000	0.000	0.000	0.000	254.058
Mitragyna parviflora	9.006	11.649	11.001	3.662	5.852	0.000	8.033	0.000	0.000	0.000	0.000	49.204
Dugenia dalbergioides	18.849	21.709	23.611	8.336	6.822	0.000	20.758	34.216	0.000	0.000	0.000	134.301
Pterocarpus marsupium	29.955	26.211	55.258	24.744	63.356	62.033	28.720	27.231	0.000	0.000	0.000	317.507
Shorea robusta	40.971	58.935	86.650	106.273	112.683	118.241	34.160	28.110	0.000	0.000	0.000	586.022
Terminalia crenulata	91.975	88.434	108.872	80.342	86.943	81.305	62.568	84.958	0.000	0.000	22.858	708.256
Miscellaneous speices	550.944	543.178	471.430	372.856	352.618	209.666	162.066	109.972	67.853	43.008	76.156	2959.749
All species total	988.106	1049.716	1145.643	1053.212	1090.054	805.296	916.022	434.494	67.853	96.912	99.014	7746.324

Table No. 6.4T(B)
STAND AND STOCK TABLES - RAIGARH DISTRICT

STRATUM - MISCELLANEOUS NO. OF PLOTS - 152 AREA - 1633.54 SQ.KM. VOLUME '000' (M^3)

Species description	Diameter classes (in c.m,)											
	10-15	15-20	20-25	25-30	30-35	35-40	40-50	50-60	60-70	70-80	80+	Total
Adina cordifolia	0.065	0.074	0.046	0.044	0.000	0.110	0.226	0.080	0.000	0.000	0.000	0.646
Anogeissus latifolia	0.509	0.454	0.520	0.463	0.294	0.324	0.315	0.436	0.000	0.000	0.000	3.316
Boswellia serrata	0.029	0.315	0.625	1.046	1.876	1.130	2.750	0.042	0.000	0.330	0.000	8.502
Diospyros melanoxylon	0.405	0.481	0.581	0.669	0.499	0.145	0.204	0.000	0.000	0.000	0.000	2.984
Lagerstroemia parviflora	0.277	0.190	0.245	0.211	0.055	0.153	0.176	0.000	0.000	0.000	0.000	1.309
Lannea coromandelica	0.223	0.318	0.365	0.364	0.102	0.183	0.000	0.000	0.000	0.000	0.000	1.555
Mitragyna parviflora	0.055	0.071	0.067	0.022	0.036	0.000	0.049	0.000	0.000	0.000	0.000	0.301
Dugenia dalbergioides	0.115	0.133	0.145	0.051	0.042	0.000	0.127	0.209	0.000	0.000	0.000	0.822
Pterocarpur marsupium	0.183	0.160	0.338	0.151	0.388	0.380	0.176	0.167	0.000	0.000	0.000	1.944
Shorea robusta	0.251	0.361	0.530	0.651	0.690	0.624	0.209	0.172	0.000	0.000	0.000	3.587
Terminalia crenulata	0.563	0.541	0.666	0.492	0.532	0.498	0.383	0.520	0.000	0.000	0.140	4.336
Miscellaneous species	3.373	3.325	2.886	2.283	2.159	1.284	0.992	0.673	0.415	0.263	0.466	18.119
All species total	6.049	6.426	7.013	6.447	6.673	4.930	5.608	2.660	0.415	0.593	0.606	47.420

Contents

Table No. 6.5T

STAND AND STOCK DISTRIBUTION(COMBINED)

