

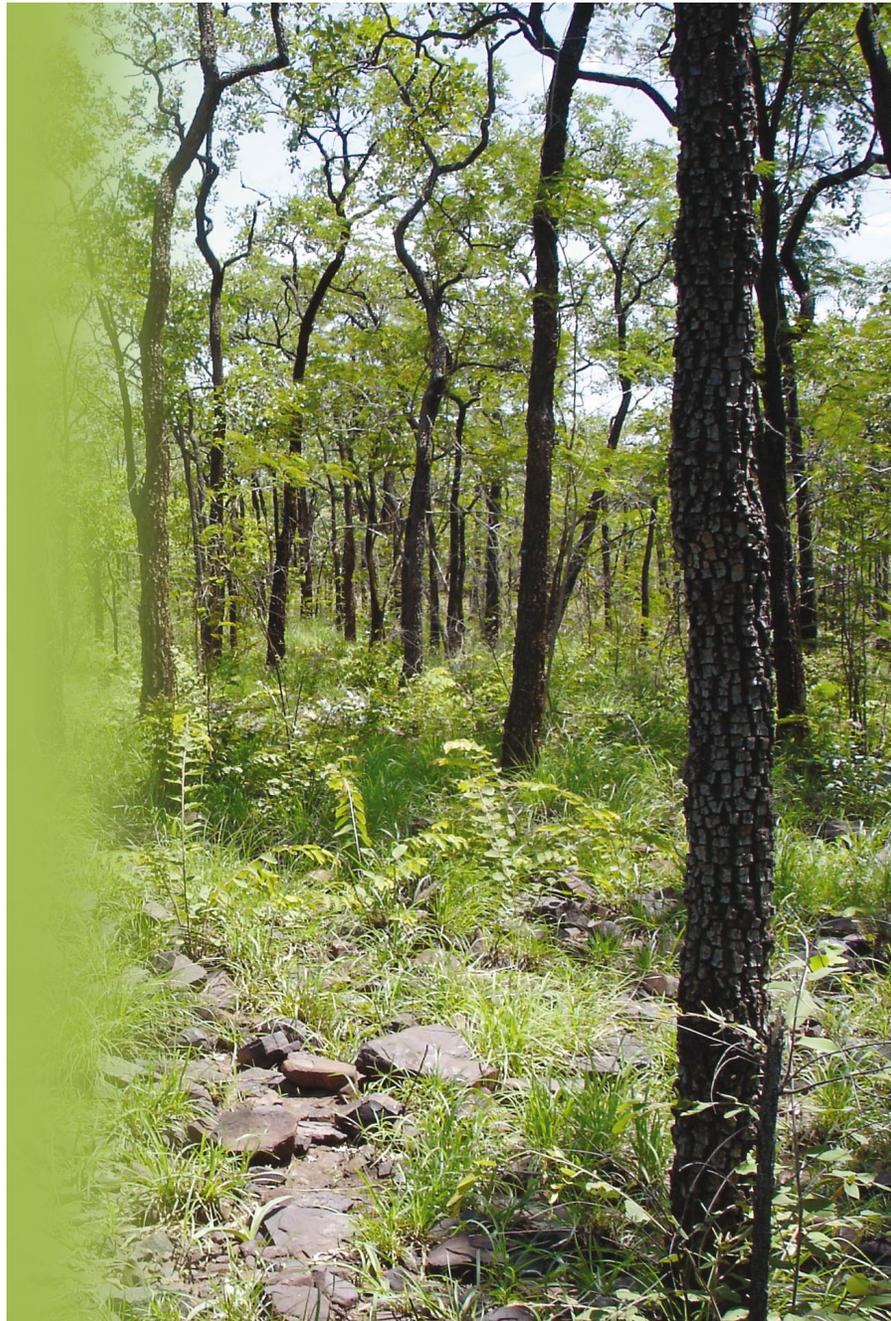
Andhra Pradesh Forest Inventory Report 2010

**Andhra Pradesh Forest Department
Government of Andhra Pradesh
Hyderabad**



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Government of A P
Hyderabad



Andhra Pradesh
Forest Inventory Report
2010

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K. ROSAIAH



**CHIEF MINISTER
Andhra Pradesh**

MESSAGE

Forests are renewable resources and the existence of human beings and their livelihood, especially in rural areas, is closely linked to the forests. The diversity of forests, which yield fuel, fodder and edible products, should be studied so that requirement of Forest dependent communities are met. The assessment of the availability of such valuable resources is a pre-requisite for the planning and development of the forests and development of tribal communities. I am happy to know that the Forest department of Andhra Pradesh is bringing out “Andhra Pradesh Forest Inventory Report-2010”, with assessment of forest wealth using modern technology. Preparation of such reports periodically will help in proper planning and fixing the priorities in planned development of the State of Andhra Pradesh.

