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GOVERNMENT OF INDIA
MINISTRY OF ENVIRONMENT AND FORESTS

REPORT ON INVENTORY OF FOREST RESOURCES OF BELLARY, CHITRADURGA, TUMKUR, BANGALORE AND KOLAR DISTRICTS OF KARNATAKA

FOREST SURVEY OF INDIA
SOUTHERN ZONE
BANGALORE
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P R E F A C E

The inventory of Forest Resources of Bellary District was taken up during 1983 and subsequently the districts of Chitradurga, Tumkur, Bangalore and Kolar were taken up during 1986.

The consolidated report presents a scenario of the results of the inventory work taken up in the above mentioned five districts. The report gives details of the inventories area, the methodology adopted, results and the findings.

Some of the salient findings of the inventory are that the net forest area is 4728.02 km2. and tree forest area is 2789.33 km2. The total number of stems of all species in tree forest area of the inventoried area is 1,56,61,006 with an average of 56.14 stems per hectare. The total standing volume in the tree forest area is 20,41,310 M^3 with Hardwickia binata comprising 3,80,056 M^3 of the total. Based on the study, indications are that the climatic, edaphic and biotic factors are less favourable and congenial, thus depicting poor quality of the crop. Few measures to tackle these have been suggested.

The inventory work was carried out by the staff of Southern Zone and the work is commendable. The cooperation and help extended by the Karnataka Forest Department at every stage is highly appreciated and thankfully acknowledged.

It is hoped that the report will serve the Foresters in their planning at different levels. Comments on the report would be most welcome.

JAGIR SINGH
DIRECTOR

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Summary

This report deals with the inventory of forest resources of Bellary, Chitradurga, Tumkur, Kolar and Bangalore carried out by Forest Survey of India, Southern Zone, w.e.f. 1983 to 1986. The first part of this report deals with the details of area inventoried, methodology of data collection and processing and the discussions on results. The second part consists of the appendices relevant to the report giving detail tables and other statistics and maps. The findings of survey are summarised below :-

1. Net forest area in inventoried area is 4728.02 km2. and tree forest area is 2789.33 km2.
2. There appears to be four major strata which are Khair, Salai, Deciduous and Miscellaneous, the later two forms the bulk of the crop composition, with 57.44 and 34.40 per cent respectively.
3. Soils appear to range from very shallow to shallow in about 65.9 percent of area and 24 percent of area has medium deep soils.
4. 94 percent of the inventoried area is subjected to mild erosion.
5. About 30.34 percent of area is covered by high and medium rockiness type.
6. There appears to be good deal of (74.27 percent) natural forest from seed origin, with man-made plantations covering about 19.66 percent of the area.
7. The size class of the crop consists mainly of pole size with 53 percent. Regeneration crop to an extent of 30.50 percent. Big timber size class and mixed size classes are very low.
8. The average height of the trees of the area is low with 74 percent of it coming under height class of 0-5 M.
9. Regeneration is absent in about 74 percent of the area and inadequate in 23 percent.
10. About 38 percent of the area has potential for plantation.
11. 93 percent of the area surveyed is under reserve forest and about 3.13 percent is private forests.
12. Heavy grazing occurs in about 31 percent of the area and medium to light grazing occurs in about 54 percent of the area.
13. The total No. of stems of all species in tree forest area is 1,56,61,006 which works out to an average of 56.14 stems per ha.
14. The total standing volume in the tree forest area is about 20,41,310 M3 with Hardwickia binata comprising 3,80,046 M3 of the total.
15. The percentage of presence of bamboo in the area is very low i.e. about 6.85 percent out of which 3.33 percent of the area has bamboo completely hacked.

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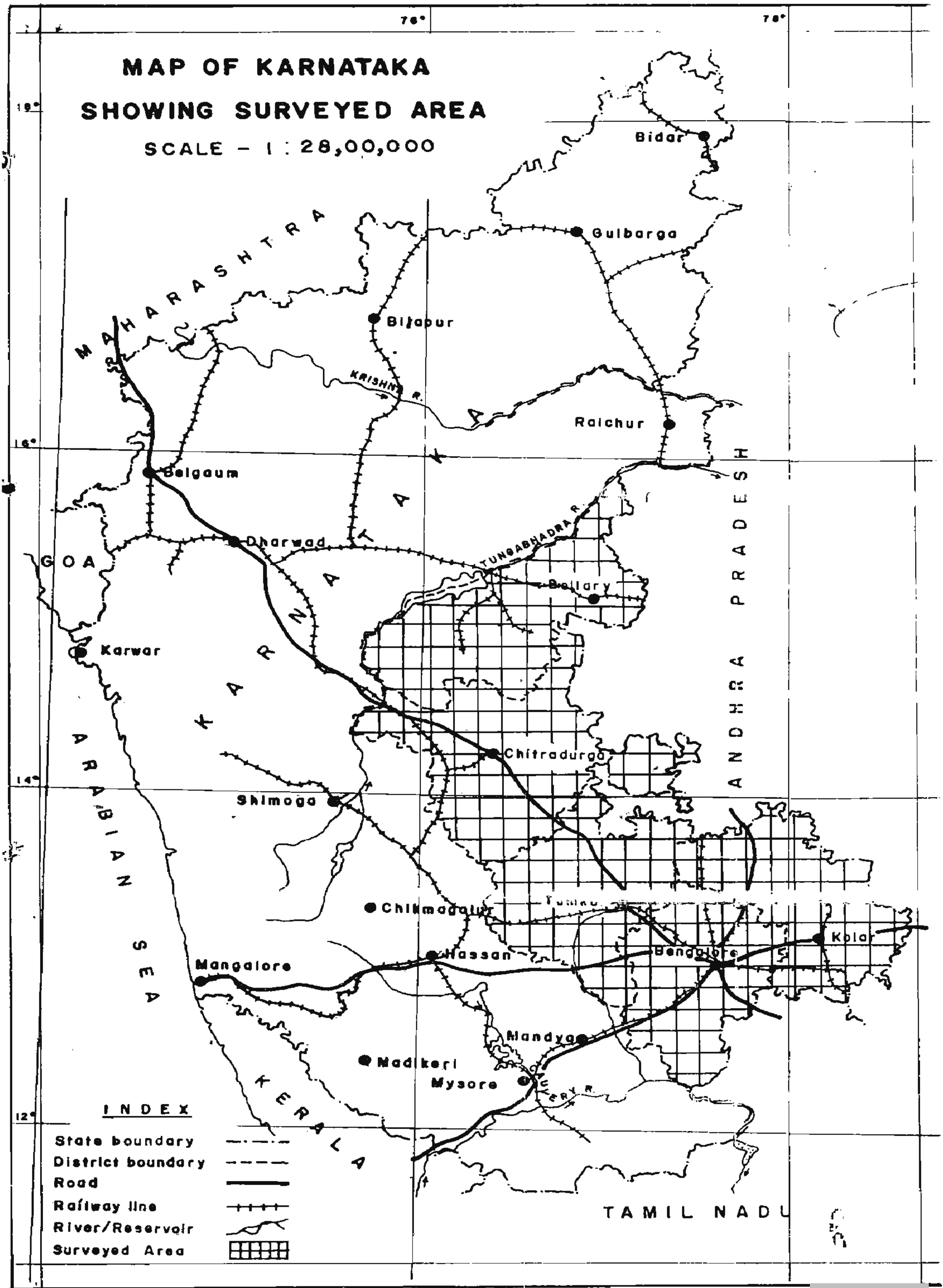
MAP OF KARNATAKA
SHOWING SURVEYED AREA
SCALE - 1 : 28,00,000
78°
19°
16°
14°
12°
Bidar
Gulbarga
Bijapur
Raichur
Belgaum
Dharwad
Bellary
Karwar
Chitradurga
Shimoga
Chikmagalur
Hassan
Bangalore
Kolar
Mangalore
Mandya
Madikeri
Mysore
MAHARASHTRA
KARNATAKA
GOA
ARABIAN SEA
KERALA
ANDHRA PRADESH
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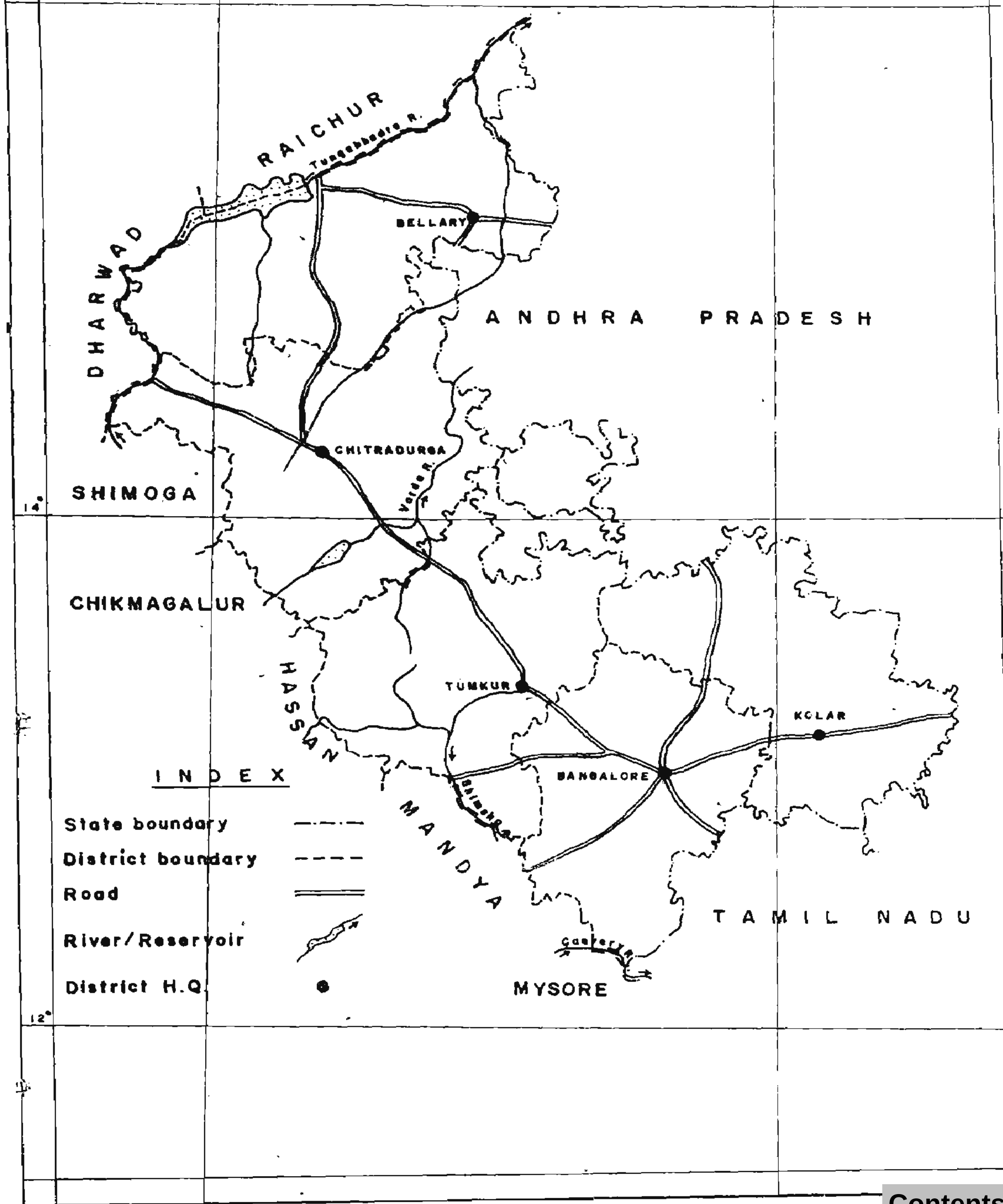

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CHAPTER - I
INTRODUCTION

Evaluation of wood resources both quantitatively and qualitatively is an essential aspect of forest inventory. The purpose of the inventory should, however, be well defined with objectives clearly visualised to help and develop and adopt a proper design and methodology which in turn will help to achieve the desired objectives. Besides, quantitative estimates, consumption pattern studies also forms an integral part of the inventory.

Inventories are taken up at various levels depending on the objectives to be achieved and also taking into account the immediate problems to be solved and priorities to be assigned. Information collected and compiled for one level of study may be inadequate for another. Inventories are done with 100 percent enumeration when area involved is small but mostly it is sampling inventory which is generally resorted to. The objectives of the inventory are to be clearly defined so that an efficient design may be adopted to achieve the desired results. Inventories are taken up at the national level or for large tracts of forest area and these differ from those taken up for preparation of Working Plans. Sometimes a combination of inventories types may be needed to efficiently achieve the desired objectives.

The inventory taken up by Forest Survey of India comes under the category of National Forest Inventories. The main objective of the field inventory is to collect qualitative and quantitative information on forest resources within precise limits, so that the data are useful for State and National level planning.

The present inventory of Bellary, Chitradurga, Tumkur, Kolar and Bangalore districts undertaken by Forest Survey of India, Southern Zone, Bangalore highlights the general points about the resources. The field work was undertaken in the year 1983-86.

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General Features of the Survey Area
Location of the area and its boundaries :

The surveyed area comprised of five districts namely Bellary, Chitradurga, Tumkur, Bangalore and Kolar. They lie between 12°14' and 15°50' North latitudes and 75°37' and 78°35' East longitudes and form part of the Eastern boundary of Karnataka. The five districts consist of five forest divisions besides other special divisions. The area is bound in the East by Tamilnadu and Andhra Pradesh and West by other districts of Karnataka.

Physical Features

The surveyed area consists of five districts. Bellary the northern most has some hilly areas but Hospet, Kudligi, Bellary areas are mostly plain. Most of Sandur area is hilly with steep slopes. Highest elevation of 1161.29 M above MSL is in the Sandur range and lowest being 490.73 M above MSL in Bellary Range. In Chitradurga district it is crossed from south to South-East to North, North-West by a belt of broad intermittent parallel chains of low hills which are mostly barren and stony. The highest point being 1181 M above MSL of Hala Ramaswaragudda in Hosadurga Taluk. Ecehalagadda and Jogimatti hills in Eastern ranges with heights of 1159 M above MSL and 1159 M above MSL respectively are also prominent peaks. The hills in the Tumkur district from the continuation of Eastern boundary of Krishna River system in Karnataka, consisting of two main ranges running more or less parallel one entering from North-West side from Chitradurga district and running in an almost straight line in South-West direction beyond Chikkanayakanahalli, the remaining area is open and undulating. The tallest of the hills is Sidda Betta at 1259.4 M above MSL and Devarayanadurga at 1246.2 M above MSL. The top of the hills are occassionally flat and the slopes are usually steep and rocky. In Bangalore district the Arkavathi valley has the Cauvery flowing at its Southern base. Elevation of the rising ground at Bangalore is 950 M above MSL.

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On the Eastern side, the broken chain of rocky hills extending from Nclamangala Taluk to Magadi, Channapatna, Kanakapura. The highest mountain is Sivaganga 1387 M above MSL. The Central-Northern and Eastern portions are mainly open and undulating. Kolar district is located in Southern maidan region. The general plateau is interrupted by number of hills more. So, in North the Nandidinga Range of mountains has a peak of 1478 M above MSL.

Forests

The inventoried area mainly consists of dry deciduous type of forest. In Bellary area the major portion is comprised of dry mixed deciduous and scrub type forest varying in condition, composition and density of crop. The average height of the crop varies from 6-8 M. In areas where rainfall is better and sub soil water level is higher, the forest type is better. According to Champion and Seth, the area is classified into :-

i) $5A/C_3$ - Southern Tropical Dry Mixed Deciduous.

ii) 6A/DST - Southern Tropical Dry Deciduous.

iii) $5E_4$ - Southern Tropical Hardwickia Forests.

Due to poor and shallow soil and low rainfall the growth in Sandur Range is of low, stunted admixture of xerophytes and thorny species. Most of the area consists of Anogeissus latifolia with Terminalia tomentosa. Tectona grandis in patches is confined to higher slopes or hill tops. Sandal is present in undulating areas. Overall the forests are thickly wooded and better stocked than other ranges as locality factors are more favourable. In Kudligi, Harapanahally areas the crop is thorny scrub with crooked branches, with Acacia catechu, Albizzia amara, Hardwickia binata. In Hospect area, Hardwickia binata, Anogeissus latifolia are some of the common species. Sandal occurs naturally in Hospect and Sandur areas.

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Forests of Chitradurga Division are mainly dry deciduous, scrub type and the growth is stunted. Extensive grazing and excessive biotic interference has resulted in degradation. Soil erosion is heavy and the rainfall is erratic and scanty. Hardwickia binata, Acacia sundra, Anogeissus latifolia, Soymida febrifuga are some of the important species.