AREA OF STRATUM - 486839.000000 CHARACTER - STEMS

Species description	Diameter classes (in c.m.)											
	10-15	15-20	20-25	25-30	30-35	35-40	40-50	50-60	60-70	70-80	80+	Total
Adina cordifolia												
Total	327898	98598	43781	32818	10891	32890	54745	10963	0.000	0.000	0.000	612587
Per ha.	.674	.203	.090	.067	.022	.068	.112	.023	0.000	0.000	0.000	1.258
Anogeissus latifolila												
Total	2021490	1070041	655151	436529	131059	98312	32890	21926	0.000	0.000	0.000	4467398
Per ha.	4.152	2.198	1.346	.897	.269	.202	.068	.045	0.000	0.000	0.000	9.176
Boswellia serrata												
Total	229299	426568	459315	448423	503311	240621	295652	54601	0.000	10963	0.000	2668757
Per ha.	.471	.876	.943	.921	1.034	.494	.607	.112	0.000	.023	0.000	5.482
Diospyros melanoxylon												
Total	2129333	1092039	786139	393463	218551	98168	32818	10891	0.000	0.000	0.000	4761406
Per ha.	4.374	2.243	1.615	.808	.449	.202	.067	.022	0.000	0.000	0.000	9.780
Lagerstroemia parviflora												
Total	1126862	284474	218622	76671	10963	21926	21926	0.000	0.000	0.000	0.000	1761448
Per ha.	2.315	.584	.449	.157	.023	.045	.045	0.000	0.000	0.000	0.000	3.618
Lannea coromandelica												
Total	1267524	492348	360788	186019	21926	43781	0.000	0.000	0.000	0.000	0.000	2372389
Per ha.	2.604	1.011	.741	.382	.045	.090	0.000	0.000	0.000	0.000	0.000	4.873
Mitragyna parviflora												
Total	207945	109347	54745	21855	10963	0.000	10963	0.000	0.000	0.000	0.000	415820
Per ha.	.427	.225	.112	.045	.023	0.000	.023	0.000	0.000	0.000	0.000	.854
Ougeinia dalbergioides												
Total	698718	251369	131273	43710	10963	0.000	21926	21926	0.000	0.000	0.000	1179889
Per ha.	1.435	.516	.270	.090	.023	0.000	.045	.045	0.000	0.000	0.000	2.424
Pterocarpus marsupium												
Total	928304	501808	447492	294363	229228	141950	43710	32746	0.000	0.000	0.000	2619605
Per ha.	1.907	1.031	.919	.605	.471	.292	.090	.067	0.000	0.000	0.000	5.381
Shorea robusta												
Total	14294128	7713433	5197011	3366840	2560493	1547345	1100210	403066	141592	54458	21783	36400368
Per ha.	29.361	15.844	10.675	6.916	5.259	3.178	2.260	.828	.291	.112	.045	74.769
Terminalia crenulata/tomentosa												
Total	3840627	2039621	1200097	545518	305685	163877	76528	54745	0.000	0.000	10963	8237664
Per ha.	7.889	4.190	2.465	1.121	.628	.337	.157	.112	0.000	0.000	.023	16.921
Miscellaneous species												
Total	22423632	8062312	3747112	1813329	1114467	567874	316648	207301	32818	54530	54530	38394560
Per ha.	46.060	16.561	7.697	3.725	2.289	1.166	.650	.426	.067	.112	.112	78.865
All species total												
Total	49495760	22141968	13301539	7659546	5128503	2956748	2008021	818170	174411	119952	87277	103891872
Per ha.	101.668	45.481	27.322	15.733	10.534	6.073	4.125	1.681	.358	.246	.179	213.401

Contents

Table No. 6.6T
STAND AND STOCK DISTRIBUTION(COMBINED)
AREA OF STRATUM 486839.000000 CHARACTER - VOLUME (M^3)