I congratulate the PCCF and all the officers and staff who have worked hard in bringing out such a good and beautiful report which will help in making “Harit Andhra Pradesh” a reality. I wish the Forest Department all the best!

K. Rosaiah

K. ROSAIAH

DR. P.RAMA CHANDRA REDDY

**Minister of Environment, Forests,
Science & Technology,
Government of A.P,
Hyderabad**



MESSAGE

It gives me great pleasure to learn that the AP Forest Department is going to release the first “Andhra Pradesh Forest Inventory Report-2010”. Assessment of Forest Resources is a regular work of the Forest Department and it is usually done by the Working Plan Officers for each of the Forest Divisions once in a period of 10 years. However, the Forest Department has carried out inventory of the forest resources of the entire state in one go for the first time; which is a feat of its own kind in the Country. Modern technologies like Remote Sensing, Global Positioning System (GPS) and Geographical Information System (GIS) have been deployed in this exercise extensively. This report not only provides information on the growing stock but also on regeneration status, bamboo occurrence and other vital information required for the Silvicultural management of the forests. The task was challenging considering the nature of the terrain and ground conditions. However, I am happy that the work has been completed on schedule and report is being published. I heartily compliment the AP Forest department in general and the Officers & Scientists of the Geomatics Wing in particular, for bringing out this beautiful report. My best wishes to the Department!

Date: 17-01-2010

P. Rama Chandra Reddy

Foreword



Forest inventory has remained the critical activity for the forest management. It primarily aims at assessing the growing stock of forests (tree numbers or their volume) which is the most important indicator of health and productive capacity of forests. In the recent past, forest inventory has gained further importance due to its role in estimation of forest biomass and carbon needed for climate change studies. It is now well known fact that forests have the potential to be major carbon sinks.

Though forest inventory on small scale (part or full area of a territorial forest division) is carried out by most of the state forest departments in the country while preparing the working plans, the large scale / state or national level forest inventories have been the responsibility of the national agencies – Forest Survey of India. State level forest inventory currently done by Andhra Pradesh Forest Department is first of its kind in the country. Statistically robust sampling approach was followed for conducting the inventory and to provide reliable information. Using the remote sensing and GIS technology entire forest area of the state was first divided into homogenous forest strata to facilitate efficient sampling and laying out sample plots. Besides measuring the trees for estimating their growing stock and estimating bamboo resource, other important indicators such as soil humus, regeneration status, incidence of fire, grazing and pest damage was also measured. Appropriate formats were drawn for data capture and customised software was developed for data analysis with help of FSI and monitoring of field operations was done by senior level officers.

The report provides analytical information on the growing stock of Andhra Pradesh forests by density class wise of each territorial circle and division distributed in different tree species and their diameter classes. A comparison of the growing stock of the areas which were inventoried in the past has also been made. In addition the report provides the distribution of bamboo resource and grasses in the state and incidence of pests, weeds and grazing.

Though some analysis of the vast data collected during inventory is yet to be done, it is hoped that the Andhra Pradesh will make extensive use of the inventory report for strategic planning at the state and district levels of forestry and related sectors and for sustainable management of the forests. It is also hoped other state forest departments will use this inventory as a model and replicate in their states.

A handwritten signature in black ink, appearing to read 'D. Pandey'.

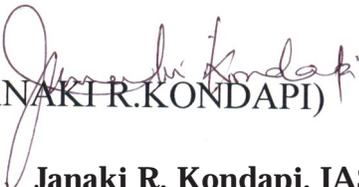
Dr D. Pandey, IFS
Former Director General, Forest Survey of India,
Noida, January 2010

Message

Forest areas in Andhra Pradesh represent a varied composition consisting of diverse species. Many of the species are not commercially viable but they are present in the forest ecosystem as part of evolution to perform a certain role in the system. To distinguish the species and their availability, it is essential to assess their spatial distribution and quantify the availability. For this purpose use of modern technologies like latest satellites imageries, GPS & GIS is essential.

The Geomatics wing of Forest Department, which was set up in the year 1994, is generating data and various maps useful in the preparation of plans and subsequent monitoring. Preparation of 'Andhra Pradesh Forest Inventory Report-2010' by this wing is a monumental work. For effective management of any resource, the availability of resource needs to be quantified so that the planning can be done depending on the availability of financial resources. The present work 'Andhra Pradesh Forest Inventory Report-2010' is a data bank which gives the details of different forest resources and thereby helps in planning for regeneration of depleted resources and harvesting of the forest produce on sustainable basis. This will go a long way in improvement of the Working Plans in the State.