Deciduous species mainly comprise the forests of Tumkur area, crop is characterised by low, stunted and branchy boles. Even trees such as Tectona grandis, Pterocarpus marsupium, Dalbergia latifolia are not able to grow to good size. In clayey areas, Shorea talura is seen mainly near the source of streams and where water percolates. Teak is found generally in higher regions. Naturally occuring Tamarind and Sandal are also seen. As per Champion and Seth the classification is :-

Dry Tropical Forests :	Group-5 :	Tropical Dry Deciduous Forests
	Group-6 :	Tropical Thron Forests
Sub	Group-6A:	Southern Tropical Thorn Forests.

The average height of crop is about 6.5 M. Some of the main species are Terminalia tomentosa, Terminalia paniculata Hardwickia binata, Anogeissus latifolia, Chloroxylon swietenia. Sandal occurs in profusion and associated commonly with Tamarind. Zizyphus and Albizzia species. Bamboo occurs in slopes and hill tops.

In Bangalore district, the forests mainly consist of dry deciduous type with thorny undergrowth. According to Champion & Seth the classification is :

$5A/C_1a$ - Southern Tropical Dry Teak.
$5A/C_3$ - Southern Dry Mixed Deciduous Forests,
$6A/C_1$ - Southern Tropical Thorny Forests.
$6A/DS_1$ - Southern Tripical Thorny Scrub.

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In the Dry Deciduous type the average height is about 9 M. Some of the common species are Teak, Rosewood, Terminalia and all are of very poor quality.

Forest Resources are meagre in Kolar district and devoid of any valuable vegetation. Most of the vegetation is confined to the hilly tracts and the forests are predominantly Dry Deciduous type or of Thorny Scrub Type. The growing stock is stunted. Area around Nandi has some Sandal wood and the remaining area is mainly scrub jungle interspersed with Eucalyptus, Pongamia and Tamarind.

Various working circles are prescribed for better management of the existing forests. Fuel working circles have been prescribed in Bellary, Chitradurga keeping in view of the demand for fuel, laying emphasis on equal production. Sandal working circle is constituted in areas where Sandal is growing and Protection Working Circle constitutes an important circle in Bellary area in view of the area being leased out for mining operation. Regeneration Working Circle in Tumkur areas covers forest area with open scrub type of forests and other revenue lands taken over by Forest Department with moisture conservation techniques.

Climate and Railfall

Climate of Bellary-area is hot with Summer spreading from February to June, hottest months being March, April and May with temperatures above 40°C. A minimum temperature of about 14°C is recorded in January. Rainfall distribution is so erratic that droughts are common. Average annual rainfall is 730 mm. Chitradurga is also characterised by hot summers and erratic rainfall. Hot weather commencing from March will continue upto June. The normal average rainfall is about 560 mm. per annum and in some years the precipitation is by South-West Monsoon and in some by North-East Monsoon.

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The climate of Tumkur district is generally hot and dry but the early mornings are cool even in Summer. The temperature during day rarely exceeds 38°C during hottest part of the year and falls to 10°C during Winter nights. The average annual rainfall is about 680 mm. and often not well distributed.

Bangalore district has a dry season starting from December to February and hot season from March to May. South-West monsoon lasts from June to October and the retreating monsoon takes over during November. Premonsoon showers are common in the month of May. Average temperature during summer is 27.5°C and the mean minimum temperature is about 12°C. The temperature during day rarely exceeds 37.5°C during the hottest part of the year. The average rainfall is about 970 mm. Kolar district has good climate throughout. Summer season is between March to May with May being the hottest month with mean temperature of 34.2°C. December is the coolest month with mean daily maximum temperature of 24.3°C and minimum of 12°C at Nandi Hills. The average rainfall is about 730 mm. with about 47 rainy days in a year.

Area and population

The total geographical area of the surveyed tract is 47,582 km^2 with a population of 1,20,97,680 and a density of 254 persons per km^2., compared with the National population density of 216 per km^2.

The break up of the geographical area of the five districts and the forest areas is as follows :-

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Table No. 1

Geographical and Forest area of the surveyed area

District	Geographical area in km2.	Forest area in km2.	Percent of forest area
Bellary	9,898	1496.67	15.12
Chitradurga	10,852	871.21	8.03
Tumkur	10,606	571.54	5.39
Bangalore	8,003	859.61	10.74
Kolar	8,223	479.55	5.83

(Source : District Census Hand Book 1981)

Land Use Pattern

The land use pattern and extent of area under different types of vegetation or land use classes is given in the following table for all the five districts.

Table No. 2

Land use pattern in the surveyed area (in ha.)

District	Forest area in ha.	Irrigated area in ha.	Unirrigated area in ha.	Cultivable waste land including graucher & groaves (in ha.)	Area not available for cultivation in ha.
Bellary	149667.64	99024.06	508576.44	61823.92	122673.51
Chitradurga	87121.81	91853.31	632190.27	165884.15	94843.34
Tumkur	57154.04	94588.86	578633.13	174151.39	155536.45
Bangalore	85961.13	65735.06	372110.75	142042.44	97490.58
Kolar	47955.89	71575.21	263124.26	140093.62	117281.82

(Source : District Census Hand Book 1981)

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Other Socio-economic conditions

Bellary district is endowed with three major economic resources which are agricultural land, good water source in the form of river and abundant mineral deposits. River Tungabhadra flows all along western and northern borders of the district. With the construction of dam at Hospet, irrigation facilities have increased. High grade of iron ore and other minerals such as Gold, Copper, Quartz are being exploited. Rice, Jowar and Sugarcane are cultivated. Chitradurga is also a district rich in mineral wealth such as iron, manganese, copper, asbestos and china clay but they are yet to be exploited. Kolar district has the famous gold mines situated in the schist belt. The important minerals in this area are gold, graphite, sillimonite, limestone feldspar etc. Gold, manganese, iron, limestone, granite, quartz, soap stone, silver sand are some of the important minerals in Tumkur district.

In Chitradurga, several industries are located manufacturing machine tools, Co-op sugar factory, Handloom weaving and Textiles. Rice, Jawar are the chief agricultural produces. Ragi is the most extensively cultivated food crop in Tumkur followed by Paddy and Jawar. Large areas of coconut groves also exist in the district.

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CHAPTER -2

DESIGN & METHODOLOGY OF THE FIELD INVENTORY SURVEY

The field inventory is one of the major aspect of work of Forest Survey of India (FSI). It is this basic information that alone becomes the foundation of further investigations such as consumption studies, industrial investigations, logging studies, vegetational mapping etc.

The main objective of the field inventory is to collect qualitative and quantitative information about the forest resources within certain precision limits required for preparing reports on potentiality and other forest based investigations in order to serve data needs of developmental planning.

For this purpose of field inventory, the statistical design prescribed is as under :

Each 1:50,000 scale Survey of India Toposheet was divided into 36 grids of 2½' x 2½' each. Such grids marked on toposheets were the basic sampling units. Two square plots each of 0.1 ha. were laid out in each such grid and data were collected from the plots falling in the forest land areas only.

The method of marking the plot centres of these two sample plots on the map in each grid of 2½' x 2½' was as under :

First the length and width of each grid was measured to smallest convenient scale. The length of the side of the plot as on the map corresponding to 0.1 ha. square plot on the ground was calculated. 'x' and 'Y' are to be the length and width of the grid and 'S' the side of

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the plot, substract side 'S' from both sides i.e. find (X-S) and (Y-S). Let these numbers be X' and Y'. Two random numbers one in the range of 0 to X' and the other in the range of 0 to Y' were selected. These numbers were called x and y respectively. Half of the side of the plot (s/2) to each were added i.e. find x + s/2 and y + s/2. The x + s/2 and y + s/2 will be the coordinates of the centre of the first plot in the grid considering left hand bottom corner (SW corner) of the grid as origin of the axis. The centre of the second plot was located by joining the centre of the first plot with the grid centre (sampling unit) and extending this line in the opposite direction. A point at an equal distance from the grid centre in the opposite direction was marked which will be the centre of the second plot.

Thus, it may be seen that the sampling design adopted was a cluster sampling with two plots in each cluster. The grids were taken as clusters. But actually it has been observed that in some grids there was only one plot. Hence, the sampling design was taken as cluster sampling with unequal sizes.

The data were collected in the following prescribed forms :

(i) Plot Approach Form

This form is meant for carrying out time study. It is filled by the Crew Leader as he proceeds from the camp to the sample plot and returns to the camp. This is only a descriptive form and is not used for processing and analysis. The main intention in filling this form is to record proper guidance, in locating the plot during re-survey in future. These forms are kept in the Zonal Office only as a record.

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(ii) Plot Description Form

This form is designed to give the qualitative description of a two ha. area around the centre of the sample plot. Information about the crop and administrative allocation of the land, land use, legal status, topography, terrain, aspect, soil, vegetation, occurrence or absence of bamboo, bamboo quality, regeneration, biotic interference etc. is recorded in it.

(iii) Plot Enumeration Form

In this form, diameters of trees and bamboo specieswise is recorded. The trees with 10 cm. diameter and above, at breast height, over bark only are enumerated. Dead trees with utility of less than 70% are not enumerated. The diameter of a bamboo clump is measured at its base. This form is filled separately for each plot of the grid.

(iv) Sample Tree Form

This form is to be filled along with plot enumeration form. In this form, data of all sample trees with a diameter of 10 cm. and above at breast height over bark (DBHOB), from NW quadrant are recorded. For each sample tree diameter at breast height, bark thickness, length of clear bole, form of tree, etc. are recorded. An abstracted information from this form is written on a card and such cards are nailed to the respective trees with the data of that tree.

(v) Bamboo Enumeration & Clump Analysis Form

In this form the data of individual culms occurring in selected clumps are recorded. The clumps bearing serial Nos. 1,9,17,25 etc. (first and every eight clump thereafter) of each bamboo species are selected and taken up for detail analysis. From these selected clumps number of bamboo culms per clump duly classified into age classes, greenness and soundness are recorded.

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(vi) Bamboo Enumeration Form (Non-clump Forming)

In this form information is collected for non-clump forming bamboos occurring in the sample plot. For the purpose of counting the culms, only 1/8th area of the plot (touching northern semi-diagonal is taken. Counting is done only in 0.0125 ha. area i.e. in 1/2 NW quadrant).

(vii) Bamboo Weight Form

For determining correlation between green and dry weights of utilisable bamboo culm length data are collected in this form. This form is, however, to be filled up for plots in which bamboos have actually been found in two ha. areas. One mature bamboo culm from each culm diameter class 2<5 cm., 5<8 cm., and 8 cm. and above is selected. The data are collected separately for each bamboo species occurring in the plot. The green weight of the utilisable culms and green weight of 30 cms. long pieces obtained on each from the top, middle and bottom portions of the utilisable culms from each diameter classes are recorded.

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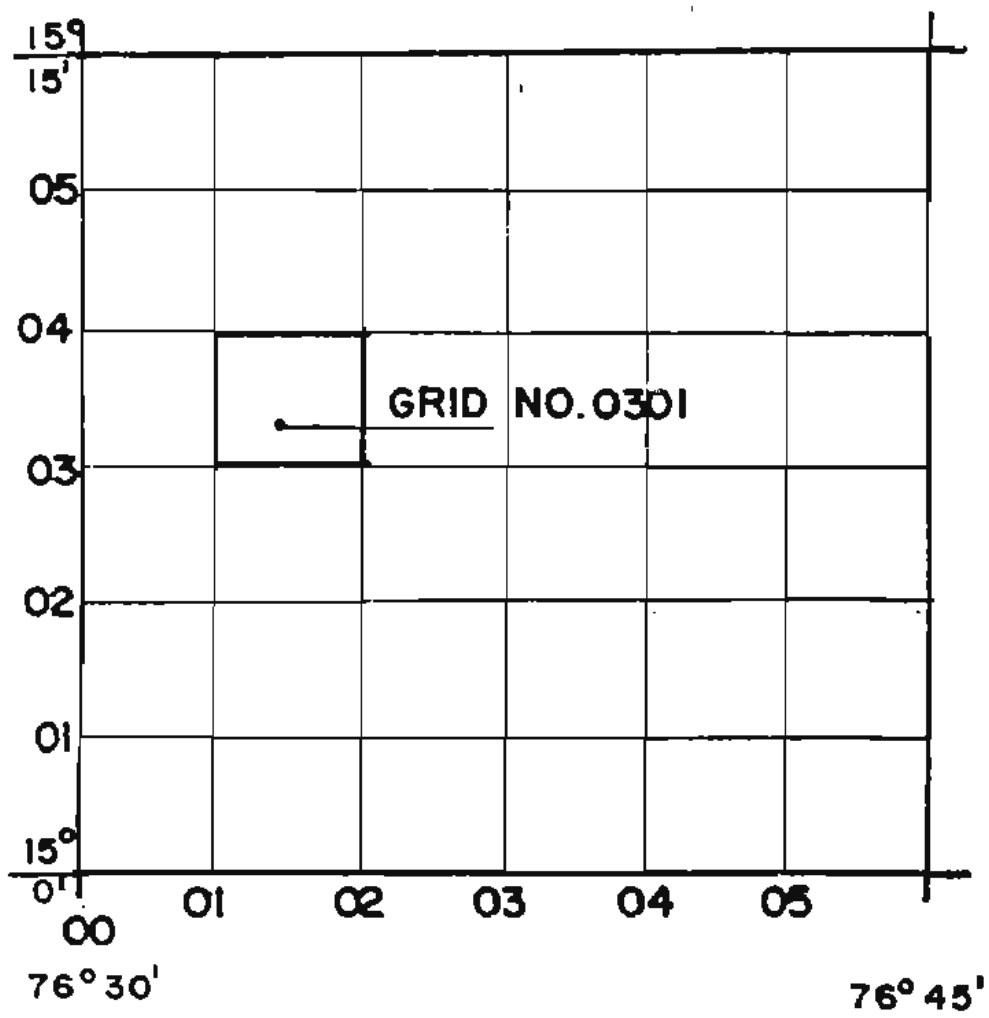
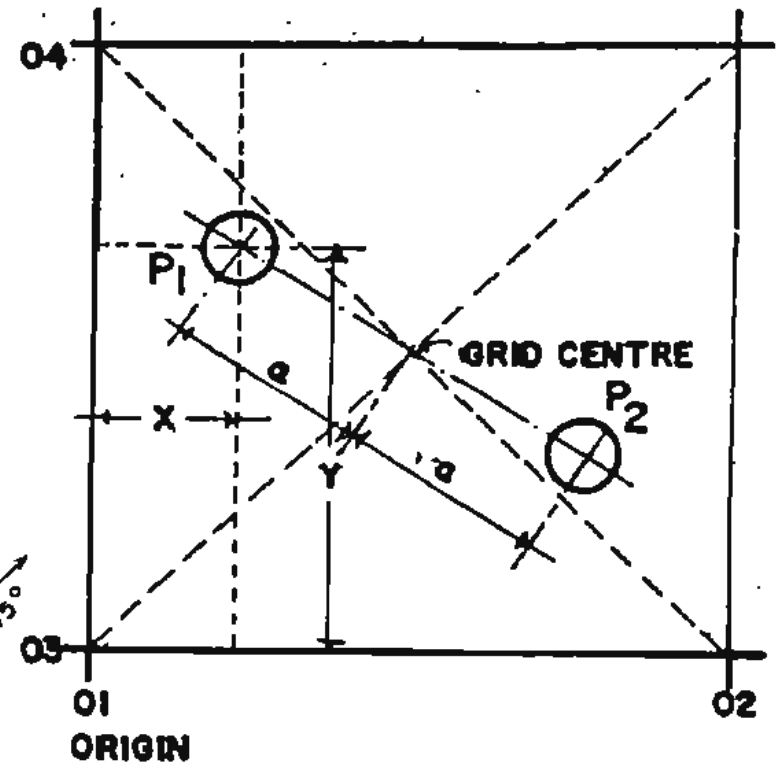