Species description	Diameter classes (in c.m.)											
	10-15	15-20	20-25	25-30	30-35	35-40	40-50	50-60	60-70	70-80	80+	Total
Adina cordifolia												
Total	20705	13302	9419	10144	4196	17982	46944	13139	0.000	0.000	0.000	135836
Per ha.	.043	.027	.019	.021	.009	.037	.096	.027	0.000	0.000	0.000	.279
Anogeissus latifolia												
Total	169694	206122	229383	247314	114632	117760	51425	71190	0.000	0.000	0.000	1207524
Per ha.	.349	.423	.471	.508	.235	.242	.106	.146	0.000	0.000	0.000	2.480
Boswellia serrata												
Total	12951	81867	164816	266543	435601	291919	548146	160287	0.000	53903	0.000	2016038
Per ha.	.027	.168	.339	.547	.895	.600	1.126	.329	0.000	.111	0.000	4.141
Diospyros melanoxylon												
Total	166330	192820	248874	205296	166149	102428	48891	29429	0.000	0.000	0.000	1160223
Per ha.	.324	.396	.511	.422	.341	.210	.100	.060	0.000	0.000	0.000	2.383
Lagerstroemia parviflora												
Total	68662	44526	69701	39544	9016	24960	28824	0.000	0.000	0.000	0.000	285237
Per ha.	.141	.091	.143	.081	.019	.051	.059	0.000	0.000	0.000	0.000	.586
Lannea coromandelica												
Total	73222	72977	106318	87396	16685	39049	0.000	0.000	0.000	0.000	0.000	395649
Per ha.	.150	.150	.218	.180	.034	.080	0.000	0.000	0.000	0.000	0.000	.813
Mitragyna parviflora												
Total	12249	17955	13906	8348	5851	0.000	8033	0.000	0.000	0.000	0.000	66344
Per ha.	.025	.037	.029	.017	.012	0.000	.017	0.000	0.000	0.000	0.000	.136
Ougeinia dalbergioides												
Total	49580	40398	34326	16009	6821	0.000	20757	34216	0.000	0.000	0.000	202110
Per ha.	.102	.083	.071	.033	.014	0.000	.043	.070	0.000	0.000	0.000	.415
Pterocarpus marsupium												
Total	73142	106626	173405	169464	188669	162258	67402	79545	0.000	0.000	0.000	1020515
Per ha.	.150	.219	.356	.348	.388	.333	.138	.163	0.000	0.000	0.000	2.096
Shorea robusta												
Total	962332	1359718	1715756	1801191	2031100	1702647	1786413	1031695	538120	270836	168891	13368703
Per ha.	1.977	2.793	3.524	3.700	4.172	3.497	3.669	2.119	1.105	.556	.347	27.460
Terminalia crenulata/tomentosa												
Total	348113	409230	422020	304834	241034	170809	111290	104542	0.000	0.000	22857	2134734
Per ha.	.715	.841	.867	.626	.495	.351	.229	.215	0.000	0.000	.047	4.385
Miscellaneous species												
Total	1288362	1179790	1039205	810749	739032	523839	440412	430396	106816	221793	484625	7265023
Per ha.	2.646	2.423	2.135	1.665	1.518	1.076	.905	.884	.219	.456	.995	14.923
All species total												
Total	3245345	3725337	4227136	3966837	3958792	3153656	3158542	1954444	644937	546533	676374	29257936
Per ha.	6.666	7.652	8.683	8.148	8.132	6.478	6.488	4.015	1.325	1.123	1.389	60.098

Contents

CHAPTER -VII

INVENTORY RESULTS - GROWING STOCK -BAMBOO

7.Ø AREA:

As stated in Chapter V there is no forest area in Raigarh district where bamboo brakes or pure bamboos are found. However, bamboos were found in association with trees in about 1Ø2Ø.96 Sq.km. area which constitutes about 21% of the total vegetated area. The occurrence of bamboo by quality, density, clump sizes, age groug and condition etc. are discussed in details in the following paragraphs.

7.1 BAMBOO AREA BY DENSITY AND QUALITY:

Table no. 7.1 T produced below gives distribution of bamboo areas by density and quality. The species found is Dendrocalamus strictus.The table indicates that 4Ø8.Ø9 Sq.km. area(8.38%) was found under first quality bamboo (average culm-height 6 m.or more), 42.Ø9 Sq.km area Ø.84%) undr second quality bamboo (average culm height 4-6 m) and the rest 569.59 Sq.km. area(11.69%) was found under regeneration crop of bamboo where clump formation had not then taken place.

Table No. 7.1 T

Bamboo area by density and quality

Density	Quality				Total
	1	2	3	4	
1	-	-	-	-	-
2	21.49 (2)	-	-	-	21.49 (2)
3	42.99 (4)	-	-	-	42.99 (4)
4	96.72 (9)	-	-	-	96.72 (9)
5	1Ø7.47 (1Ø)	-	-	-	1Ø7.47 (1Ø)
6	139.71 (13)	42.99 (4)	-	-	182.7Ø (17)
7.	-	-	354.65 (33)	-	354.65 (33)
8.	-	-	214.94 (2Ø)	-	214.94 (2Ø)
Total	4Ø8.38 (38)	42.99 (4)	569.59 (53)		1Ø2Ø.96 (95)

Note:- Bamboo density: -

Contents

Code	Description	
1	Pure bamboo	- 200 or more clumps/ha.
2	Very dense	- 150-200 clumps/ha.
3	Dense	- 100-150 clumps/ha.
4	Moderately dense	- 50-100 clumps/ha
5	Scattered	- 20-50 clumps/ha.
6	Sparse	- 1-20 clumps/ha.
7	Bamboo present but clumps completely hacked by people.	
8	No bamboo	- Totally bamboo absent.
9	Regeneration crop- clump formation has not yet taken place.	