I compliment the PCCF and all the officers and staff of Geomatics Wing for their efforts in preparing this report, which is first of its kind in the Country.


(JANAKI R. KONDAPI)

Janaki R. Kondapi, IAS
Spl. Chief Secretary, EFS & T Department,
Government of Andhra Pradesh

Overview



Forests are crucial for the well being of humanity. They provide foundations for life on earth through ecological functions. Forests regulate the climate and water resources and serve as the habitats for wildlife. Forests also furnish a wide range of goods such as wood, food, fodder and medicines, in addition to opportunities for recreation, spiritual renewal and other services.

Today, forests are under pressure from increasing demands for land-based products and services, which frequently leads to the conversion or degradation of forests into unsustainable forms of land use. When forests are lost or severely degraded, their capacity to function as regulators of the environment is also lost. This in turn, increases flood and soil erosion damages; reduce fertility of soil and leads to the loss of plant and animal life. As a result, the sustainable provision of goods and services from forests is jeopardized.

Under such circumstances, sustainable management of forests becomes a great challenge for the foresters. It is only with the sensitive & focussed planning and sincere implementation that the Forest Department can provide goods and services to the people, specially forest dependent communities. Information on the growing stock, health of the forests, forest soils etc. are crucial for meticulous planning.

The Forests are managed based on the prescriptions contained in the Working Plans for the Forest Divisions. Hitherto this information was being collected by the concerned Working Plan Officers for the Divisions, at different points of time. However, never before information for the entire State was collected at a time; which is essential for preparation of the Strategic Plan at the State & District levels.

The Geomatics Wing of the Department has undertaken this work, under the AP community Forest Management Project using modern tools like Remote Sensing, GPS & GIS, for the first time in the State as well as country. The impressive work turned out by the wing is being presented as “Andhra Pradesh Forest Inventory Report – 2010”. This work is a data bank, which gives detailed information on the forest resources for the State up to Forest Divisions, species wise. I am sure, all the Forest Officers will utilise the information contained in the Report extensively and help realize the goal of greening the State efficiently.

I congratulate the entire team of officers, led by the Addl. Prl. Chief Conservator of Forests (IT), who had taken pains in organising the entire exercise and producing the above work.



C. Madhukar Raj, IFS

Principal Chief Conservator of Forests & Head of Forest Force
Government of Andhra Pradesh



Preface

Andhra Pradesh is India's fifth biggest state with a Geographic area of 27.51 million Hectares which constitutes 8.37% of India's total area. There is a recorded forest of 63,81,400 Hectares which was never inventoried in a single attempt. The present task of Forest Inventory of the recorded forests was thus gigantic and cumbersome which has been successfully completed by a spirited team of officers of the department.

The Forest Inventory was planned and executed between 2006 and 2008 and the report is finalized after elaborate discussions during 2009.

Chapter-I presents details of notified forests of Andhra Pradesh, its Endemic Flora, Protected areas, History of Forest Management & a brief history of Joint Forest Management and Community Forest Management in the state. It also gives a short history of Geomatics activity in Andhra Pradesh since 1994 apart from various forest inventories undertaken in the past in the state.

Chapter-II gives the objectives of the Present exercise of the Inventory, the design of the Inventory, the organisation of field work and the various steps taken effectively to conduct the inventory exercise. It speaks of data collection mechanism, data processing details, volume equations & various outputs of the Inventory.

Chapter-III presents the estimation of Growing Stock of the state, division-wise and circle-wise, Stem Estimation, Basal Area, etc, and Volume of major species.

Chapter-IV summarises the Health of Forests which includes Status of Regeneration, Incidence of Fire, Illicit Fellings, Grazing, Weeds, Grass, Pests, and Soil Erosion Status.

Chapter-V gives Status of Forest Soil, including depth, Distribution of Stoniness, Humus, Soil pH & Organic Carbon.

Chapter-VI gives Division-wise total Growing Stock, Average Growing Stock canopy coverwise and Prominent Species & their Volume.

Chapter-VII gives the Bamboo Resources in the State, including Areas of Bamboo Occurrence in various Circles and Estimation of Bamboos age & class-wise including Dry & Decay Bamboos, and High Cuts of Bamboo.

Chapter-VIII deals with Analysis and Conclusion. It compares the results of present Inventories with all the previous ones for the readers.

There is an appendix showing the seven zones made for the purpose of Inventory and Divisions included in it, distribution of Canopy classes in the various Divisions and various volume equations used.