DIAGRAM-1
DIAGRAM SHOWING IDENTIFICATION OF GRIDS ON 1:50,000 OR 1:63,360 SCALE TOPOSHEETS

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

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



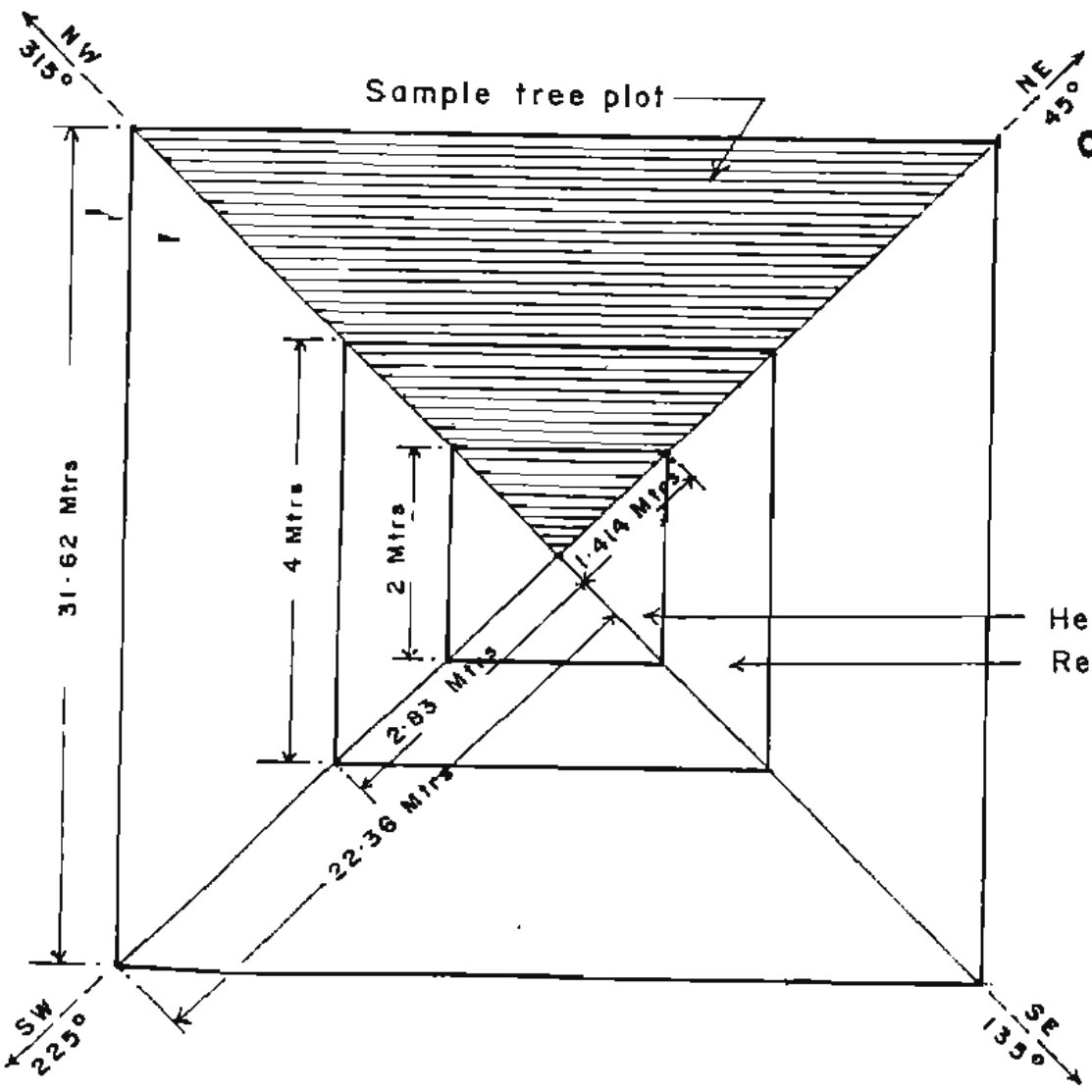


DIAGRAM-3
DIAGRAM SHOWING LAY-OUT OF PLOT

Contents

CHAPTER-3
DATA PROCESSING

Sampling Design

Grids were marked at 2½' x 2½' interval in the green wash area of the Survey of India Toposheets relating to the districts of Bellary, Chitradurga, Tumkur, Bangalore and Kolar. Two plots were laid in each grid. The first plot was laid out at random whereas the second one was linked to the first in the opposite quadrant at equal distance from the grid centre. The plots laid out were square in shape with an area of 0.1 ha.

Data Base

In all there were 1405 field forms. The number of cards resulting from each card design is given below :-

Table No. 3

Details of No. of cards in each category

Card design Number.	Field Form	No. of cards.
01	Plot Description Form	511
03	Plot Enumeration Form	545
04	Sample Tree Form	554
05	Bamboo Enumeration & Clump Analysis Form	30
07	Bamboo Weight Form	16
	Total :	1656

Date Processing

The data processing was done in three main stages namely (i) Manual Processing, (ii) Processing on Unit Record Machine and (iii) Electronic Computer.

Contents

Manual Processing

The field forms received in the Data Processing Unit were checked with the list supplied by the Zone. Entries of the field forms were made in the register giving the number of field forms relating to each map sheet, grid and plot. The total number of records to be punched in each card design were estimated. Job number, card design, code and leading zeros (whenever missing) were filled up in the field forms.

The entire information filled in the field forms was checked manually for consistency in the data. The main checks applied were the validity of codes and consistency checks for inter-relation between the entries for two/more fields.

Processing on Unit Record Machine

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

Processing on Electronic Computer

The verified and sorted data on data cards were loaded on magnetic tapes. The listings of the loaded data were taken and checked with reference to the field forms. On the basis of the validated data various tables were generated as explained in the following paragraphs. The processing of data was done at system IBM-3083 of ONGC., Dehradun.

Contents

A r e a

Area figures related to the forest area were not available from interpretated aerial photographs. Forest area was supplied by Zonal Office which was calculated by dot grid method for each district. On the basis of sample plots falling in this area, weightage of each sample plot was calculated. This factor was used to derive area figures by different land use classes which is given in Table No.5. The area falling in land uses, namely; dense tree forest, moderately dense tree forest, open tree forests, scrub forests, bamboo brakes, shifting cultivation, young plantation of forestry species, tree in line, forest road, Government grass lands, barren land and young crop of natural or artificial regeneration was considered as net forest area and was classified by crop composition (Forest type) classes on the basis of the number of sample plots in each separate estimation for four crop compositions viz. Khair, Salai, Deciduous and Miscellaneous forest. This has been given by soil depth (Table No.7), Soil consistency (Table No.8), Soil erosion (Table No.9), Rockiness (Table No.10), Coarse fragments (Table No.11), Grazing incidence (Table No.18) and Origin of stand (Table No.12).

The area falling under land use classes i.e. dense tree forests, moderately dense tree forests, open tree forests, shifting cultivation, young plantation of forestry species, tree in line and young plantation of natural or artificial regeneration was classified as actual forest area and was given by crop composition (Table No.6), Intensity of regeneration (Table No.15), Fire incidence (Table No. 19), Size class (Table No.13), Top height (Table No.14).

Further break up of total forest area was also given by Plantation Potential (Table No.16), Legal status (Table No.17) and Bamboo density in forest area (Table No.29).

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Volume Estimation

Felled tree data were not collected. Sample tree data were inadequate in most of the species to develop local volume equations. Therefore, local volume equations developed in Mandsor, Ratlam, Shajapur and Rajgarh district were used to estimate the volume of following species :-

1. *Boswellia serrata*

$$\sqrt{V} = -0.155316 + 2.714875\ D$$

2. *Anogeissus latifolia*

$$\sqrt{V} = -\ 0.004378 + 4.575823\ D^2$$

Similarly local volume equations already developed in Khargone, Dewas, Jhabua, Indore and Dhar districts were used to estimate the volume of following species :-

1. *Acacia catechu*

$$V = -\ 0.048108 + 5.873169\ D^2$$

2. *Pterocarpus marsuipium*

$$\sqrt{V} = 0.175068 + 4.598243\ D - 1.500562/D$$

3. *Terminalia crenulata*

$$\sqrt{V} = -\ 0.203947 + 3.159215\ D$$

4. *Diospyros melanoxylon*

$$\sqrt{V} = -0.184139 + 2.892723\ D$$

To estimate the volume of *Eucalyptus species* the local volume equation developed in U.P. was used.

1. *Eucalyptus species*

$$V = 0.02894 - 0.89284\ D + 8.73416\ D^2$$

Contents

For estimation of volume of Buchnania latifolia and rest of species the local volume equations developed in Bhandara catchment and Indore catchment were used respectively:-

1. Buchnania latifolia (Bhandara Catchment)
   $V = 0.019341 - 0.262689\ D + 4.293135\ D^2$
2. Rest of species (Indore Catchment)
   $V = 0.081467 - 1.063661\ D + 6.452919\ D^2$

Enumerated Tree Volume

Volume of each enumerated tree was estimated from the breast height over bark diameter of the tree by using the local volume equations for each species. The estimated tree volume was converted to per hectare and stored in tree plot volume file with species code, tree diameter, parameters of Plot Description Form, Per hectare stem and volume in the sample plot.

Plot Volume

The estimated volume of each enumerated tree in a plot when added up over the whole plot provided the plot volume and the same was stored in the tree/plot volume file.

Stand Tables

The file giving the estimates of Tree/Plot Volume was utilized to clarify the trees by species and diameter, crop composition etc. The estimates of the number of stems per hectare and total stems by species and diameter classes were obtained for each crop composition and was given in the computer output.

Contents

Stock Tables

The 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 and were given in computer output.

Standard Errors

Standard errors were estimated for the growing stock in each crop composition (Table No.20).

Bamboo

Occurrence of bamboo was not much to obtain any reliable results in growing stock. However, the data is given in Table No. 29.

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CHAPTER-4

RESULTS OF THE INVENTORY

The following table shows that about 511 plots were located in various parts of the forest area and data were collected from these plots. On the basis of total number of plots falling in the forest area of each district, the weight of the sample plot was calculated.

Table No. 4

Area figures and weightage of sample plots in the surveyed area

District	Geographical area in km2.	Forested area in km2.	No. of sample plots.	Weightage in km2.
Bellary	9,898	1568.38	148	10.597
Chitradurga	10,852	933.97	100	9.340
Tumkur	10,606	815.78	81	10.071
Bangalore	8,003	915.50	94	9.739
Kolar	8,223	820.80	88	9.327
Total :	47,582	5054.43	511	9.891

Forest area by land use classes

The pattern of utilisation of land in the forest area given in the Table No.5 shows that the dense tree forest area is less than 1 per cent and that of moderately dense tree forest area comes to 11.5 per cent. 32.2 per cent is shown as scrub forests and a negligible percentage of bamboo brakes occur. Major area comes under open scrub type which constitutes about 58.5 per cent. About 87.7 per cent of the area constitutes the various types of land use pattern under forest although majority of them falling under open and scrub type. Ramining 12.3 percent of the area includes grass lands, barren lands, agricultural lands, with or without trees surrounding, water bodies etc.

Contents

Table No. 5

Different types of land use pattern in forest area

Sl.No.	Land use	No. of sample points.	Area in km2.	Percentage
1.	Dense tree forest	3	29.67	0.59
2.	Moderately dense forest	59	583.58	11.55
3.	Open tree forest.	134	1325.43	26.22
4.	Scrub forest	165	1632.06	32.29
5.	Bamboo brakes	1	9.89	0.20
6.	Shifting cultivation	-	-	-
7.	Young plantation of forestry species.	35	346.19	6.85
8.	Trees in line	-	-	-
9.	Forest roads	-	-	-
10.	Government grass lands	4	39.57	0.78
11.	Barren lands	25	247.28	4.89
12.	Agricultural land without trees surround.	20	197.83	3.91
13.	Agri. land with trees in surround.	7	69.24	1.37
14.	Non-forestry plantations	-	-	-
15.	Habitation	-	-	-
16.	Water Bodies	2	19.78	0.39
17.	Other lands	4	39.57	0.78
18.	Young crop of natural/ artificial regeneration.	51	504.45	9.98
19.	Inaccessible	1	9.89	0.20
	Total :	511	5054.43	100.00

Contents

The net forest area consists of categories such as Dense tree forest, Moderately dense tree forests, Open tree forests, Scrub forest, Bamboo brakes, Young plantation of forestry species, trees in line, Government grass lands, Barren lands and young crop of natural and artificial regeneration. The number of sample plot in this comes to about 478. The actual tree forest area is confined only to the first three sub-categories and young plantation of forestry species and young crop of natural/artificial regeneration. The number of sample plots comes to about 282.

Land use classes map and surveyed area

Map No.1 indicates the distribution of various plots in the different land use classes of the surveyed area (Appendix-1). The map shows that moderately dense forest are located in Central part of Bellary. In southern portion of Bellary, it is mainly the open forests. Central and Southern portion of Chitradurga and North-West of Tumkur indicates open and scrub-type of forests.

Area by crop composition

Map No. 2 (Appendix-2) shows the location of various plots in the surveyed area of different crop composition. Deciduous type occurs in Central, West and North-West of Bellary and North-West of Tumkur, North of Kolar and South of Bangalore. Khair and Salai occurs mainly in Bellary district.

The crop composition in the surveyed area is based on the location of the sample plots and presence of dominant species in the sampled location. Following is the classification found in the forest area :-

1. Khair : Where Khair constitutes more than 50 percent.
2. Salai : Where Salai constitutes more than 50 percent.

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3. Deciduous forests. : Where deciduous species predominate in the top canopy. The trees in the forests are leafless during the dry season.

4. Miscellaneous forests. : Forests which could not be classified in any of the above classes.

The following table shows crop composition in the surveyed area :-

Table No. 6

Crop composition in surveyed area

Surveyed area	No. of plots.	Area in in km2.	Percentage
Khair	15	148.37	5.32
Salai	8	79.13	2.84
Deciduous	162	1602.38	57.44
Miscellaneous	97	959.45	34.40
Total	282	2789.33	100.00

Khair and Salai have been identified as separate stratum in the crop composition. Deciduous and miscellaneous forms the bulk of the composition with 57.44 and 34.40 percent respectively. Khair forms about 5.32 percent of the composition.

Forest Soils

Parameters such as depth, consistency, erosion and density of vegetation cover on the soil are the indicators of the State of forest soils.

Soil Depth

Soil sample is taken out from a depth of 15 cm. in the sample plots and other observations are made by looking at fresh soil profiles. The categories are :-

Contents

Category	Description
Very shallow	Soil depth less than 15 cm.
Shallow	Soil depth 15 cm. and more but < 30 cm.
Medium	Soil depth 30 cm. and more but < 90 cm.
Deep	Soil depth 90 cm. and more

The following table shows the classwise and the area and percentage of different categories :-

Table No. 7

Soil depth categories in the surveyed area

Category	No. of sample plots	Area in km2.	Percentage
No soil	16	158.26	3.35
Very shallow	68	672.61	14.22
Shallow	247	2443.14	51.67
Medium	115	1137.49	24.06
Deep	30	296.74	6.28
Not recorded	2	19.78	0.42
Total	478	4728.02	100.00

It may be seen that about 65.9 percent forms very shallow to shallow soils and about 24 percent is of medium soils. Deep soils are only to an extent of 6.3 per cent. The map (Map No. 3 , Appendix-3) whows that very shallow to shallow soils occur in South-East of Bellary, Chitradurga, Northern portion of Kolar and Southern portions of Bangalore. Soil of medium depth exist in Central and North portion of Bellary, Southern Chitradurga, North-West Tumkur. Soil on the Eastern portion of Kolar district are deep.

Contents

Soil Consistency

Consistency of the soil is measured by recording the resistance offered by the soil to digging and rupture. Friable soils are those which crumble to even slightest pressure of the fingers. Those that require pick axes to dig are classified as slightly compact soils. The soils in the surveyed area are found to be under the following categories.

Table No. 8
Categories of soil consistency

Soil consistency	Sample points.	Area in km2.	Percentage
Not recorded	2	19.78	0.42
Friable	45	445.11	9.41
Slightly compact	409	4045.52	85.56
Compact	5	49.46	1.05
Cemented	1	9.89	0.21
No soil	16	158.26	3.35
Total	478	4728.02	100.00

Majority of the area comes under slightly compact category with 85.56 percent followed by friable soil type with 9.41 percent.

Erosion Status

Erosion status of the surveyed area is judged by the magnitude and frequency of rills, gullies, ravines, formed due to wind and water effect. The following table gives the status in the forest area.

Contents

Table No. 9

Erosion status in the surveyed area

Soil erosion	No. of sample plots	Area in km2.	Percentage
Mild erosion	453	4480.74	94.77
Moderate	8	79.13	1.67
Heavy	1	9.89	0.21
Not recorded	16	158.26	3.35
Total	478	4728.02	100.00

Mils erosion is prevalent in the surveyed area. As seen from the table which indicates about 94% falls under this category. The map (Map No.4, Appendix-4) indicates most of the plots come under this category.

Rockiness

The following table shows the status of rockiness in the net forest area :

Table No. 10

Rockiness in the surveyed area

Sl.No.	Description	No. of sample plots	Area in km2.	Percentage
1.	High	56	553.91	11.72
2.	Medium	89	880.32	18.62
3.	Low	125	1236.41	26.15
4.	No rock	207	2047.49	43.30
5.	Not recorded	1	9.89	0.21
	Total	478	4728.02	100.00

About 43.30 percent falls under the category of No Rock and 26.15 percent under low rocky condition, giving an indication that there is a sufficient soil cover. Map No. 5 (Appendix-5) shows the distribution of different rockiness classes in the surveyed area.

Contents

Coarse Fragments

The table shows the coarse fragment status of the surveyed area.

Table No. 11

Coarse fragments in the surveyed area

Category	No. of sample points	Area in km2.	Percentage
Loose stones	70	692.39	14.64
Bouldery	97	959.45	20.29
Gravel	194	1918.90	40.59
No coarse gravel	115	1137.50	24.06
Stone absent	-	-	-
Not recorded	2	19.78	0.42
Total	478	4728.02	100.00

About 41 percent of the area is gravelly and 24 percent has no coarse gravels. About 20 percent of it has bouldery area giving an indication that the surveyed area is slightly bouldery and is having loose stones also.