7.2 CLUMPS/HA BY QUALITY AND CLUMP SIZE CLASSES:

Table no. 7.2T produced below gives the number of bamboo clumps present per hectare in the forests of Raigarh district by their quality and clump sizes. It was estimated that 75.405 clumps of diameter less than 1 m, 20.270 clumps of diameter 1-2 m, and 0.541 clumps of diameter above 2 m, were found per hectare under first quality bamboos. Under second quality bamboos, 6.667 clumps of below 1 m diameter class were found per hectare in the forests of the district.

Table No.7.2T

No. of clumps/ha by quality and clump sizes

Quality	Clumps size			Total
	< 1 m	< 2 m	< 3 m	
1	75.405	20.270	0.591	
2	6.667	-	-	

7.3 MEAN NUMBER OF BAMBOO CULMS/CLUMP BY AGE:

Table no. 7.3T produced below gives distribution of culms/culmp by age of the culms. Accordingly, it was estimated that in clump size I, having diameter below 1 m there are 6.659 culms/ha of different age groups whereas in clump size II, having diameter 1-2 m, there are 16.273 clumps of different age groups. The second quality bamboo has small clumps with only 5 culms of different age group in each clump.

Contents

Table No. 7.3T

Mean number of bamboo culms/clump by age

Species- Dendrocalamus strictus

Quality	Clump size class	Current year	One to two season	Over two seasons old.	Dry sound	Dry damaged.	Decayed	Total
	1	1.583	1.617	2.488	0.149	0.659	0.213	6.659
1	2	2.818	2.273	6.909	0.455	0.909	2.909	16.273
	3	-	-	-	-	-	-	-
	1	-	1.000	2.000	1.000	1.000	-	5.000
2	2	-	-	-	-	-	-	-
	3	-	-	-	-	-	-	-

7.4 MEAN NUMBER OF BAMBOO CULMS/CLUMP BY SOUNDNESS:

Table no.7.4T produced below gives distribution of culms per clump by the soundness of the culms. Accordingly, it was estimated that out of a total of 16.273 culms per clump only 8.181 culms were found to be green sound in bigger sized clumps, the other culms are either damaged, dry or defective. Even in smaller clump sizes, only 50% of the culms per clump are green sound and the rest have some or the other defects. Almost the same trend is seen in second quality bamboo.

Table No. 7.4T

Mean number of bamboo culms/clump by soundness

Quality	Clump size	Green sound	Green damaged	Dry sound	Dry damaged	Decayed	Total
	1	4.468	1.170	0.149	0.659	0.213	6.659
1	2	8.181	3.819	0.455	0.909	2.909	16.273
	3	-	-	-	-	-	-
	1	2.000	1.000	1.000	1.000	-	5.000
2	2	-	-	-	-	-	-
	3	-	-	-	-	-	-

7.5 MEAN NUMBER OF BAMBOO CULMS/CLUMP BY QUALITY, SIZE CLASS, AGE AND SOUNDNESS:

Table no. 7.5T produced below gives distribution of culms/clump by quality, age and soundness of culms. The table indicates that major occurrence of culms/clump is under small sized culms having diameter 2-5 cm. at breast height. Bamboo area is not very rich with regard to occurrence of bamoos, its quality, density and soundness.

Table No. 7.5T

Mean number of bamboo culms/clump by quality, size class, age and soundness

Quality	Clump size class	Green sound culms						
		One two season old				Over two season old		
		Current year	2 <5 cm	5 <8 cm	>8 cm	2 <5 cm	5 <8 cm	>8 cm
1	1	1.255	1.213	-	Ø.Ø64	1.936	-	-
	2	2.454	1.364	-	-	3.545	Ø.818	-
	3	-	-	-	-	-	-	-
2	1	-	1.ØØØ	-	-	1.ØØØ	-	-
	2	-	-	-	-	-	-	-
	3	-	-	-	-	-	-	-
3	1	-	-	-	-	-	-	-
	2	-	-	-	-	-	-	-
	3	-	-	-	-	-	-	-