I congratulate the entire team of Geomatics wing, which completed the task of preparing the Report under the guidance of Dr. H.C. Mishra, IFS, Chief Conservator of Forests (GIS).

P. K. Sharma, IFS

Additional Principle Chief Conservator of Forests (IT)
Andhra Pradesh Forest Department

Acknowledgements



The Inventory of the forest resources of the state of Andhra Pradesh at the state level was conceived and organised during the tenure of Sri S.K. Das, IFS formerly PCCF, Andhra Pradesh without whose guidance and continuous patronage it would not have been possible. I first of all, sincerely acknowledge his contribution to the entire exercise. Sri K.S. Rao, IFS formerly PCCF Andhra Pradesh also pursued the matter and his contribution is acknowledged. It was during period of Sri C. Siva Sankara Reddy, IFS, formerly PCCF the report was prepared and approved in the present form. His review of the draft report on inventory and comments there upon were highly valuable and the same have been incorporated in the report and his contribution is sincerely acknowledged. The guidance of Sri C. Madhukar Raj, IFS; PCCF & HOFF (FAC) during final printing stage is also sincerely acknowledged.

The contributions of Sri PK Sharma, IFS APCCF (IT) is worth mentioning, who steered the Inventory work from the beginning to the report preparation stage. His everyday guidance right from the beginning has shaped the report with accuracy and precision. The co-operation of Sri R.G. Kalaghatgi, IFS APCCF (CFM), Sri B. Murali Krishna, IFS; APCCF (SF), Sri Faujdar, IFS APCCF (Project Formulation) and Sri Pushkar Srivastava, IFS, DyCF (FR); who were all members of the Technical Committee on Inventory, deserve special mention for constantly guiding the Inventory work. Contribution of Dr. Manoranjan Bhanja, IFS; CCF (Research) who organised the analysis of soil samples collected in a decentralised manner and assisted the cell in preparation of the Species Master, correction of species names and helped in finalising the Volume Equations of unavailable species is specially acknowledged.

Special thanks are due to Sri Anoop Singh, IFS, former Conservator of Forests (IT) and Sri A.K Naik, IFS, former Conservator of Forests (GIS) who under the guidance of Dr. Devendra Pandey, IFS, former Director General of the FSI, Dehradun and Dr. K.D. Singh, formerly FAO consultant on Forestry, finalised the design of the Inventory, prepared the Inventory Manual and organised the training of the Officers and Staff. They were assisted in the task by Sri P. Sreenivasa Rao, ACF (GIS), Sri V.Anjaneyulu, Sri S. Madhava Rao, Dr.A. Rama Murthy, all FROs of Geomatics Centre.

Contribution of Dr. Devendra Pandey, IFS; Formerly Director General of FSI, Dehradun & his team & Dr K.D.Singh, formerly FAO expert in regularly guiding the Inventory work are great fully acknowledged.

The Soil samples collected were analysed by Sri T. Tulasi Rao, ACF Biodiversity, Srisailam, Srimati T. Jyothi former State Silviculturist Rajahmundry, Dr. G. Narsaiah, IFS, Former Forest Geneticist, Warangal and Sri P. Srinivas Shastry, IFS, Former State Silviculturist, Tirupati under the

guidance of Soil Science Department of Acharya N.G. Ranga Agriculture University, Rajendra nagar, Hyderabad.

I also acknowledge the contribution of Sri P.Uday Sanker, Former ACF (NW) in monitoring the in-house development of the customised Software for data entry and analysis by the two Project Scientists - Sri Surender Singh and Sri Sharat Chandra of Geometrics Centre, Hyderabad. Contributions made by the Forest Range Officers of the Geomatics centre, Hyderabad namely Sri V. Anjaneyulu, Dr. A. Rama Murthy, Sri S. Madhava Rao, Sri M. Ashok Kumar, Miss T. Nagamaneswari, & Sri I.Prakash and Forest Section Officer G. Srinivas, who have toiled hard in stratification, preparation of maps, training the field staff, data entry, data checking & analysis and preparation of the report are gratefully acknowledged. Services of the Project Scientists, viz, Sri K.Rajasekhar Reddy, Sri M.Rajeshwar Reddy, Sri K.Bhaskar, Sri K.Chakravarthy, Sri R.Venkateshwarulu, Miss Ch.Neeraja, Mrs A.I. Sheeba, Mrs Mallika, and Miss Swathi, who have worked tirelessly all through the process are acknowledged & highly appreciated.