Origin of Stand

The forest areas surveyed were classified as natural, man made, coppice forests, depending on their origin. The following table gives distribution of forest areas on the basis of the origin of the stand.

Table No.12

Origin of stand in the surveyed area

Sl. No.	Origin of stand	No. of sample points	Area in km2.	Percentage
1.	Natural forests of seed origin.	355	3511.39	74.27
2.	Natural forests of coppice origin.	1	9.89	0.21
3.	Man-made forests	94	929.78	19.66
4.	Not recorded	28	276.96	5.86
	Total	478	4728.02	100.00

Contents

It may be seen from the above table that 74.27 percent is natural forests of seed origin. About one fifth of the area is under man-made forests which is about 929.78 km^2.

Size Classes

The trees in the sample plots were categorised according to timber utility. The different size classes adopted in the present study are -

1. Regeneration - Crop below 10 cm. diameter predominating.
2. Pole crop - Crop between 10-20 cm. diameter predominating.
3. Small timber - Crop between 20 cm. to under 30 cm. diameter predominating.
4. Big timber - Trees with diameter of 30 cm. and above predominating.
5. Mixed size class. - Tree crop with no marked domination of any size class.

The extent of areas under different size classes in the forest area surveyed are given in the following table :-

Table No. 13

Different size classes of crop in surveyed area

Size class	No. of sample points	Area in km2.	Percentage
Regeneration	86	850.65	30.50
Pole crop	150	1483.68	53.19
Small timber	29	286.85	10.28
Big timber	1	9.89	0.36
Mixed size class	16	158.26	5.67
Total	282	2789.33	100.00

The table shows that about 53 percent of the crop is of pole size and 30.50 percent is regenerating one. Big timber size class and mixed size classes are low. Map No. 6 (Appendix-6) shows the distribution of plots under different size classes in the surveyed area which is mostly pole crop and regeneration categories.

Contents

Top height

The top height is arrived by taking the average height of dominant trees occurring in the plot or in the surrounding area of 2 ha.

The following table shows the top height classes and sample point located in each and the percentagg.

Table No.14

Top height classes of the surveyed area

Top height classes.	No. of plots.	Are in km2.	Percentage
0-5M	208	2057.38	73.76
6-10M	74	731.95	26.24
11-15M	-	-	-
16-20M	-	-	-
21-25M	-	-	-
Total	282	2789.33	100.00

It may be seen that about 74 percent of the crop is in the top height class of 0-5M and remaining 26 percent in 6-10M class, indicating that the average top height is low in the surveyed area which could be due to the age of the crop as 53 percent of the area surveyed consists of pole crop and 30 percent regeneration. Otherwise also the area predominantly consists of stunted, branchy growth. Map No. 7 (Appendix-7) shows the top height class distribution in the surveyed area.

Intensity of Regeneration

Regeneration status for economically important species was considered. Established regeneration of all samples (diameter of 2 to 10 cm. at breast height) in a plot of 4M x 4M laid at the centre of the sample plot was counted. The different categories are :-

Status	Regeneration
1. Profuse	More than 16 seedlings
2. Adequate	8-10 seedlings
3. Inadequate	Upto 8 seedlings
4. Absent	No regeneration

Contents

The intensity of regeneration in the tree forest area is given in the following table :-

Table No. 15

Intensity of regeneration in the surveyed area

Sl. No.	Intensity of regeneration.	No. of sample points.	Area in km2.	Percentage
1.	Profuse	-	-	-
2.	Adequate	5	49.46	1.77
3.	Inadequate	66	652.82	23.40
4.	Absent	210	2077.16	74.47
5.	Not recorded	1	9.89	0.36
	Total	282	2789.33	100.00

The above table shows that regeneration is absent in about 74 percent of the area and inadequate in 23 percent. This could be due to biotic interference in one or the other form. Thus management emphasis has to be on artificial regeneration coupled with protection measures.

Plantation Potential

Plantation potential in the entire forest land is assessed by considering the land class to which the sample plot laid out belongs to whether it has potential for growing forest or not. While deciding this, other factors such as aspect, soil, depth, drainage, crop in the surrounding area and other biotic, climatic factors are considered.

The following table gives the plantation potential in the forest land :

Table No. 16

Plantation potential in the surveyed area

Plantation potential	No. of plots.	Area in km2.	Percentage
Plantable	197	1948.58	38.55
Unplantable	124	1226.51	24.27
Not applicable	137	1355.10	26.81
Not recorded	53	524.24	10.37
Total	511	5054.43	100.00

Contents

The table shows about 38 percent of the area has potential for plantation and this should be seriously given a consideration while preparing the future plans.

Legal Status

The following table shows the distribution of land class by legal status:-

Table No. 17
Distribution of land class by legal status

Sl. No.	Legal status	No. of sample points.	Area in km2.	Percentage
1.	Reserve forests	477	4718.12	93.35
2.	Protected forests	4	39.57	0.78
3.	Unclassed forests	14	138.48	2.74
4.	National Park	-	-	-
5.	Private forests	16	158.26	3.13
6.	Private land with trees owned by Govt.	-	-	-
7.	Undetermined	-	-	-
	Total	511	5054.43	100.00

The table shows that about 93 percent of the area under reserve forest where the sample plots fall. Only 3.13 percent is private forests and 2.74 percent is unclassed forests.

Grazing Incidence

Grazing intensity is classified into any of the following classes depending on the severety.

1. Heavy grazing.
2. Medium grazing.
3. Light grazing.
4. No grazing.

Contents

The following shows the grazing incidence in the net forest area.

Table No. 18

Grazing incidence in surveyed area

Sl. No.	Category	No. of plots.	Area in km2.	Percentage
1.	Heavy grazing	148	1463.90	30.96
2.	Medium grazing	125	1236.41	26.15
3.	Light grazing	136	1345.21	28.45
4.	No grazing	45	445.11	9.41
5.	Not recorded	24	239.39	5.03
Total		478	4730.02	100.00

The table shows that grazing in different intensities occurs in about 84 percent of the area, out of which 30 percent of the area is heavily grazed. Grazing has a direct impact on the regeneration status and their survival and of the plantation in the forest area. It also renders the soil compact. Map No. 8 (Appendix-8) shows the grazing incidence in different areas in the surveyed area.

Fire Incidence

Fire incidence in the surveyed area is judged by occular estimation and classified accordingly, The following table shows the incidence of fire in the tree forest area

Table No. 19

Fire incidence in the surveyed area

Sl. No.	Category	No. of sample points	Area in km2.	Percentage
1.	Very heavy	-	-	-
2.	Frequent	3	29.67	1.06
3.	Occassional	35	346.19	12.41
4.	No fire	243	2403.58	86.17
5.	Not recorded	1	9.89	0.36
Total		282	2789.33	100.00

Contents

The table shows that very heavy incidence of fire in the tree forest area is not there. Only occassional fire to the extent of 12.41 percent occured and no fire in about 86 percent of the area.

Growing Stock

Growing stock has been estimated for different crop composition stratum in terms of volume per ha. and total volume.

Table No. 20

Growing stock with S.E. by crop composition

Crop composition	No. of sample points.	Area in km2.	S.E.%	Vol./ ha.	S.E.%	Total (000m3)	S.E.%
Khair	15	148.37	26.1	3.167	46.3	46.993	53.1
Salai	8	79.13	34.8	16.033	48.9	126.869	60.0
Deciduous Forest	162	1602.38	7.1	10.134	13.9	1623.866	15.6
Miscellaneous Forest	97	959.45	9.7	2.539	27.5	243.582	29.2
Total	282	2789.33	4.2	7.318	12.5	2041.310	13.2

The standard error for estimation of growing stock by crop composition-wise appears to be high when taken individually which is mainly due to the fact that the number of plots falling under that particular strata is less. Thus, the estimation for crop-wise is only indicative keeping in view of the small number of sample plots and high standard error.

Total number of stems and stems per hectare.
Crop composition Khair.

Table No. 21 shows the total number of stems and stems per hectare in Khair stratum (Area 148.37 km^2). Out of total number of 850654 stems in this stratum, Khair has a tally of 652828 (about 76 percent) stems followed by *Hardwickia binata* with 39.565 stems, *Dalbergia paniculata* with 19.783 stems and finally *Anogeissus latifolia* with 9,891 stems. The rest of the species put together constitutes about 128,587 stems in this stratum (about 15 percent).

Contents

There are about 57.335 stems/ha. in the Khair composition out of which majority is of Khair with 44 stems per ha. followed by 2.667 stems/ha. of Hardwickia binata and 1.334 of Dalbergia paniculata. Rest of the species contribute about 8.667 stems/ha. The following table shows the details number of stems and stem/ha. in Khair stratum.

Table No. 21

No. of stems & stems/ha. in Khair crop composition

Sl. No.	Species Name	No. of stem	Stem/ha.	Percentage
1.	Acacia catechu	652828	44.000	76.73
2.	Hardwickia binata	39565	2.667	4.66
3.	Dalbergia paniculata	19783	1.334	2.33
4.	Anogeissus latifolia	9891	0.667	1.16
5.	Rest of the species	128587	8.667	15.12
	Total	850654	57.335	100.00

Crop composition Salai

Table No.22 shows the total number of stems and stems/ha. in Boswellia serrata stratum (Area 79.13 km2). The total number of stems in this stratum is 1186950 out of which 418259 (About 35 percent) is of Boswellia serrata and followed by 101739 (About 8.5 percent), each of Albizzia amara and Chloroxylon swietenia. This is followed by Terminalia crenulata with 22609 and closely by Pterocarpus marsupium with 22,608, Tamarindus indica and Anogeissus latifolia each with 11304 number. A total of 497388 forms the rest of the species.

Regarding stems per hectare, out of 150.002 stems per hectare, 52.857 stems per hectare is of Boswellia serrata followed by Chloroxylon swietenia and Albizzia amara with 12.857 stems per hectare. Rest of the species contributes about 62.858 stems per hectare. Another feature in this stratum is most of the species has a crop upto diameter class of 35-40 cm. and not beyond this (Appendix-12).

Contents

Table No.22

No. of stems and stems per hectare in SALAI strata

Sl. No.	Species Name	No. of stems	Stems/ha.	Percentage
1.	Boswellia serrata	418259	52.857	35.24
2.	Albizzia amara	101739	12.857	8.57
3.	Chloroxylon swietenia	102739	12.857	8.57
4.	Terminalia crenulata	22609	2.857	1.91
5.	Pterocarpus marsupium	22608	2.858	1.91
6.	Tamarindus indica	11304	1.429	0.95
7.	Anogeissus latifolia	11304	1.429	0.95
8.	Rest of the species	497388	62.858	41.90
	Total	1187950	150.002	100.00

Crop composition DECIDUOUS

Table No. 23 shows the total number of stems in this stratum (Area 1602.39 km2). Out of 11387984 stems, 1652768 (14.5 percent) is of Hardwickia binata followed by Terminalia crenulata with 947319 (8.3 percent) and Boswellia serrata at 735684 numbers. The number of stems of other species which are occurring in this stratum is shown in the table. Majority of the species occur within a diameter class of 30-40 cm., although a few species such as Hardwickia binata has a few spattered trees in diameter class of 50-60 cm. and 80 cm. above. Almost 65% of the crop falls within the diameter class of 10-15 cm. (Appendix-13).

Table No. 23

No. of stems and stems per hectare in DECIDUOUS crop composition

Sl. No.	Species Name	Total no. of stems.	Stems/ha.	Percentage
1.	Hardwickia binata	1652768	10.314	14.51
2.	Terminalia crenulata	947319	5.912	8.32
3.	Boswellia serrata	735684	4.591	6.46
4.	Albizzia amara	725606	4.528	6.37
5.	Anogeissus latifolia	715529	4.466	6.28
6.	Dalbergia paniculata	594594	3.711	5.22
7.	*.			
8.	*.			
	Total	11387984	71.073	100.00

(*Details of other species is given in Appendix- 13 & 14)

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Out of 71.073 stems/ha., Hardwickia binata with 10.314 forms about 14.5 percent of the standing stems Terminalia crenulata forms about 8.32 percent followed by Boswellia serrata and Albizzia amara at 6.46 percent and 6.37 percent respectively.

Crop composition MISCELLANEOUS

Table No. 24 shows the total number of stems and stems/ha. and percentage in the stratum Miscellaneous (Area 959.45 km2).

Out of the total number of stems of 2235418 about 1572706 (say 70 percent) is of single species i.e. Eucalyptus hybrid. Other species in this stratum forms low percentage except Hardwickia binata which has about 197825 stems (about 8.85 percent). Rest of the species totals to about 375866 stems.

Table No. 24

No. of stems and stems per hectare in MISCELLANEOUS crop composition

Sl. No.	Name of species	No. of stems.	Stems/ha.	Percentage
1.	Eucalyptus hybrid	1572706	16.391	70.35
2.	Hardwickia binata	197825	2.061	8.85
3.	Tamarindus indica	69239	0.721	3.10
4.*	.....			
5.*	.....			
	Total	2235418	23.297	100.00

(* Details of other species is given in Appendix - 15 & 16)

Eucalyptus hybrid has about 16.391 stems/ha. out of total stems of 23.297.

The majority of the crop falls in the diameter class of 35-40 cm. except Hardwickia binata which has scattered representation in 50-60 cm. and 60-70 cm. diameter class. Eucalyptus which forms 70 percent of total stem and stems/ha. has 91 percent of the crop distributed in diameter class of 10-15 cm. (Appendix - 16).

Contents

Total volume and volume per hectare.
Crop composition KHAIR

Table No. 25 shows the total volume distribution and volume per hectare in khair stratum (Area 148.37 km2.). The table shows out of total volume of 46,992 m^3, Khair obviously has a volume of 35,581 m^3 which is about 75.7 percent followed by Dalbergia paniculata with 6.020 percent.

Table No. 25
Total volume and volume per hectare in m^3 for KHAIR crop composition

Sl. No.	Species Name	Total volume in m3.	Volume/ha. in m3.	Percentage
1.	Acacia catechu	35,581	2.398	75.717
2.	Dalbergia paniculata	2,829	0.191	6.020
3.	Hardwickia binata	1,993	0.134	4.241
4.	Anogeissus latifolia	409	0.028	0.871
5.	Rest of the species	6,180	0.416	13.151
	TOTAL	46,992	3.167	100.00

Out of the total volume of 3.167 m^3/ha., Acacia catechu contributed about 2.398 m^3/ha. On comparing the position of various species in Table No.21 where, as far as the total number of stems and stems/ha. is concerned Acacia catechu stood first and so also in terms of total volume and volume/ha. whereas although Hardwickia binata had more number of stems and stems/ha. but in volume it stands third after Dalbergia paniculata. The reason could be that although the number of stems is more in case of Hardwickia binata, all of them under the diameter class of 10-15 cm. whereas Dalbergia paniculata is distributed in diameter classes of 10-15 cm. and 20-25 cm. i.e. slightly higher diameter class (Appendix - 17).

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Crop composition SALAI

Table No.26 gives the total volume and volume/ha. for Salai stratum (Area 79.13 km^2). The total volume is about 126,867 m^3 out of which 58,052 (45.7 percent) consists of Boswellia serrata followed by Albizzia amara with 14,788 (11.65 percent).

Table No. 26
Total volume and volume/ha. for crop composition of SALAI

Sl. No.	Species Name	Total volume in m3.	Volume/ha. in m3.	Percentage
1.	Boswellia serrata	58,052	7.337	45.758
2.	Albizzia amara	14,788	1.869	11.656
3.	Chloroxylon swietnia	6,735	0.851	5.309
4.	Pterocarpus marsupium	3,928	0.496	3.096
5*	....			
6*	....			
	Total	126,867	16.033	100.000

(* Details of other species is given in Appendix - 19 & 20)

Both in terms of total volume and volume/ha. and total number of stems and stems/ha., Boswellia serrata stands first followed by Albizzia amara and Chloroxylon swietenia. Although the later two has the same number of stems and stem/ha., there is a difference in the total volume and volume/ha. out put. The reason is that the distribution of number of stems of Albizzia amara in the diameter class of 20-25 cm. is more whereas in Chloroxylon swietenia the distribution is confined to diameter classes of 10-15 cm. and 15-20 cm. (Appendix-19).

Crop composition DECIDUOUS

Table No.27 shows the total volume and volume per ha. in the stratum Deciduous. It is seen from the table that Hardwickia binata stands first with a total volume of 309,615 m^3 and volume/ha. of 1.932 m^3 and constitute about 19 percent.