Table No. 7.5T(Contd)

Quality	Clump size class	Green damanged culms						
		One two season old				Over two season old		
		Current year	2 <5 cm	5 <8 cm	>8 cm	2 <5 cm	5 <8 cm	>8 cm
1	1	Ø.298	Ø.34Ø	-	-	Ø.532	-	-
	2	Ø.364	Ø.273	Ø.636	-	2.182	Ø.364	-
	3	-	-	-	-	-	-	-
2	1	-	-	-	-	1.ØØØ	-	-
	2	-	-	-	-	-	-	-
	3	-	-	-	-	-	-	-
3	1	-	-	-	-	-	-	-
	2	-	-	-	-	-	-	-
	3	-	-	-	-	-	-	-

Contents

Table No. 7.5T(Contd.)

Quality	Clump size class	Dry sound culms 2 <5 cm	5 <8 cm	>8 cm	Dry damaged culms 2 <5 cm	5 >8 cm	>8 cm	Decayed culms	Total
1	1	0.149	-	-	0.659	-	-	0.213	6.659
	2	0.364	0.091	-	0.727	0.182	-	2.909	16.273
	3	-	-	-	-	-	-	-	-
2	1	1.000	-	-	1.000	-	-	-	5.000
	2	-	-	-	-	-	-	-	-
	3	-	-	-	-	-	-	-	-
3	1	-	-	-	-	-	-	-	-
	2	-	-	-	-	-	-	-	-
	3	-	-	-	-	-	-	-	-

7.6 MEAN NUMBER OF BAMBOO CULMS/HECTARE BY AGE:

Table no.7.6T produced below gives the distribution of bamboo culms per hectare found in Raigarh district by age and quality classes. Accordingly, 831.97 culms per hectare of first quality bamboos and 33.34 culms per hectare of second quality bamboos(total 865.31 culms/ha) were found in the vegetated forest area of the district. The major bamboo crop is of first quality. In first quality bamboo, the current year's culms contribute significantly whereas in second quality bamboo the current year's culms are absent. The occurrence of second quality bamboo is very sparse and sporadic.

Table No. 7.6T
Mean number of bamboo culms/ha by age

Quality	Clump size	Current year	One to two season old	Over two season old	Dry sound	Dry damaged	Decayed	Total
I	1	117.10	121.93	186.10	11.24	49.69	11.06	501.12
	2	57.12	46.07	140.05	9.22	18.42	58.97	329.85
	3	-	-	-	-	-	-	-
Total		174.22	168.00	326.15	20.46	68.11	70.03	830.97
II	1	-	6.67	13.33	6.67	6.67	-	33.34
	2	-	-	-	-	-	-	-
	3	-	-	-	-	-	-	-
G.Total		174.22	174.67	339.48	27.13	74.78	70.03	864.31

Contents

MEAN NUMBER OF BAMBOO CULMS/HA BY SOUNDNESS:

Table no.7.7T produced below gives distribution of mean number of culms found per hectare by their soundness and quality classes. The table indicates that in all 63% culms are sound and the rest 37% have some defects. 75.03 culm per hectare were found to be decayed which have no utility. The other defective culms are utilisable for some or other purpose.

Table No. 7.7 T

Mean number of bamboo culms/ha. by soundness

Quality	Class size class	Green sound	Green damaged	Dry sound	Dry damaged	Decayed	Total
I	1	336.91	88.22	11.24	49.69	16.06	502.12
	2	165.33	77.41	9.22	18.42	58.97	329.85
	3	-	-	-	-	-	-
Total		502.24	165.63	20.46	68.11	75.03	831.97
II	1	13.33	6.67	6.67	6.67	-	33.34
	2	-	-	-	-	-	-
	3	-	-	-	-	-	-
Grand total I+II		515.57	172.30	27.13	74.78	75.03	865.31

7.8 TOTAL NUMBER OF BAMBOO CULMS BY SOUNDNESS:

Table no.7.8T produced below gives total growing stock of bamboos by soundness of culm. The table indicates that in all 33975990 culms of first quality bamboo and 143320 culms of second quality are estimated to occur in bamboo forests of Raigarh district which cover about 1020.96 Sq.km. of vegetated area. Total 34119310 culms of different sizes, quality and soundness were found, out of which 3064080 (9%) are decayed which have no utility and the rest 91% are utilizable.