Contribution of Dr M.S.R. Murthy, Head of the Natural Resource & Forestry Division of NRSC Hyderabad, deserves a special acknowledgment for sharing information on vegetation type map of Andhra Pradesh and constant co-operation. Finally the department acknowledges the valuable contributions & guidance given by Mr. Parmesh Shah, Former task Leader, Dr Grant Milne, the present task leader & Dr Paul Ryan, Forestry expert of the World Bank in shaping of the Andhra Pradesh Forest Inventory Project & the World Bank for Financing the Inventory Project without which the AP Forest Inventory would not have been possible.

Last, but not the least, I would like to acknowledge the contributions of all the senior officers as well as the field officers who had toiled hard to organise the field work, without which the Inventory work would not have been possible.



Dr HC Mishra, IFS
Chief Conservator of Forests (GIS)
Andhra Pradesh Forest Department
Hyderabad

Date: 21-01-2010

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Abbreviations

ABO	Assistant Beat Officer	LISS	Linear Imaging Self Scanner
ACF	Assistant Conservator of Forests	M³	Meter Cube
APFA	Andhra Pradesh Forest Academy	MTS	Metric Tonnes
APFD	Andhra Pradesh Forest Department	NDVI	Normalized Difference Vegetation Index
AP	Andhra Pradesh	NP	National Park
APFI	Andhra Pradesh Forest Inventory	NRSA	National Remote Sensing Agency
APCCF	Additional Principal Chief Conservator of Forests	NTFP	Non Timber Forest Produce
AWiFS	Advanced Wide Field Sensor	PA	Protected Area
BA	Basal Area	PAN	Panchromatic
CCF	Chief Conservator of Forests	PCCF	Principal Chief Conservator of Forests
CF	Conservator of Forests	PAF	Plot Approach Form
CI	Confidence Interval	PDF	Plot Description Form
CFM	Community Forest Management	PIS	Pre Investment Survey of Forest Resources
Cu M	Cubic Meters	PPA	Probability Proportionate to Area
DBH	Diameter at Breast Height	PPV	Probability Proportionate to Volume
DCF	Deputy Conservator of Forests	RF	Reserved Forest
FAO	Food & Agriculture Organization	RS	Remote Sensing
FBO	Forest Beat Officer	SD	Standard Deviation
FCA	Forest Conservation Act	Sqkm	Square kilometer
FCD	Forest Canopy Density	UNDP	United Nations Development Program
FDPT	Field Director Project Tiger	VE	Volume equation
FRLHT	Foundation for Revitalization of Local Health Traditions	VSS	Vana Samrakshana Samithi
FRO	Forest Range Officer	WiFS	Wide Field Sensor
FSI	Forest Survey of India	WL	Wild Life
GIS	Geographical Information System	WLS	Wildlife Sanctuary
GPS	Global Positioning System	WP	Working Plan
GS	Growing Stock	WPA	Wildlife Protection Act
Ha	Hectare		
IFA	Indian Forest Act		
IRS	Indian Remote Sensing Satellite		
JFM	Joint Forest Management		
Km²	Square Kilometer		
Lat- Long:	Latitude - Longitude		





Executive Summary

Forest Inventory in Andhra Pradesh

I. Back ground:

Forests are renewable resources and need to be managed on scientific basis. Inventory of forest resources is *sin-qua-non* to the scientific management of the forests on sustainable basis. Hitherto, inventory of forest resources was taken up Division-wise by the Working Plan Officers using traditional tools and methodology in the past. The recent inventory has been taken up for assessing the forest resources of the entire state of Andhra Pradesh, using modern tools of management like Remote Sensing, GIS and GPS.

II. Objectives:

Andhra Pradesh is the fourth largest state in the country with the second largest forest area of 63,814 sqkm. The following were the objectives of the state wide inventory:

1. To collect qualitative and quantitative information, about the forest resources
2. To prepare reports on potentiality and other forest based investigations
3. To serve the data needs of development planning at state and district level
4. Estimate growing stock of timber, including species-wise distribution
5. Inventory of forest resources at the State level had never been attempted in the past. This time inventory of the forest resources of the entire State has been done

III. Methodology:

The methodology involved a stratified random sampling technique using LISS-III Remote Sensing data of IRS P6 satellite, determining number of sample points for 80% accuracy & physical measurements of trees, counting of regenerations, soil sample collection & testing and measuring various other parameters, objectively, like Grazing, Soil erosion, Fire incidence, Stoniness, Pest Incidence, Occurrence of grasses & weeds etc. One dimensional Volume Equations were used for determining the volume of trees and the result of about 50 parameters determined for State & Regional Planning.