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Table No. 27

Total volume & volume/ha. in DECIDUOUS crop composition

Sl. No.	Name of the species	Total volume in m3.	Volume/ha. in m3.	Percentage
1.	Hardwickia binata	309616	1.932	19.067
2.	Albizzia amara	145745	0.897	8.852
3.	Boswellia serrata	80110	0.500	4.933
4.	Anogeissus latifolia	72264	0.451	4.450
5*	....			
6*	.....			
Total		16,23,869	10.134	100.000

(*Details of other species is given in the Appendix-21 & 22)

This is followed by Albizzia amara which comprises half of Hardwickia binata at 8.852 percent. Comparing the number of stems and stems/ha. Hardwickia binata stands first in this stratum in number of stems/ha. and total stems and it has well distributed representation in all diameter classes upto 50-60 cm. Terminalia crenulata which stood second as far as total number of stems and stems/ha. is concerned is low down in the list of volume out put mainly because the representation is in the category of less than 20-25 cm. diameter class and out of this major portion is in diameter class 10-15 cm. Albizzia amara which was in the fourth position as far as total number of stems and stems/ha. was concerned stands second in the volume out put as the distribution is well spread out in the diameter classes from 10-15 cm. to 40-50 cm. with more volume out put obviously coming from diameter class of 40-50 cm. (Appendix-21).

Crop composition MISCELLANEOUS

Table No. 28 shows that the total volume and volume/ha. in stratum Miscellaneous. It is seen from the table that Eucalyptus hybrid is the major species comprising this crop composition.

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Table No. 28

Total volume and volume/ha. in crop composition MISCELLANEOUS

Sl. No.	Name of the species	Total volume in m3.	Volume/ha. in m3.	Percentage
1.	Eucalyptus hybrid	85,220	0. 888	34.94
2.	Hardwickia binata	68,437	0.714	28.06
3.	Tamarindus indica	23,961	0.250	9.82
4.	Buchnania latifolia	977	0.010	0.401
5.	....			
6.	....			
	Total	243,882	2.538	100.00

(*Details of other species is given in the Appendix 23 & 24)

Eucalyptus hybrid comprises about 34.94 percent of the total volume in this stratum followed by Hardwickia binata with 68,437 m^3 with 28 percent of the total. Similar trend is observed in the number of stems and stems/ha. with Eucalyptus standing first and followed by Hardwickia binata. Although the total volume of Eucalyptus is highest in this stratum, with 67,187 m^3 of volume distributed in the diameter class of 10-15 cm.., the total volume out put tends to be low, whereas Hardwickia binata has a well represented distribution in diameter classes upto 60-70 cm. with a total volume of 22,409 m^3 in diameter class of 60-70 cm. (Appendix - 23).

B a m b o o

Bamboo density in the forest area is shown in the following table :-

Contents

Table No. 29

Bamboo density in the surveyed area

Sl. No.	Occurrence of bamboo	Sample plots.	Density in km2.	Percentage
1.	Pure bamboo	-	-	-
2.	Very dense	-	-	-
3.	Dense	3	29.67	0.59
4.	Moderately Dense	1	9.89	0.20
5.	Scattered	4	39.57	0.78
6.	Sparse	10	98.91	1.95
7.	Bamboo present but completely hacked.	17	168.15	3.33
8.	No bamboo	421	4164.22	82.39
9.	Regeneration crop	1 475	9.89	0.20
10.	Not recorded	54	534.13	10.56
	Total	511	5054.43	100.00

It may be seen from the table that no pure bamboo patches exist in the sampled locality and 82 percent of the area has no bamboo. In the category of dense occurrence of Bamboo to Bamboo present but clumps completely hacked category the percentage varies from 0.59 to 3.33.

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Conclusions

Within the frame work and the limitations existing in the study due to low intensity of sampling, some broad conclusions and broad area of work have been suggested as follows :-

The overall picture of the crop varies from poor, stunted, branchy and low quality to medium in places where the locality factors such as climatic, edaphic and biotic factors are slightly favourable.

The existing crop appears to be a young crop with much of it being of pole size (about 53 percent) and regeneration crop is about 30 percent. Very negligible or small quantity is under big timber and mixed class. By this it is obvious that at a particular stage of the crop when managed for a specific purpose this might not have been followed up with adequate regeneration and thus apparently some time gap might have occurred by the time the regeneration crop is establishing. The reasons for this could be pressure on fuel wood, grazing which resulted in inadequate regeneration.

The other reason in major part of the area is the edaphic factors (more particularly is Bellary area) the soil appears to be shallow (about 51.67 percent) and good portion of it is slightly compact with 94.77 percent subjected to mid erosion. Soil also has low organic matter in Bellary area as a result . a poor crop of pole exists. Edaphic factors plays a major role in deciding the site quality of the area and in turn the crop growth, crop height is a direct indicator of site quality and it may be seen here that major portion of the crop is within the height class of 0-5 M (about 74 percent) and about 26 percent in 5-10 M height class.

Inadequate and absence of regeneration in about 98 percent of the area indicates that there has been biotic interference in terms of grazing to an extent of heavy grazing in 31 percent of the area. Origin of the stand of the crop is from Natural forests of seed origin indicating that most of the regeneration is natural and this could be possible only if there is sufficient mature crop to function

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as 'Mother trees'. Thus the possible reason for inadequate regeneration could be biotic interference coupled with lack of well distributed, sufficient number of 'Mother trees'. One another reason in these areas is the vagaries of monsoon which results in unfavourable climatic pattern for the regeneration. process.

The growth pattern of the crop is reflected in the total volume standing and the volume per hectare. It is seen that although some species have more number of total stems and stem per hectare, the total volume and volume per hectare is still less and the reason could be that the majority of this crop is represented in lower diameter class of 10-15 cm., thus forming a predominantly crop of pole size rather than well distributed in different diameter classes. Due to low representation in higher dia class of timber size and mixed size class the volume tends to be low. Apparently it is seen that where-ever there is more number of stem distribution in diameter classes of 20-25 cm. and above this is directly reflected in terms of total volume and volume per hectare.

These patterns does give an indication that whenever the crop is of young age it might be in need of rest and protection and good stocking can be ontained when the crop is supplemented with artificial planting. Measures are to be taken to ensure that natural regeneration status is improved.

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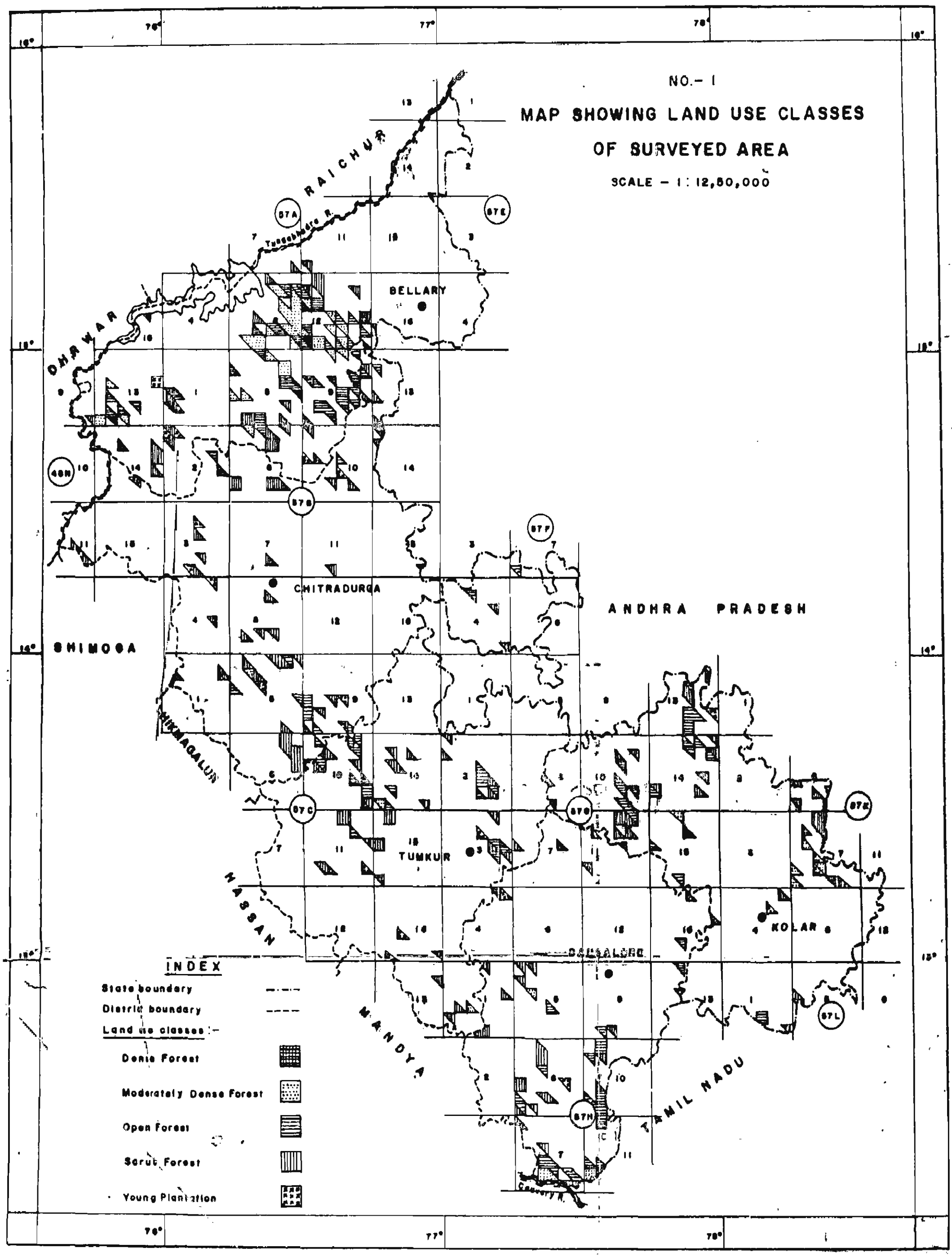
NO.- I
MAP SHOWING LAND USE CLASSES
OF SURVEYED AREA
SCALE - 1 : 12,50,000
RAICHUR
DHARWAR
BELLARY
CHITRADURGA
ANDHRA PRADESH
SHIMOGA
CHIKMAGALUR
TUMKUR
HASSAN
KOLAR
BANGALORE
MANDYA
TAMIL NADU
INDEX
State boundary
District boundary
Land use classes :-
Dense Forest
Moderately Dense Forest
Open Forest
Scrub Forest
Young Plantation

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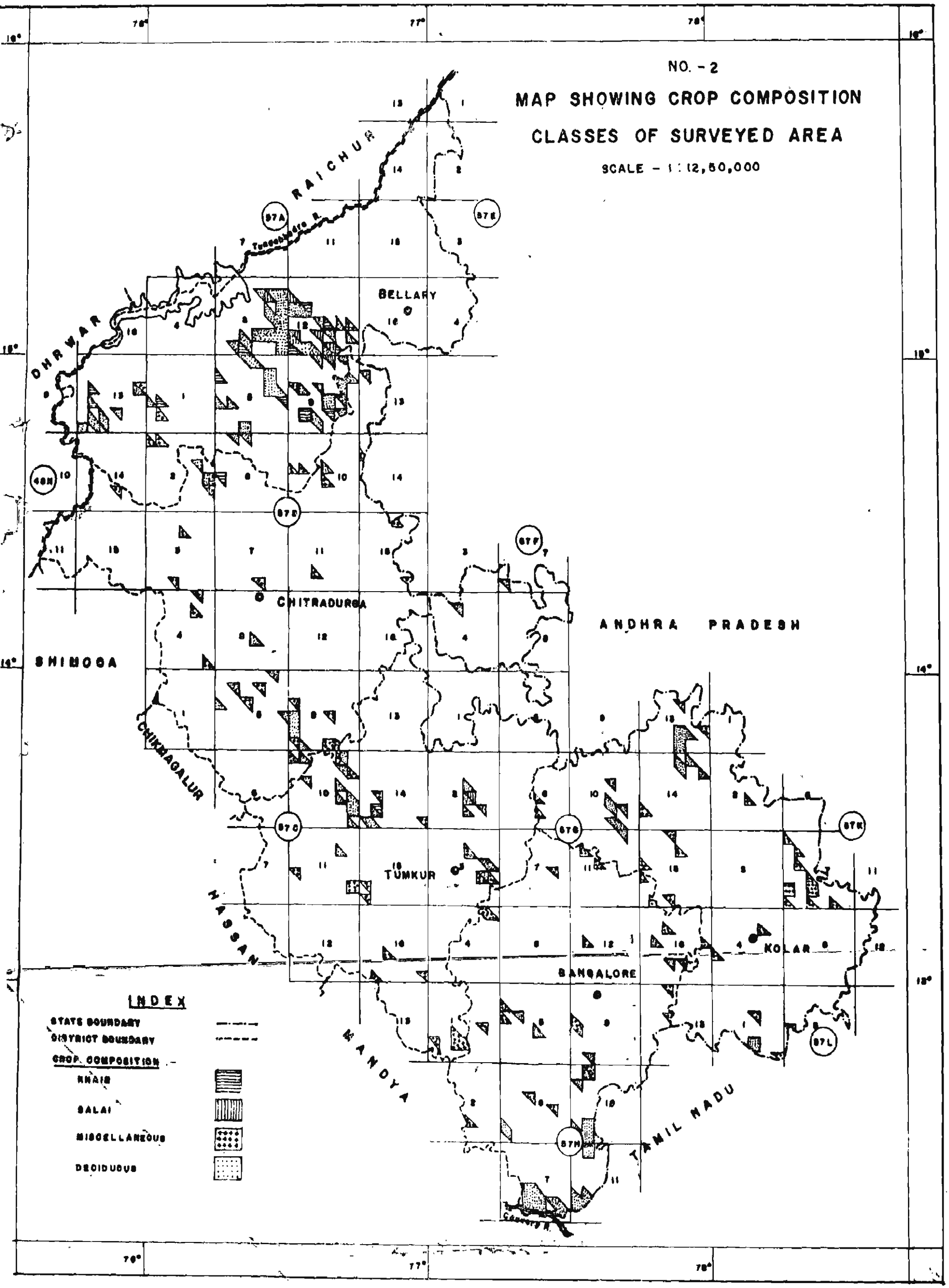
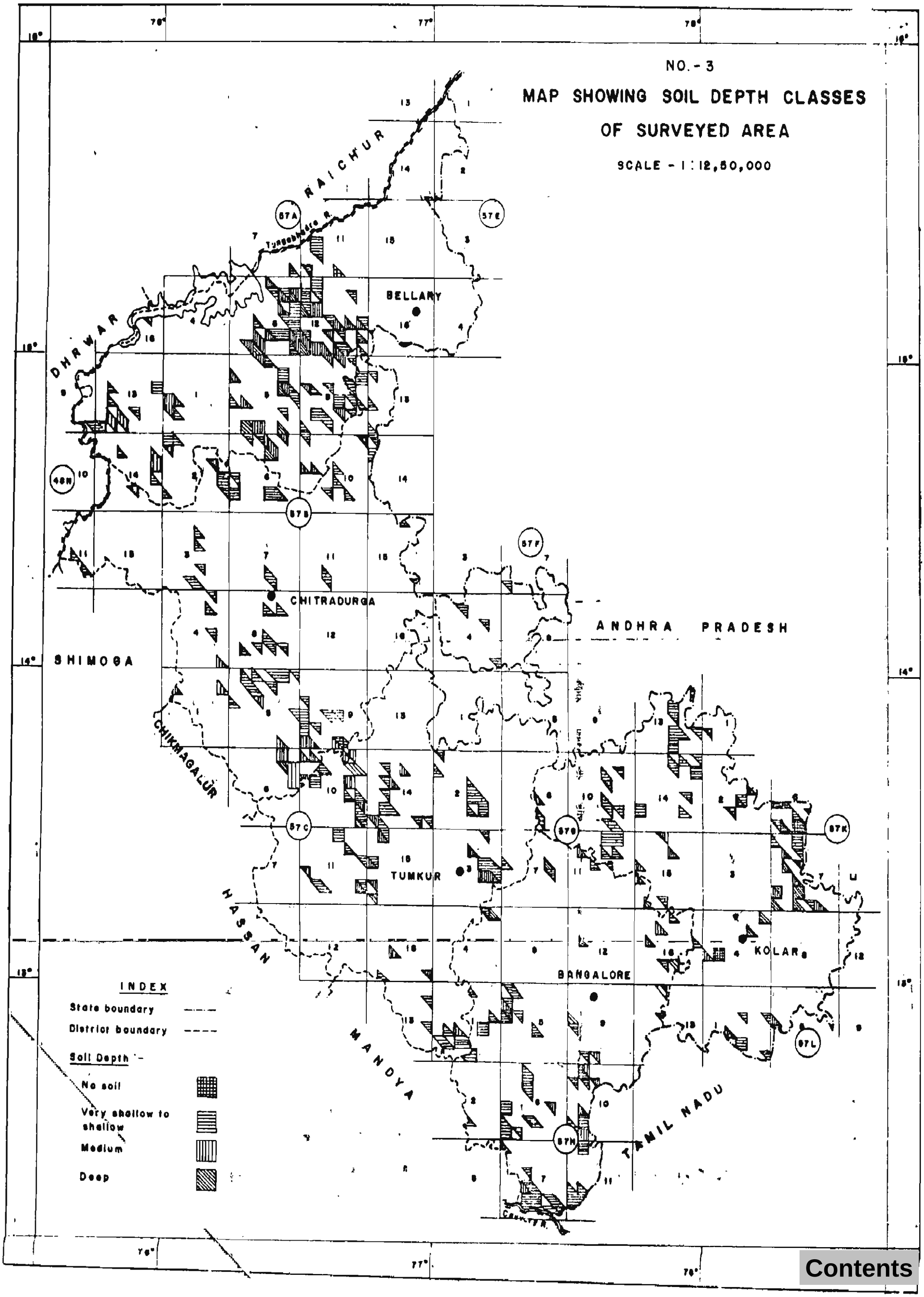
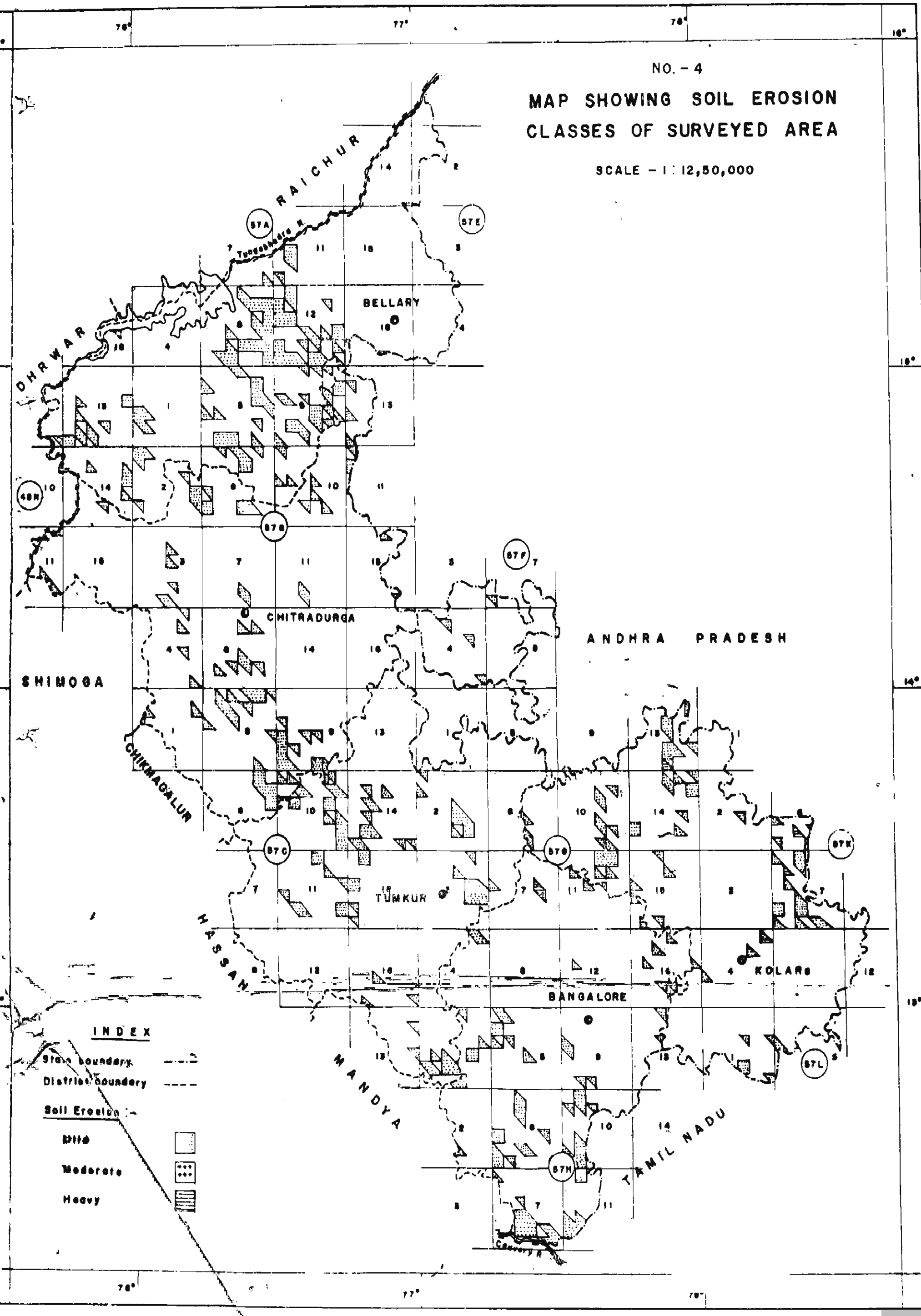