Contents

Table No. 7.8 T

Mean number of bamboo culms(000)by soundness

Quality	Class size class	Green sound	Green damaged	Dry sound	Dry damaged	Decayed	Total
I	1	13758.75	3602.73	459.02	2029.24	655.86	20505.58
	2	6772.16	3161.27	376.52	752.24	2402.22	13470.41
	3	-	-	-	-	-	-
Total		20530.91	6764.00	835.54	2781.48	3058.08	33975.99
II	1	57.31	28.67	28.67	28.67	-	143.32
	2	-	-	-	-	-	-
	3	-	-	-	-	-	-
G.Total		20588.22	6792.67	864.21	2810.15	3058.08	34119.31

7.9 GREEN BAMBOO STOCK BY SOUNDNESS, QUALITY AND CLUMP SIZES:

Table no. 7.9T produced below gives distribution of bamboo growing stock in thousands of tonnes, by quality and soundness of culms and by clump sizes. The green weight of the growing stock has been estimated using the following factors for green equivalent weight of different types of bamboo culms found in the area. The green weight of sample bamboos from each quality and diameter class was collected during survey work and the total green weight was estimated.

1.	Dry sound	1.0
2.	Dry damaged	1.0
3.	Green sound	1.0
4.	Green damaged	1.0
5.	Decayed	0.0

Accordingly, it was estimated that in all 118238 tonnes of first quality bamboo and 572 tonnes of second quality bamboo (118810 tonnes) was present in the district. There are 69135 tonnes of bamboos under clump size I and 49103 tonnes under clump size II in the first quality and 572 tonnes under clump size I in second quality bamboo.

Contents

Table No. 7.9T

Green bamboo stock (in ØØØ tonnes) by soundness and quality

Quality	Class size class	Green sound	Green damaged	Dry sound	Dry damaged	Total
I	1	51.879	6.546	3.335	7.375	69.135
	2	31.Ø67	9.691	4.174	4.171	49.1Ø3
	3	-	-	-	-	-
Total		82.946	16.237	7.5Ø9	11.546	118.238
II	1	Ø.2Ø8	Ø.Ø52	Ø.2Ø8	Ø.1Ø4	Ø.572
	2	-	-	-	-	-
	3	-	-	-	-	-
Grand total		83.154	16.289	7.717	11.65Ø	118.81Ø

7.1Ø GREEN BAMBOO STOCK BY QUALITY, SIZE CLASSES, AGE AND SOUNDNESS:

Table no.7.1ØT produced below gives distribution of total bamboo growing stock in thousand tonnes by clump size class, qauality, age and soundness of culms. The table indicates that major bamboo stock is under lower diameter class of clumps. The bigger size clumps and the culms were found less in number in the district. Hence, the bamboo crop can be said to be of poor stocking both in terms of number of culms, their weight and quality.

Table No. 7.1Ø T

Green bamboo stock in 'ØØØ' tonnes by quality, size class, age and soundness

Quality	Clump size class	Green sound culms						
		One two season old				Over two season old		
		Current year	2 <5 cm	5 <8 cm	>8 cm	2 <5 cm	5 <8 cm	>8 cm
1	1	14.Ø44	13.574	-	2.596	21.665	-	-
	2	7.382	4.1Ø3	-	-	1Ø.664	8.918	-
	3	-	-	-	-	-	-	-
Total		21.426	17.677	-	2.596	32.329	8.918	-
2	1	-	Ø.1Ø4	-	-	Ø.1Ø4	-	-
	2	-	-	-	-	-	-	-
	3	-	-	-	-	-	-	-
Total		-	Ø.1Ø4	-	-	Ø.1Ø4	-	-

Contents

3	1	-	-	-	-	-	-	-
	2	-	-	-	-	-	-	-
	3	-	-	-	-	-	-	-

Table No. 7.10T(Contd.)

Quality	Clump size class	Green damaged culms						
		One two season old				Over two season old		
		Current year	2 <5 cm	5 <8 cm	>8 cm	2 <5 cm	5 <8 cm	>8 cm
1	1	1.667	1.902	-	-	2.977	-	-
	2	0.547	0.411	3.467	-	3.282	1.984	-
	3	-	-	-	-	-	-	-
	Total	2.214	2.313	3.467	-	6.259	1.984	-
2	1	-	-	-	-	0.052	-	-
	2	-	-	-	-	-	-	-
	3	-	-	-	-	-	-	-
	Total	-	-	-	-	0.052	-	-
3	1	-	-	-	-	-	-	-
	2	-	-	-	-	-	-	-
	3	-	-	-	-	-	-	-

Table No. 7.10T(Contd.)