IV. Key results:

Total Growing Stock in the 63,814 sqkm of recorded forest area is estimated to be 232 million cubic meters and the average growing stock of the state is 36.37 cubic meters per Ha. The State forest growing stock has decreased from 291.394 million cubic meters as reported in FSI in 1995 in their publication “Extent, Composition, Density, Growing stock and annual increment of India’s forests in 1995” to 232 million cubic meters now. The number of stems per ha in the state is 179. Majority of stems are in 10-20 cm diameter class only.

Anogeissus latifolia, *Tectona grandis* and *Xylia xylocarpa* are the three predominant species in terms of number of stems. In terms of volume, however, *Anogeissus latifolia*, *Xylia xylocarpa* and *Terminalia tomentosa* top the list in that order.

Of the State's Growing Stock, Khammam circle with 12% of total forest area contributes to 19% of the Growing Stock of the State, which is the highest. Vizag Circle with 10% of Forest area contributes to 16% of the Growing Stock and ranks second. Adilabad district with 11% forest area contributes to 14% of the Growing Stock and ranks third.

Srisailem Circle comprising of Rajiv Gandhi Tiger Project has the Growing Stock of 17.84 Million cubic meters.

Hyderabad circle has the lowest of Growing Stock per Ha of 7.8 cubic meters only. Ananthapur Circle which includes Ananthapur & Chittoor West Divisions has next lowest Growing Stock of 10.53 cubic meters per Ha.

Visakhapatnam circle has maximum Growing Stock per Ha which is 57.84 cubic meters per Ha followed by Rajahmundry Circle with 56.79 cubic meters per Ha and Khammam circle 53.60 cubic meters per Ha.

Seedling regeneration is inadequate in 30,440 sqkm and absent in 5650 sqkm in the State. An extent of 2110 sqkm in state has high fire incidence, and 11,640 sqkm has medium fire incidence.







1. Introduction

Introduction

1. About Andhra Pradesh

Andhra Pradesh is situated on the southeast coast of India and lies between 12° 40' and 19° 50' North Latitude and 76° 45' and 84° 40' East Longitude. It has a geographical area of 27.51 million Ha which is 8.37% of the total area of the country. It is the fourth largest State of the Country. Physiographically, the State can be divided into 3 distinct regions, viz, (i) the hilly region with Nallamalai and Erramalai Hills of the Rayalaseema and the Eastern Ghats (ii) the plateau region with an altitude of 100M to 1000M, spread mainly over the Telangana region and (iii) the delta region of the rivers Godavari and Krishna between the Eastern Ghats and the Sea coast. The major rivers drain into the Bay of Bengal.

Climate of the State is hot and humid with temperatures ranging from 15°C to 45°C. Annual rainfall ranges from 1100 to 1250 mm in the north reducing to about 500 mm in the south. The north-eastern areas along the coastline are periodically lashed by cyclones.

The total population of the State is 76.21 million (Census 2001) which is 7.41% of the Country's population. Of this, the rural population is 72.70% and the urban 27.30%. The population density is 277 persons per sqkm. The livestock population is 48.2 million (Livestock census 2003).

1.1. Forests of Andhra Pradesh

The recorded forest area is 63,821 sqkm which is 23.2% of the geographic area of the State. By legal status, Reserved Forests constitute 79.1%, Protected Forests 19.4% and un-classed forests 1.5%. The 4 major forest types occurring in the State are Tropical Dry Deciduous Forest, Southern Tropical Thorn Forest, Southern Tropical Moist Deciduous Forest and Littoral and Swamp forests. Forests are distributed mainly in the form of a wide strip in the north of the state starting from Nizamabad district in the west to Srikakulam in the east. Besides this, a belt runs from the central to the Southern part of the State in the Nallamalai hills.

Andhra Pradesh is famous for its endemic specie *Pterocarpus santalinus* or Red Sanders tree, also known as Red Gold, which is obtained in the forests in the Southern Rayalaseema region i.e. in Chittoor, Kadapa, Kurnool and Nellore districts. Other endemic / endangered tree species found in Andhra Pradesh are *Syzigium alternifolium*, *Terminalia pallida*, *Phlebophyllum jeyporensis* (Visakhapatnam and Godavari districts), *Pimpinella tirupatiensis* (endemic to Tirupati hills), *Ceropegia spiralis* (endemic to peninsular India), *Toxocarpus longistigma* (East Godavari and Visakhapatnam districts), *Cycas beddomei* (endemic to the Kadapa-Tirupati range of Eastern Ghats), *Phyllanthus narayanaswamii* (East Godavari and Visakhapatnam districts), *Acacia campbelli* (rare occurrence in Godavari to Nellore, Kurnool and Kadapa districts), *Indigofera barberi* (rare and endemic to Eastern Ghats, Kadapa, Kurnool and Chittoor districts) and *Leucas mukerjiana* (Hills of Visakhapatnam).