NO. - 2
MAP SHOWING CROP COMPOSITION CLASSES OF SURVEYED AREA
SCALE - 1 : 12,50,000
RAICHUR
DHARWAR
BELLARY
CHITRADURGA
ANDHRA PRADESH
SHIMOGA
CHIKMAGALUR
TUMKUR
KOLAR
BANGALORE
KANARA
TAMIL NADU
INDEX
STATE BOUNDARY
DISTRICT BOUNDARY
CROP COMPOSITION
RAGI
SALAI
MISCELLANEOUS
DECIDUOUS

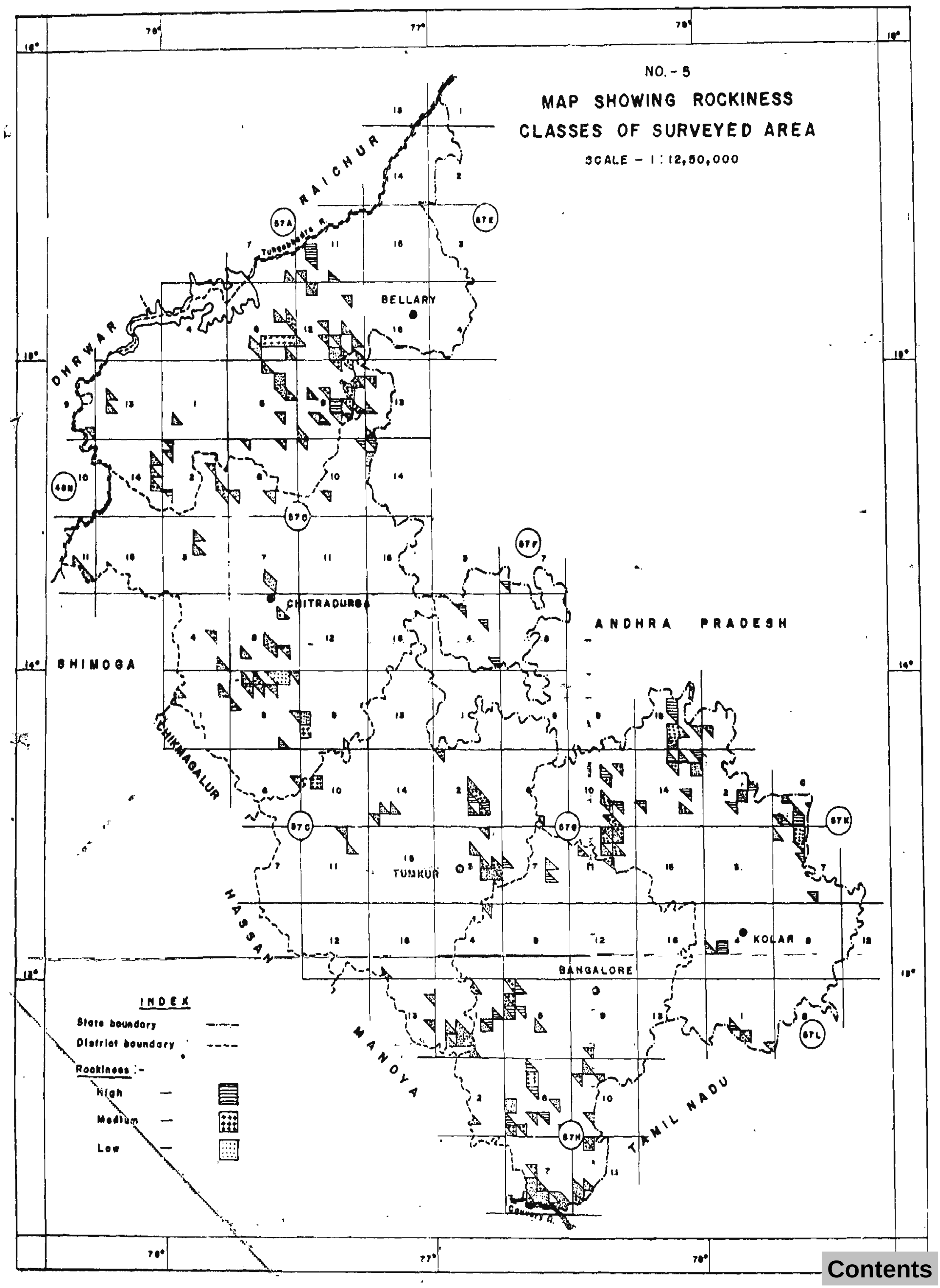
Contents


NO. - 3
MAP SHOWING SOIL DEPTH CLASSES
OF SURVEYED AREA
SCALE - 1 : 12,50,000
RAICHUR
DHRWAR
BELLARY
CHITRADURGA
ANDHRA PRADESH
SHIMOGA
CHIKMAGALUR
TUMKUR
HASSAN
KOLAR
BANGALORE
MANDYA
TAMIL NADU
INDEX
State boundary
District boundary
Soil Depth :-
No soil
Very shallow to shallow
Medium
Deep

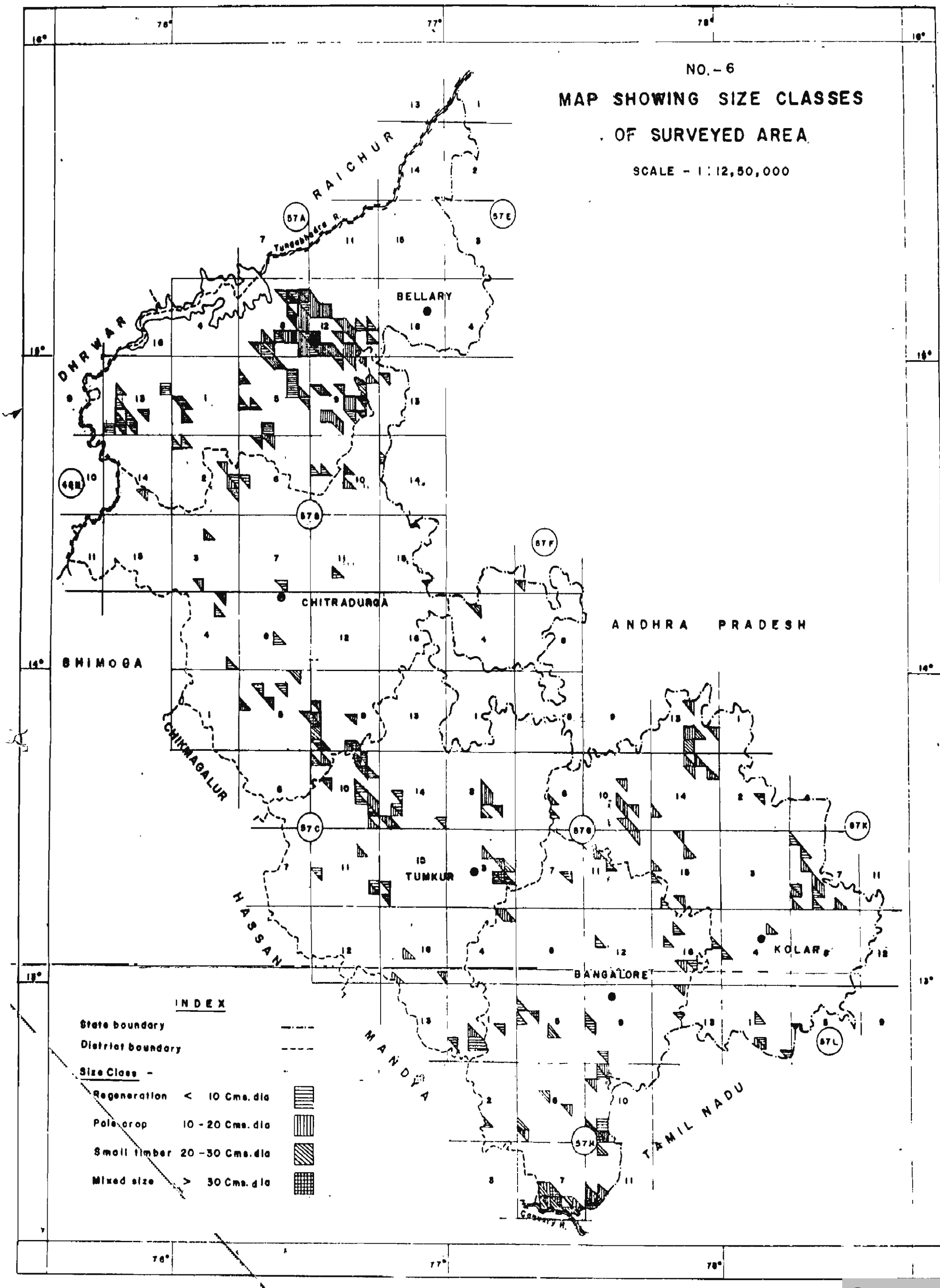
Contents


NO. - 4
MAP SHOWING SOIL EROSION CLASSES OF SURVEYED AREA
SCALE - 1 : 12,50,000
RAICHUR
DHARWAR
BELLARY
CHITRADURGA
ANDHRA PRADESH
SHIMOGA
CHIKMAGALUR
TUMKUR
HASSAN
KOLARS
BANGALORE
MANDYA
TAMIL NADU
INDEX
State boundary
District boundary
Soil Erosion :-
Mild
Moderate
Heavy

Contents


NO. - 5
MAP SHOWING ROCKINESS CLASSES OF SURVEYED AREA
SCALE - 1 : 12,50,000
RAICHUR
DHARWAR
BELLARY
CHITRADURGA
ANDHRA PRADESH
SHIMOGA
CHIKMAGALUR
TUMKUR
KOLAR
BANGALORE
HASSAN
MANDYA
TAMIL NADU
INDEX
State boundary
District boundary
Rockiness :-
High
Medium
Low