Quality	Clump size class	Dry sound culms		Dry damaged culms		Total
		2 <5 cm	5 <8 cm	2 <5 cm	5 >8 cm	
1	1	3.335	-	7.375	-	69.135
	2	2.190	1.984	2.187	1.984	49.103
	3	-	-	-	-	-
	Total	5.525	1.984	9.562	1.984	118.238
2	1	0.208	-	0.104	-	0.572
	2	-	-	-	-	-
	3	-	-	-	-	-
	Total	0.208	-	0.104	-	0.572
3	1	-	-	-	-	-
	2	-	-	-	-	-
	3	-	-	-	-	-

Contents

7.11 COMPARISON OF RESULTS OF BAMBOO GROWING STOCK WITH THE RESULTS OF STATE'S SURVEY:

As a result of earlier survey conducted by State Forest Department during 1975-77, bamboo was found to be occurring overlapping in 6.25% of total forest area surveyed by them. However, during our survey bamboo was found to be occurring (overlapping) in 1020.96 Sq.km. area which is 21% of total vegetated area, out of which 8.38% area was under first quality bamboo, 0.84% area under second quality bamboo and the rest 11.69% area was found to be under regeneration crop wherein the clump formation had not taken place. Thus, there appears to be increase in bamboo forest area from 1975-77 to 1985.

Further, the total bamboo stock was estimated to be 7396000 culms on the basis of 1975-77 survey. As per the results of inventory survey condcuted by Forest Survey of India, the total growing stock of bamboos was estimated to be 34119310 culm which when converted in terms of weight was found to be 118810 tonnes of green bamboo. Thus, with regard to growing stock also there is substantial increase in the bamboo growing stock from years 1975-77 to 1985. It is, however, again mentioned that State Forest Survey was confined to only 4008 Sq.km. as aganist 6029 Sq.km. area surveyed by this organisation.

****

ANNEXURE -I

GLOSSARY OF LOCAL AND BOTANICAL NAMES OF COMMON TREES, WEEDS, CLIMBERS AND GRASSES

Local Name	Botanical Name	Family
1	2	3
Achar	Buchanania lanzan	Anacardiaceae
Am	Mangifera indica	-do-
Amaltas	Cassia fistula	Caesalpiniaceae
Amta	Bauninia malabarica	-do-
Aonla	Emblica officinalis	Euphorbiaceae
Apta	Bauhinia racemosa	Caesalpiniaceae
Arjun(koha)	Terminalia arjuna	Combretaceae
Bahera	Terminalia belerica	-do-
Bar	Ficus benghalensis	Urticaeceae
Baranga	Kydia calycina	Malvaceae
Bel	Aegle marmelos	Rutaceae
Ber	Zizyphus mauratiana	Rhamenaceae
Bhilwa	Semecarpus anacardium	Anacardiaceae
Bhirra	Chloroxylon swietenia	Maliaceae
Bhornrmal	Hymenodictyon excelsum	Rubiaceae
Bijasal	Pterocarpus marsupium	Papulionaceae
Chichwa	Albizzia odoratissima	Mimisaceae
Chirol	Holoptelea integrifolia	Urticaceae
Dahiwas	Cordia dishooma	Boraginaceae
Datrangi	Ehretia leavis	-do-
Dengla	Securinega virosa	Euphorbiaceae
Dhaman	Grewia tiliaefolia	Tiliaceae
Dhaora	Anogeissus latifolia	Combretaceae
Dhobin	Dalbergia paniculata	Papilionaceae
Dudhi	Holarrhena antidysentrica	Apocynaceae
Garari/Karra	Cleistanthus collinus	Euphorbiaceae
Ghont	Zizyphus xylopyra	Rhamnaceae
Haldu	Adina cordifolia	Rubiaceae
Gongal	Cochlospermum religiosum	Bixaceae
Harra	Terminalia chebula	Combretaceae
Harsinger	Nyctanthes arbortristis	Oleaceae
Hiwar	Acacia leucophloea	Mimisaceae
Imli	Tamarindus indica	Ceasalpiniaceae
Jamrasi	Elaeodendron glaucum	Celastroceae
Jamun	Syzygium cumini	Myrtaceae
Kachnar	Bauhinia variegata	Ceasalpiniaceae
Kakai	Flacourtia indica	Bixaceae
Kalmi	Mitragyna parvifolia	Rubiaceae
Karanji	Pongamia pinnata	Papilionaceae
Kasai	Bridelia retusa	Euphoribiaceae
Khair	Acacia catechu	Mimosaceae
Kulu	Sterculia urens	Sterculiaceae
Kumbhi	Careya arborea	Myrtaceae
Kusum	Schliechera oleosa	Sapindaceae
Lasora	Cordia dichotoma	Boraginaceae