1.2. Protected Areas of Andhra Pradesh

Andhra Pradesh has got a strong network of Protected Areas (PA) consisting of 6 National Parks spread over an area of 1,388.391 sqkm and 21 Wildlife Sanctuaries covering an area of 11,617.35 sqkm. In all, an area of 13,005.781 sqkm is set apart for the PA Network, constituting 4.72% of the geographical area and 20.4% of the forest area of the state.

Rajiv Smriti Project Tiger, Srisailem spread over an area of 0.36 million Ha is the largest Tiger Reserve in the country. The Kolleru & Pulicat Wildlife Sanctuaries are the RAMSAR Sites located in the State.

Among the avifauna, the discovery of the “Jerdon’s Courser” (*Rhinoptilus bitorquatus*), which was believed to be extinct for about hundred years and the encouraging recovery of “The Great Indian Bustard” (*Ardeotis nigriceps*) in Rollapadu Sanctuary; deserve special mention. Slender Loris (*Loris tardigradus*), an endangered species, is found in Seshachalam hills.

2. Brief History of Forest Management

2.1. History in India

Forestry practices in India are centuries old. The earliest record of forestry practice prevalent in India dates back to the Mauryan period in the 3rd century BC when Forest and Wild Life were given lots of importance. The great Mauryan Emperor Ashoka had planted lots of trees along roadsides for the passers-by. The punishment for killing of an elephant was death sentence during the regime of Chandragupta Maurya. There is historical record to show that forestry and Wild life were given a great importance in the Gupta and Mughal periods. Kings and emperors had all along enjoyed forests and wild life. Traditionally, many tribals even today greatly adore wild life and many animals like black bucks, monkeys, rats etc are treated as sacred in many parts of India.

A separate Forest Department was created under the technical guidance of Brandis, who became the first Inspector General of Forests in 1864. Upto that time forests were part of the Revenue Department. The practice of scientific forestry was started in India in 1860s and gradually extended over other lands having good forests. However, forests were denuded considerably over the years because of rapid population growth and the commercial exploitation of the forest wealth resulting in consequent pressure on the forests. It was only after the seventh decade of nineteenth century that forest policy, legislation, demarcation and conservancy made big strides.

Out of the total Forests of the world 3,952 million Ha as reported by FAO of United Nation in 2005, the forest cover in India is only 67.8 million Ha which is only 1.7% of the world’s forests but has to meet demands of 16% of the World’s population and 15% of world’s livestock population. The per capita forest in India is 0.06 Ha, against the world average of 0.7 Ha.

2.2. History in Andhra Pradesh

The state of Andhra Pradesh was formed in 1956 by unifying the areas of Andhra region (the present coastal Andhra and Rayalseema regions) taking out from the Presidency of Madras and the Telangana region from the Hyderabad State (other parts had gone to Maharashtra and Karnataka states).

In Andhra region, forest conservancy was established in 1856 by Cleghorn and by the end of 1870, several forest blocks were demarcated. The Madras Forest Act, 1882 came into force from 1st of January 1883. During 1920 to 1950 plantations, particularly of Casuarina were raised in Coastal areas. During 1940 to 1950 the Zamindari was abolished and jagir forests were taken over by the State Forest Department.

In Telangana region, the forests were managed by non-technical officers for 44 years since 1857. The Revenue department was also having control over the forest areas, and due to the dual control there was no effective prevention of deforestation and fellings for bringing the land under cultivation. In 1890, State Forest Policy was formulated which stressed on preservation of the existing forests. The first Forest Act was promulgated in 1900 for reserving forests of Adilabad district. The Act was amended in 1914, to make it more effective. The services of F.A. Lodge were requisitioned for organising the Forest department. He prepared a Forest Code in 1921 and formed Divisions and Circles for better administration of forest resources. Important forest tracts were reserved. The first Working Plan was prepared for Nirmal Division in 1938. In 1949, the forests of Jagirs, Paighas and Sarfekhas were taken over by State Forest department.

After the formation of the State of Andhra Pradesh on 01.11.1956, the laws in force in respective regions were allowed to continue by virtue of Section 119 of the States Reorganisation Act, 1956. There were two enactments in force, namely Andhra Pradesh (Andhra Area) Forest Act, 1882 (or Madras Forest Act, 1882) and Andhra Pradesh (Telangana Area) Forest Act, 1355 Fasli (or Hyderabad Forest Act, 1355 Fasli). The integration of the laws was examined by Law Commission of Andhra Pradesh and the commission examined the provisions of the two enactments and also examined the corresponding laws in force in Bombay, Uttar Pradesh, Mysore and Kerala. Based on the recommendations of the commission, the Andhra Pradesh Forest Act, 1967 was drafted and passed by the State Legislature and it is in force since 15.04.1967.