Contents


NO. - 6
MAP SHOWING SIZE CLASSES
OF SURVEYED AREA
SCALE - 1 : 12,50,000
RAICHUR
DHARWAR
BELLARY
CHITRADURGA
ANDHRA PRADESH
SHIMOGA
CHIKMAGALUR
TUMKUR
HASSAN
KOLAR
BANGALORE
MANDYA
TAMIL NADU
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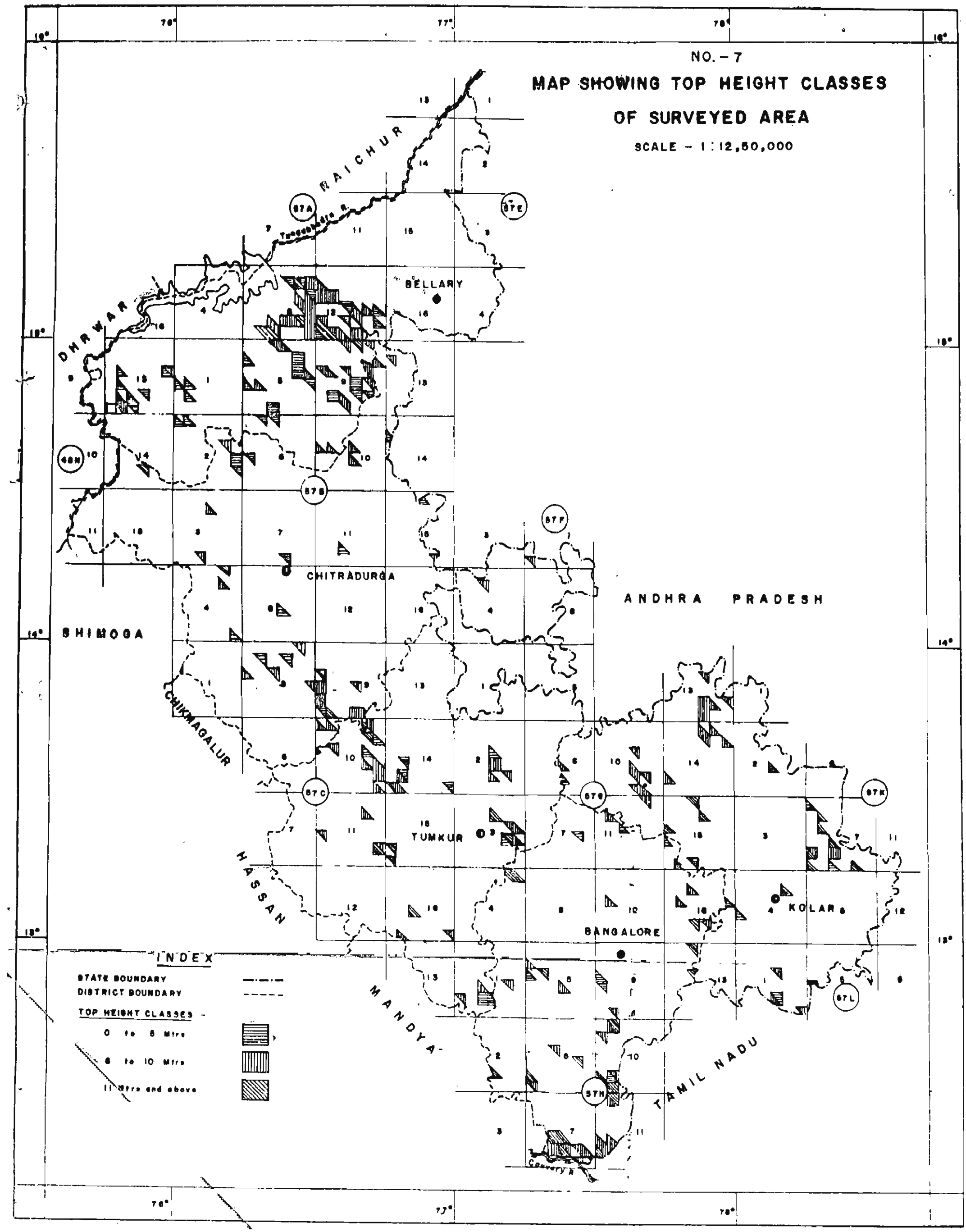
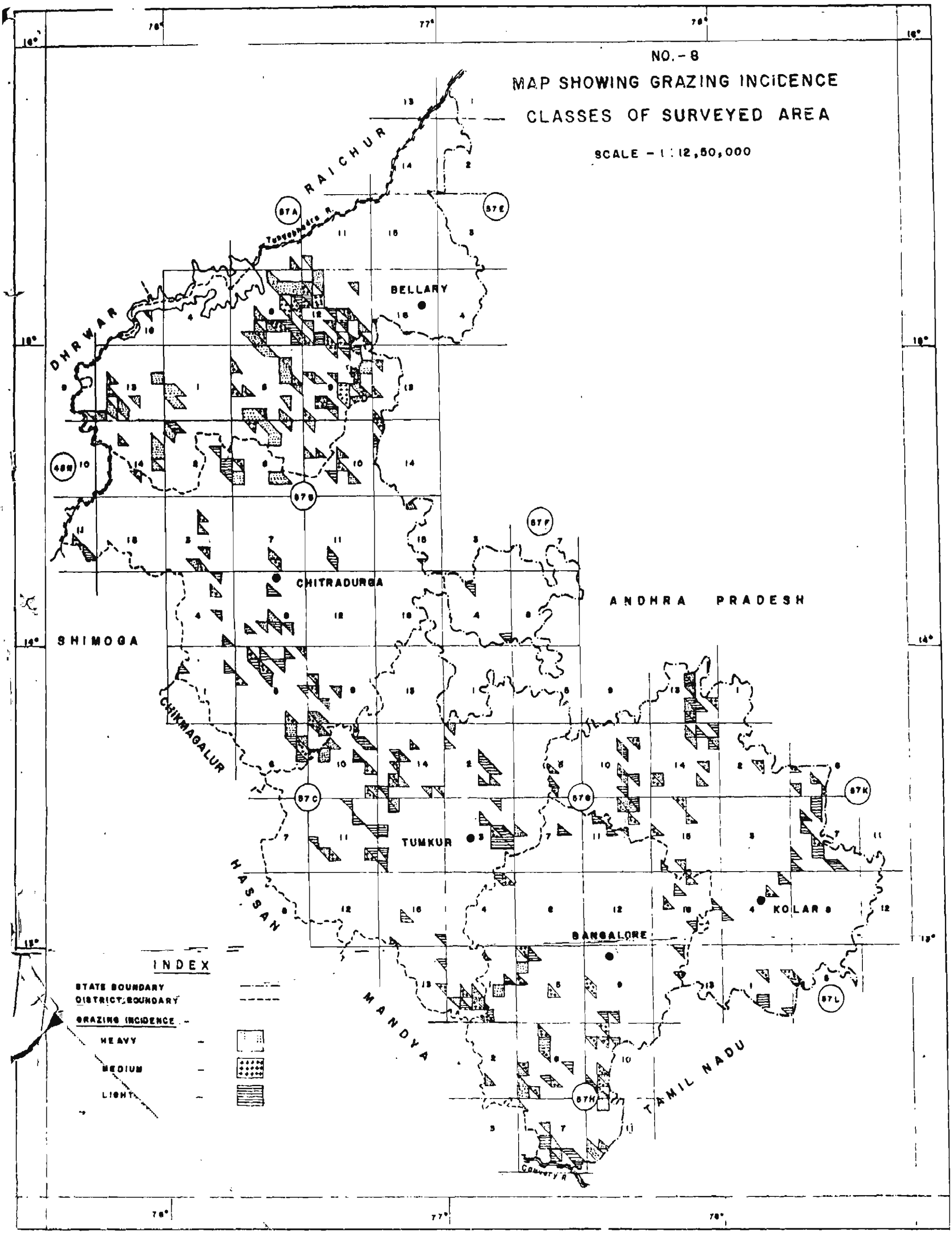
State boundary
District boundary
Size Class -
Regeneration < 10 Cms. dia
Pole crop 10 - 20 Cms. dia
Small timber 20 - 30 Cms. dia
Mixed size > 30 Cms. dia

Contents


NO. - 7
MAP SHOWING TOP HEIGHT CLASSES
OF SURVEYED AREA
SCALE - 1 : 12,50,000
RAICHUR
DHARWAR
BELLARY
CHITRADURGA
ANDHRA PRADESH
SHIMOGA
CHIKMAGALUR
TUMKUR
HASSAN
KOLAR
BANGALORE
MANDYA
TAMIL NADU
INDEX
STATE BOUNDARY
DISTRICT BOUNDARY
TOP HEIGHT CLASSES -
0 to 5 Mtrs
5 to 10 Mtrs
11 Mtrs and above

Contents


NO. - 8
MAP SHOWING GRAZING INCIDENCE
CLASSES OF SURVEYED AREA
SCALE - 1 : 12,50,000
RAICHUR
DHARWAR
BELLARY
CHITRADURGA
ANDHRA PRADESH
SHIMOGA
CHIKMAGALUR
TUMKUR
HASSAN
KOLAR
BANGALORE
MANDYA
TAMIL NADU
INDEX
STATE BOUNDARY
DISTRICT BOUNDARY
GRAZING INCIDENCE
HEAVY
MEDIUM
LIGHT

Contents

APPENDIX - 9

Table for stratum KHAIR crop composition, No. of Stem ('000)
No. of plots = 15 Area = 148.37 km2

Code	Species description	Total	Diameter classes (in cm.)										
			10-15	15-20	20-25	25-30	30-35	35-40	40-50	50-60	60-70	70-80	80
006	Acacia catechu	652.828	553.915	89.022	9.891								
063	Anogeissus latifolia	9.891	9.891										
221	Dalbergia paniculata	19.783	9.891		9.891								
345	Hardwickia binata	39.565	39.565										
736	Rest of species	128.587	118.696	9.891									
999	All species total	850.654	731.958	98.913	19.783								

Table for stratum KHAIR crop composition stem/ha.

No. of plots = 15 Area = 148.37 km2.

Code No.	Species description	Total	Diameter classes (in cms.)										
			10-15	15-20	20-25	25-30	30-35	35-40	40-50	50-60	60-70	70-80	80+
006	Acacia catechu	44.000	37.333	6.000	0.667								
063	Anogeissus latifolia	0.667	0.667										
221	Dalbergia paniculata	1.334	0.667	-	0.667								
345	Hardwickia binata	2.667	2.667										
736	Rest of species	8.667	8.000	0.667									
999	All species total	57.335	49.334	6.667	1.334								

Table for stratum SALAI crop composition, No. of stem ('000)

No. of plots = 8 Area = 79.13 km2.

Code No.	Species description	Total	Diameter classes (in cms.)										
			10-15	15-20	20-25	25-30	30-35	35-40	40-50	50-60	60-70	70-80	80+
038	Albizzia amara	101.739	22.609	33.913	45.217								
063	Anogeissus latifolia	11.304		11.304									
111	Boswellia serrata	418.259	158.260	158.260	45.217	33.913	22.609						
169	Chloroxylon swietenia	101.739	67.826	33.913									
567	Pterocarpus marsupium	22.608		11.304	11.304								
671	Tamarindus indica	11.304	11.304										
681	Terminalia crenulata	22.609	22.609										
736	Rest of species	497.388	316.520	158.260				11.304	11.304				
999	All species total	1186.950	599.128	406.954	101.738	33.913	33.913	11.304					

APPENDIX-12

Table for stratum SALAI crop composition Stem/ha.

No. of plots = 8

Area = 79.13 km2.

Code No.	Species description	Total	Diameter classes (in cms.)										
			10-15	15-20	20-25	25-30	30-35	35-40	40-50	50-60	60-70	70-80	80+
038	Albizzia amara	12.857	2.857	4.286	5.714								
063	Anogeissus latifolia	1.429	-	1.429									
111	Boswellia serrata	52.857	20.000	20.000	5.714	4.286	2.857						
169	Chloroxylon swietenia	12.857	8.571	4.286									
567	Pterocarpus marsupium	2.858	-	1.429	1.429								
671	Tamarindus indica	1.429	1.429										
681	Terminalia crenulata	2.857	2.857										
736	Rest of species	62.858	40.000	20.000			1.429	1.429					
999	All species total	150.002	75.714	51.430	12.857	4.286	4.286	1.429					

Table for stratum DECIDUOUS crop, No. of Stem ('000)

No. of plots = 162 Area = 1602.38 km2

Code No.	Species description	Total	Diameter classes (in cms.)										
			10-15	15-20	20-25	25-30	30-35	35-40	40-50	50-60	60-70	70-80	80+
006	Acacia catechu	382.959	292.258	60.467	20.156	10.078							
038	Albizzia amara	725.606	302.336	161.246	90.701	40.311	70.545	10.078	50.389				
063	Anogeissus latifolia	715.529	564.360	90.701	30.234	20.156			10.078				
111	Boswellia serrata	735.684	423.270	151.168	90.701	60.467	10.078						
116	Buchanania latifolia	201.558	171.324	10.078	10.078			10.078					
169	Chloroxylon swietenia	534.127	503.893	20.156		10.078							
221	Dalbergia paniculata	594.594	342.647	151.168	40.311	30.234		30.234					
234	Diospyros melanoxylon	60.467	50.389	10.078									
282	Eucalyptus hybrid	120.935		70.545	30.234	10.078	10.078						
345	Hardwickia binata	1652.768	927.163	332.569	131.012	110.856	60.467	50.389	10.078	20.156		10.078	
567	Pterocarpus marsupium	493.815	322.491	120.934	30.234	10.078		10.078					
671	Tamarindus indica	201.558	100.779	40.311	10.078	10.078	10.078	20.156	10.078				
681	Terminalia crenulata	947.319	856.618	80.623	10.078								
736	Rest of species	4021.065	2529.542	705.450	362.803	110.856	80.623	50.389	90.701	40.311	30.234	20.156	
999	All species total	11387.984	7387.070	2005.494	856.620	423.270	241.869	181.402	171.324	60.467	30.234	30.234	

Contents

Table for stratum DECIDUOUS crop composition Stem/ha.

No. of plots = 162 Area = 1602.38 km2.

Code No.	Species description	Total	Diameter classes (in cms.)										
			10-15	15-20	20-25	25-30	30-35	35-40	40-50	50-60	60-70	70-80	80+
006	Acacia catechu	2.390	1.824	0.377	0.126	0.063							
038	Albizzia amara	4.528	1.887	1.006	0.566	0.252	0.440	0.063	0.314				
063	Anogeissus latifolia	4.466	3.522	0.566	0.189	0.126			0.063				
111	Boswellia serrata	4.591	2.642	0.943	0.566	0.377	0.063						
116	Buchanania latifolia	1.258	1.069	0.063	0.063			0.063					
169	Chloroxylon swietenia	3.334	3.145	0.126		0.063							
221	Dalbergia paniculata	3.711	2.138	0.943	0.252	0.189		0.189					
234	Diospyros melanoxylon	0.377	0.314	0.063									
282	Eucalyptus hybrid	0.755		0.440	0.189	0.063	0.063						
345	Hardwickia binata	10.314	5.786	2.075	0.818	0.692	0.377	0.314	0.063	0.126			0.063
567	Pterocarpus marsupium	3.083	2.013	0.755	0.189	0.063		0.063					
671	Tamarindus indica	1.259	0.629	0.252	0.063	0.063	0.063	0.126	0.063				
681	Terminalia crenulata	5.912	5.346	0.503	0.063								
736	Rest of species	25.095	15.786	4.403	2.264	0.692	0.503	0.314	0.566	0.252	0.189		0.126
999	All species total	71.073	46.101	12.515	5.348	2.643	1.509	1.132	1.069	0.378	0.189		0.189

Table for stratum MISCELLANEOUS crop composition, No. of Stem ('000)

No. of plots = 97 Area = 959.45 km2.

Code No.	Species description	Total	Diameter classes (in cms.)										
			10-15	15-20	20-25	25-30	30-35	35-40	40-50	50-60	60-70	70-80	80+
116	Buchanania latifolia	9.891		9.891									
234	Diospyros melonoxylon	9.891	9.891										
282	Eucalyptus hybrid	1572.706	1434.229	128.586	9.891								
345	Hardwickia binata	197.825	69.239	39.565	29.674	9.891	9.891	19.782		9.891	9.891		
671	Tamarindus indica	69.239		19.782	9.891	19.782		9.891	9.891				
736	Rest of species	375.866	168.151	69.239	59.347	19.782	29.674	19.782	9.891				
999	All species total	2235.418	1681.510	267.063	108.804	49.456	39.565	49.456	19.782	9.891	9.891		

APPENDIX-16

Table for stratum Miscellaneous crop composition Stem/ha.

No. of plots = 97 Area = 959.45 km2.

Code No.	Species description	Total	Diameter classes (in cms.)										
			10-15	15-20	20-25	25-30	30-35	35-40	40-50	50-60	60-70	70-80	80+
116	Buchanania latifolia	0.103		0.103									
234	Diospyros melanoxylon	0.103	0.103										
282	Eucalyptus hybrid	16.391	14.948	1.340	0.103								
345	Hardwickia binata	2.061	0.722	0.412	0.309	0.103	0.103	0.206		0.103	0.103		
671	Tamarindus indica	0.721		0.206	0.103	0.206		0.103	0.103				
736	Rest of species	3.918	1.753	0.722	0.619	0.206	0.309	0.206	0.103				
999	All species total	23.297	17.526	2.783	1.134	0.515	0.412	0.515	0.206	0.103	0.103		

Contents

Table for stratum KHAIR crop composition Volume ('000)M^3

No. of plots = 15 Area = 148.37 km2.

Code No.	Species description	Total	Diameter classes (in cms.)										
			10-15	15-20	20-25	25-30	30-35	35-40	40-50	50-60	60-70	70-80	80+
006	Acacia catechu	35.581	21.285	11.960	2.336								
063	Anogeissus latifolia	0.409	0.409										
221	Dalbergia paniculata	2.829	0.664		2.165								
345	Hardwickia binata	1.993	1.993										
736	Rest of species	6.180	5.318	0.862									
999	All species total	46.992	29.669	12.822	4.501								

Table for stratum KHAIR crop composition Volume/ha

No. of plots = 15 Area = 148.37 km2.

Code No.	Species description	Total	Diameter classes (in cms.)										
			10-15	15-20	20-25	25-30	30-35	35-40	40-50	50-60	60-70	70-80	80+
006	Acacia catechu	2.398	1.435	0.806	0.157								
063	Anogeissus latifolia	0.028	0.028										
221	Dalbergia paniculata	0.191	0.045		0.146								
345	Hardwickia binata	0.134	0.134										
736	Rest of species	0.416	0.358	0.058									
999	All species total	3.167	2.000	0.864	0.303								

Table for stratum SALAI Crop composition Volume (!000)M^{3+}

No. of plots = 8 Area = 79.13 km2.

Code No.	Species description	Total	Diameter classes (in cms.)										
			10-15	15-20	20-25	25-30	30-35	35-40	40-50	50-60	60-70	70-80	80+
038	Albizzia amara	14.788	1.517	3.539	9.732								
063	Anogeissus latifolia	1.445		1.445									
111	Boswellia serrata	58.052	5.095	18.363	9.408	12.786	12.400						
169	Chloroxylon swietenia	6.735	3.196	3.539									
567	Pterocarpus marsupium	3.928		1.292	2.636								
671	Tamarindus indica	0.528	0.528										
681	Terminalia crenulata	0.375	0.375										
736	Rest of species	41.016	16.192	14.235			4.543	6.046					
999	All species total	126.867	26.903	42.414	21.775	12.786	16.943	6.046					

Table for stratum SALAI crop composition Volume/ha.