Contents

Lendia	Lagerstroemia parviflora	Lythraceae
Lokhandi	Ixora arborea	Rubiaceae
Maharukh	Ailanthus excelsa	Simarubaceae
Mahua	Madhuca indica	Sapindaceae
Mainphal	Randia dumetorum	Rubiaceae
Mokha	Schrebra swietenioides	Oleaceae
Moyen	Lannea coromandelica	Anacardiaceae
Neem	Azadirachta indica	Meliaceae
Padar	Stereospermum suaveolens	Bignoniaceae
Palsas	Butea monosperma	Papilionaceae
Padar(chhota)	Stereospermum personatum	Bignoniaceae
Panjre	Erythrina suberosa	Papilionaceae
Papra	Gardenia latifolia	Rubiaceae
Phetra kala	Randia ulginosa	-do-
Phetra safed	Gardenia turgida	-do-
Pipal	Ficus religiosa	Urticaceae
Rohan	Soymida febrifuga	Meliaceae
Sagon	Tectona grandis	Verbenaceae
Saja	Terminalia tomentosa	Combretaceeae
Sal	Shorea robusta	Dipterocarpaceae
Salai	Boswellia serrata	Burseraceae
Semal	Bombax ceiba	Malvaceae
Shisham	Dalbergia latifolia	Papilionaceae
Sinduri	Mallotus philippensis	Euphorbiaceae
Siris safed	Albizzia procera	Mimosaceae
Siris kala	Albizzia lebbeck	-do-
Sissoo	Dalbergia sissoo	Papilionaceae
Siwan	Gmalina arborea	Verbenaceae
Tendu	Diospyros melanoxylon	Ebenaceae
Tilwa	Windlandia exserta	Rubiaceae
Tinsa	Ougeinia oojeinensis	Papilionaceae
Umar	Ficus glomerata	Urticaceae
Bans	Dendrocalamus strictus	Gramineae

COMMON WEEDS

Amera	Colebrookia
Baichandi	Dioscorea daemona
Baibarang	Embelia robusta
Chhind	Phoenix acaulis
Childi	Flemingia bracteata
Dhawai	Woodfordia floribunda
Dikamali	Gardenia lucida
Gursakri	Grewia hirsuta
Gokhuru	Tribulus terrestris
Khirsai	Nyetanthes arbortristis
Kuro	Holarrhena antidysenterica
Marorphal	Helicteres isora
Neel	Indigofera pulchella
Sindhuri	Mallotus phillipphensis

Contents

COMMON CLIMBERS

Gurar	Millittia auriculata
Kalsibel (keoti)	Ventilago calyculata
Malkamini	Celastrus paniculata
Mahul	Bauhinia vahlii
Nasbel	Spatholobus roxburghii
Palasbel	Butea superba
Ramdaton	Smilax macrophylla

COMMON GRASSES

Bhusbhusi	Eragrostis tenella
Chhir	Imperata cylindrica
Ghunad	Anthistiria cialiata
Khus	Vetiveria zizanioides
Kusal	Heteropogon contortus
Phulbahari	Thysanolaena maxima
Rusa	Cymbiopogon martinii
Sabai	Eulaliopsis binata

******

Contents

ANNEXURE - II

BIBLIOGRAPHY

1. Working plan of Raigarh Forest Division.
2. Working plan of Jashpur Forest Division.
3. District Statistical Handbook of Raigarh District.
4. Census Report of 1971 Census of Madhya Pradhes.

******

Contents