No. of plots = 8 Area = 79.13 km2.

Code No.	Species description	Total	Diameter classes (in cms.)										
			10-15	15-20	20-25	25-30	30-35	35-40	40-50	50-60	60-70	70-80	80+
038	Albizzia amara	1.869	0.192	0.447	1.230								
063	Anogeissus latifolia	0.183		0.183									
111	Boswellia serrata	7.357	0.644	2.321	1.189	1.616	1.567						
169	Chloroxylon swietenia	0.851	0.404	0.447									
567	Pterocarpus marsupium	0.496		0.163	0.333								
671	Tamarindus indica	0.067	0.067										
681	Terminalia crenulata	0.047	0.047										
736	Rest of species	5.183	2.046	1.799			0.574	0.764					
999	All species total	16.033	3.400	5.360	2.752	1.616	2.141	0.764					

Table for stratum DECIDUOUS crop composition Volume ('000)M^3

No. of plots = 162 Area = 1602.38 km2.

Y

Code No.	Species description	Total	Diameter classes (in cms.) 10-15	15-20	20-25	25-30	30-35	35-40	40-50	50-60	60-70	70-80	80+
006	Acacia catechu	26.270	9.698	7.390	5.026	4.156							
038	Albizzia amara	143.745	15.036	18.371	17.482	11.685	29.349	5.390	46.432				
063	Anogeissus latifolia	72.264	34.291	13.179	7.656	7.424			9.714				
111	Boswellia serrata	80.110	12.315	16.352	22.675	22.828	5.940						
116	Buchanania latifolia	17.728	9.142	1.396	2.052			5.138					
169	Chloroxylon swietenia	28.510	23.939	1.903		2.668							
221	Dalbergia paniculata	67.444	17.370	15.931	7.804	8.253		18.086					
234	Diospyros melanoxylon	1.826	1.043	0.783									
282	Eucalyptus hybrid	32.404		12.240	8.653	5.085	6.426						
345	Hardwickia binata	309.616	44.579	35.031	26.900	32.967	26.902	30.008	10.148	29.965			73.116
567	Pterocarpus marsupium	53.811	15.224	15.711	7.654	4.504		10.718					
671	Tamarindus indica	42.722	5.034	3.887	1.994	3.182	4.366	13.076	11.183				
681	Tarminalia crenulata	37.671	23.892	10.683	3.096								
736	Rest of species	709.748	121.258	68.312	70.739	31.676	34.397	29.982	83.120	58.074	64.001		148.189
999	All species total	1623.869	332.821	221.169	181.731	134.428	107.380	112.398	160.597	88.039	64.001		221.305

Table for stratum DECIDUOUS crop composition Volume/ha.

No. of plots=162 Area = 1602.38 km2.

Code No.	Species description	Total	Diameter classes (in cms.)										
			10-15	15-20	20-25	25-30	30-35	35-40	40-50	50-60	60-70	70-80	80+
006	Acacia catechu 001	0.164	0.061	0.046	0.031	0.026							
038	Albizzia amara 043	0.897	0.094	0.115	0.109	0.073	0.183	0.034	0.290				
063	Anogeissus latifolia 072	0.451	0.214	0.082	0.048	0.046			0.061				
116	Buchanania latifolia 143	0.111	0.057	0.009	0.013			0.032					
111	Boswellia serrata 133	0.500	0.077	0.102	0.142	0.142	0.037						
169	Chloroxylon swietenia 201	0.178	0.149	0.012		0.017							
221	Dalbergia paniculata 267	0.421	0.108	0.099	0.049	0.052		0.113					
234	Diospyros melanoxylon 285	0.012	0.007	0.005									
282	Eucalyptus hybrid 346	0.202		0.076	0.054	0.032	0.040						
345	Hardwickia binata 441	1.932	0.278	0.219	0.168	0.206	0.168	0.187	0.063	0.187			0.456
567	Pterocarpus marsupium 722	0.336	0.095	0.098	0.048	0.028		0.067					
671	Tamarindus indica 856	0.265	0.030	0.024	0.012	0.020	0.027	0.082	0.070				
681	Terminalia crenulata 866	0.235	0.149	0.067	0.019								
736	Rest of species 944	4.429	0.757	0.426	0.441	0.198	0.215	0.187	0.519	0.362	0.399		0.925
999	All species total	10.134	2.076	1.380	1.134	0.840	0.670	0.702	1.003	0.549	0.399		1.381

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Table for stratum MISCELLANEOUS crop composition Volume ('000)M^3

No. of plots = 97 Area = 959.45 km2.

Code No.	Species description	Total	Diameter classes (in cms.)										
			10-15	15-20	20-25	25-30	30-35	35-40	40-50	50-60	60-70	70-80	80+
116	Buchanania latifolia	0.977		0.977									
234	Diospyros melanoxylon	0.109	0.109										
282	Eucalyptus hybrid	85.220	67.187	14.890	3.143								
345	Hardwickia binata	68.437	3.720	3.473	5.884	3.123	4.607	12.062		13.159	22.409		
671	Tamarindus indica	23.961		2.011	2.385	5.741		5.290	8.534				
736	Rest of species	64.878	7.240	8.741	11.392	5.987	12.595	11.701	7.222				
999	All species total	243.582	78.255	30.093	22.805	14.850	17.203	29.053	15.755	13.159	22.409		

Table for stratum MISCELLANEOUS crop composition Volume/ha.

No. of plots = 97 Area = 959.45 km2.

Code No.	Species description	Total	Diameter classes (in cms.)										
			10-15	15-20	20-25	25-30	30-35	35-40	40-50	50-60	60-70	70-80	80+
116	Buchanania latifolia	0.010		0.010									
234	Diospyros melanoxylon	0.001	0.001										
282	Eucalyptus hybrid	0.888	0.700	0.155	0.033								
345	Hardwickia binata	0.714	0.039	0.036	0.061	0.033	0.048	0.126		0.137	0.234		
671	Tamarindus indica	0.250		0.021	0.025	0.060		0.055	0.089				
736	Rest of species	0.675	0.075	0.091	0.119	0.062	0.131	0.122	0.075				
999	All species total	2.538	0.815	0.313	0.238	0.155	0.179	0.303	0.164	0.137	0.234		

Stand table showing total number of stems in the tree forest

No. of sample plots = 282 Area = 2789.33 km2.

Sl. No.	Code	Species	Total number of stems
1.	006	Acacia catechu	10,35,787
2	038	Albizzia amara	8,27,345
3	063	Anogeissus latifolia	7,36,724
4	111	Boswellia serrata	11,53,943
5	116	Buchanania latifolia	2,11,449
6	169	Chloroxylon swietenia	6,35,866
7	221	Dalbergia paniculata	6,14,377
8	234	Diospyros melonoxylon	70,358
9	282	Eucalyptus hybrid	16,93,641
10	345	Hardwickia binata	18,90,158
11	567	Pterocarpus marsupium	5,16,423
12	671	Tamarindus indica	2,82,101
13	681	Terminalia crenulata	6,69,928
14	736	Rest of species	50,22,906
		Total of all species	1,56,61,006
		Average number of stem per ha.	56.147489

Contents

Stock table showing volume in tree forest area

No. of sample plots =282 Area = 2789.33 km2.

Sl.No.	Code No.	Species Name	Volume in m^3
1	006	Acacia catechu	61,851
2	038	Albizzia amara	1,58,533
3	063	Anogeissus latifolia	74,118
4	111	Boswellia serrata	1,38,162
5	116	Buchanania latifolia	18,705
6	169	Chloroxylon swietenia	35,245
7	221	Delbergia paniculata	70,273
8	234	Diospyros melanoxylon	1,935
9	282	Eucalyptus hybrid	1,17,624
10	345	Hardwickia binata	3,80,046
11	567	Pterocarpus marsupium	57,739
12	671	Tamarindus indica	67,211
13	681	Terminalia crenulata	38,046
14	736	Rest of species	8,21,822
		Total of species	20,41,310
		ha	73.183

Contents

F.S.I., S.A.? Bangalore. Field form No. 1

P L O T A P P R O A C H F O R M

1. Plot approach form muct be filled in while the journey is in progress.
2. While recording data it is essential to record month and year also
3. If a plot is visited on more than one day, a separate form of each visit shall be filled up.

1. State and code.
2. Division and code.
3. District and code
4. Map sheet and code
5. Grid code
6. Crew Leader (Name)
7. Name of camp
8. Time (hrs) at which left the camp.
9. Distance covered by vehicle (Km)
10. Time taken in journey by vehicle Hours Minutes
11. Name of the place up to which journey was performed by vehicle (describe in brief)

12. Conspicuous features observed during the journey by vehicle (describe in brief.)

Time at which started on foot.

Direction and distance covered on foot up to the reference point (km)

15. Conspicuous features observed during the journey on foot (describe in brief)
16. Time (Hrs) at which arrived at the reference point.
17. Description of the reference point (Describe in details.

18. Compass bearing from reference point to the plot approached for commencing survey (please give the plot No. also) if any.
19. Distance of the plot from reference point (mts)
20. Date and Time at which arrived at the plot Plot 1 Plot 2
21. Time (hrs) of leaving the plot
22. Time (hrs) at which returned to the camp

Name and designation.

Contents

23. Compassing done by

24. Distance measured by

25. Plot laid out by

26. Tree enumeration done by

27. Height measurements taken by

28. B.T. and other measurements taken by

29. Bamboo enumeration done by

30. Bamboo weight taken by

31. Reference in the field written by

32. Remarks.

Date

Signature of crew leader.

Diagrams etc.

A

B

Contents

Plot Description Form

Field Form-2

Job No.	Card design	Zone	State	District	Forest Division	Map Sheet No.	Grid No.	Plot No.	Legal Status	Land use
1-3	4-5	6	7-8	9-10	11-12	13-18	19-22	23	24	25-26

Terrain Data							Soil Data						Crop Data													Bamboo Data																	
																																	Accessibility		Rd. distance to Market							
General Topography	SLOPE	Position on Slope	Altitude	Aspect	Rockiness	Humus	Soil colour	Soil consistency	Soil texture	Coarse Fragments	Soil Depth	Soil Erosion	Origin of stand	Crop composition	Canopy layer or storey	Top height	Size class	Intensity of regeneration	Important Species	Injuries to crop	Fire incidence	Grazing incidence	Presence of weeds	Presence of grass	Bamboo density	Bamboo quality	Bamboo flowering	Bamboo regeneration	Plantation potential	Distance to Road	Distance to mule path	Distance to river/stream	Kacha Road distance	Pucca Road distance	River distance to Market outlet	Obstacles	Plot Status	Degraded forest				
27	28-30	31	32-35	36	37	38	39	40	41	42	43	44	45	46-47	48-49	50-51	52	53	54-56	57	58	59	60	61	62	63	64	65	66	67	68	69	70-71	72-74	75-76	77	78	79-80				

Signature of the Crew Leader .....

Name of the Crew Leader.....

Date.....

Contents

PLOT ENUMERATION FORM

Field Form No. 3

Job No.	Card Design	Map Sheet No.	Grid No.	Plot No.
1-3	4-5	6-11	12-15	16

Total No. of Bamboo Clumps	Total No. of Trees
71-73	74-76

Species		Species		Species		Species		Species		Species		Species		Species		Species	
Code	Dia	Code	Dia	Code	Dia	Code	Dia	Code	Dia	Code	Dia	Code	Dia	Code	Dia	Code	Dia
17-19	20-22	23-25	29-28	29-31	32-34	35-37	38-40	41-43	44-46	47-49	50-52	53-55	56-58	59-61	62-64	65-67	68-70

Date.....

Signature of Crew Leader.....

Name of the Crew Leader.....

Contents

SAMPLE TREE FORM

Field Form No. 4

Job No.	Card Design	Map Sheet No.	Grid No.	Plot No.
1-3	4-5	6-11	12-15	16

Total No. of Trees
55-56

SPECIES	Tree Serial No.	Species Code	Dominance	DBH OB (cm)	DBT (mm)	Tree Height (m)	Clear Bole (m)	Condition	Form: Longitudinal	Form: Sectional	SPECIES	Tree Serial No.	Species Code	Dominance	DBH OB (cm)	DBT (mm)	Tree Height (m)	Clear Bole (m)	Condition	Form: Longitudinal	Form: Sectional
	17-18	19-21	22	23-25	26-28	29-30	31-32	33	34	35		36-37	38-40	41	42-44	45-47	48-49	50-51	52	53	54

Date _____

Signature of the Crew Leader.....

Name of the Crew Leader.....

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BAMBOO ENUMERATION FORM

Job No.	Card Design	Map Sheet No.	Grid No./ Inter Sectional No	Plot No.
1—3	4—5	6—11	12—15	16

Average culm height (In dcm)		Bamboo quality
Upto 1 cm. top dia. 72–74	Upto 2 cm. top dia. 75–77	78

Species	Species Code	Clump Serial No.	Clump diameter (in Cms)	Clump size class	Green sound culms							Green damaged culms							Dry sound culms			Dry damaged culms			Decayed culms	Total No. of culms
					Current year's	One to two seasons old			Over two seasons old			Current year's	One to two seasons old			Over two seasons old										
						2<5 Cms	5<8 Cms	8 + Cms	2<5 Cms	5<8 Cms	8 + Cms		2<5 Cms	5<8 Cms	8+ Cms	2<5 Cms	5<8 Cms	8+ Cms	2<5 Cms	5<8 Cms	8 + Cms	2<5 Cms	5<8 Cms	8+ Cms		
	17-19	20-22	23-25	26	27-28	29-30	31-32	33-34	35-36	37-38	39-40	41-42	43-44	45-46	47-48	49-50	51-52	53-54	55-56	57-58	59-60	61-62	63-64	65-66	67-68	69-71

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Signature of Crew Leader.....

Name of Crew Leader.....

BAMBOO ENUMERATION FORM (NON CLUMP FORMING)

Job No.	Card Design	Map Sheet No.	Grid No.	Plot No.
1—3	4—5	6—11	12—15	16

Species Code	Green sound culms							Green damaged culms							Dry sound culms			Dry damaged culms			Decayed culms	Average culm Ht in decimeter	Total No. of culms
	Current year	One to two years old			Over two years old			Current year	One to two years old			Over two years old											
		2<5 Cms	5<8 Cms	8+ Cms	2<5 Cms	5<8 Cms	8+ Cms		2<5 Cms	5<8 Cms	8+ Cms	2<5 Cms	5<8 Cms	8+ Cms	2<5 Cms	5<8 Cms	8+ Cms	2<5 Cms	5<8 Cms	8+ Cms			
17-19	20-22	23-25	26-28	29-30	31-33	34-36	37-38	39-41	42-44	45-47	48-49	50-52	53-55	56-57	58-60	61-62	63-64	65-67	68-69	70-71	72-73	74-76	77-80

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ate.....

Signature of Crew Leader.....

Name of Crew Leader.....

R. S. I. S. Z, Bangalore.

Field Form

Job Number	Card Design
1—3	4—5

BAMBOO WEIGHT FORM

Map sheet Number	Grid No./ Inter Sectionl No.	Plot Number
6—11	12—15	16

Species	Sample No.	Green Weight of Culm															Green weight of sub sample for co-relation with dry weight		
		DIAMETER CLASS																	
		2 to under 5 cm.					5 to under 8 cm.					8 cm. and over							
		Diameter in cm.	Total length in dmt.	Utilizable length in dmt.		Weight in Grams	Diameter in cm.	Total length in dmt.	Utilizable length in dmt.		Grams Weight in	Diametet in cm	Total length in dmt.	Utilizable length in dmt.		Weight in Grams	Sub-sample culm 2 cm. & uuder 5 cm. diam.	Sub-sample culm 5cm. & under 8 cm. diam.	Sub sample culm 8 cm. and over
				Upto 1 cm top dia	Upto 2 cm top dia				Upto 1 cm top dia	Upto 2 cm top dia				Upto 1 cm top dia.	Upto 2 cm top dia				

17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

Date :____________

Signature of the Crew Leader____________

Name of the Crew leader____________

Contents

ap Sheet No.
RID No.
.OT No.

HERBS AND SHRUBS DATA FORM

Field Form No.

HERBS								SHRUBS									
Name of Species	Total No.	Characteristics Occurrence					Colour of flower if observed	Name of Spp.	Total No.	Avr. Ht.	Pattern of Branching			Occurrence		information on flowers & frui	
		Erect	Prostrate	Creeping	Grega-rious	Sporadic					Opposite	Alternate	Whorling	Grega-rious	Sporadic	Colour of flowers	Size fruit(Sm mediur big)

Signature of the Crew Leader.....
Name of Crew Leader.....
Date.....

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