The forests in the State, were managed by and large, as per the Working Plan prescriptions and Silvicultural systems. The forests were looked at as source of revenue to begin with. However, in the sixties the focus was on consolidation of forests, which gave way to the production forestry in the



seventies. In the eighties, the trend changed to extension forestry and the emphasis was on increasing the tree cover on the lands outside the forest department. With the new National Forest Policy 1988, the focus has now shifted to **Joint Forest Management** which later on was converted into **Community Forest Management**.

2.3. Joint Forest Management /Community Forest Management in AP

The National Forest Policy of 1988 has recognised the need to involve local people in management of forests and for ensuring their effective conservation. The Government of India had issued detailed guidelines in the year 1990, on the concept of implementing Joint Forest Management. Accordingly, the Government of Andhra Pradesh has issued formal orders in 1992 for adopting Joint Forest Management (JFM) as a strategy for rehabilitation of degraded forests. Detailed guidelines were also issued in the year 1993, for taking up JFM through village level committees called **Vana Samrakshana Samities (VSSs)**.

Initially, there was a lot of skepticism among the Foresters about the efficacy of this strategy for the protection of forests. As this approach was new, a lot of effort was needed to convince the people about the advantages of this approach, if adopted and implemented and the returns promised through the Joint Forest Management.



However, gradually the JFM concept gained acceptance among both the foresters and the people and in due course the program has

attained commendable success. The number of VSSs increased steadily from a mere 69 in 1994 to 7992 in 2002 (the number has established now). These VSSs are managing an area of 22.89 Lakh Ha of forests, which is 35.8 % of the total forest area in the State. Today, 15.39 Lakh VSS members are involved in this movement of which 3.23 Lakh belong to SC and 4.65 Lakh to ST communities.

Since February 2002, the Joint Forest Management has graduated into Community Forest Management (CFM), which is an advancement in terms of devolution of more powers to the people/VSS in management of the resources placed at their disposal and the Forest Department is donning the role of a facilitator and a provider of technical support.

2.4. Geomatics in Andhra Pradesh

Geomatics was totally an unknown field in AP Forest Department before AP Forestry Project was started. Use of RS, GIS & GPS had a very modest beginning in the year 1994, as part of the World Bank funded AP Forestry Project, under the guidance of Dr. K.D. Singh, Forestry Expert with the FAO, Rome. It started working with simple hardware, software and data in the headquarters of the AP Forest Department, Hyderabad. However, the enlarging scope of the Geomatics necessitated setting up of a separate unit with sophisticated infrastructure, work stations, hardware, software and data storage facility at AP Forest Academy, Dulapalli, located 22 km away from the City, in the year 2000. Later on the Geomatics Centre was transferred back to the newly constructed Aranya Bhawan Complex in Hyderabad during 2007. The Officers of Geomatics Centre have been trained in India and abroad and are capable of handling projects related to Geomatics in Forestry and related fields.

The Department is making use of the tools of Geomatics, i.e., Remote Sensing, Geographical Information System (GIS) and Global Positioning System (GPS) in planning and decision making processes and also in effective monitoring and evaluation of various programmes. The following are the major activities:

1. **Spatial Database Creation and Updation:** About 30 basic layers which include Division, Range, Beat, Compartment, VSS boundaries, Roads, Rail tracks, Village, Plantation, Vegetation Type and Density, Slope and Aspect etc have been generated on 1:50K scale. This data is distributed to Divisions for use in day-to-day management.
2. **Vegetation - Canopy Cover Monitoring:**
Geomatics Centre started the work of monitoring the vegetation cover in 1996, using IRS1C- LISS III & PAN data to classify forest canopy cover into density classes like Dense forest, Open forest, Scrub forest and Blank areas of the Notified forests and this is continued at an interval of 1 year since 1999. AP Forest Department has been bringing out **State of Forests Report** annually.
3. The Geomatics Centre also provides valuable inputs to the field officers for preparing the Working Plans & Micro-Plans for the VSSs.
4. The Centre has also carried out forest-fire risk zonation, selection of sites suitable for water harvesting structures, biodiversity characterisation at landscape level, Wildlife habitat mapping, micro-level watershed modeling & selection of sites for eco-tourism etc.

2.5. Forest Inventory in Andhra Pradesh

2.5.1. Inventories Undertaken during revision of working plans

Working plan officers traditionally have undertaken forest inventory for preparing of the working plans. As per the records available in the office of Project formulation circle which is looking after the periodic revision of the working plans; inventories undertaken in different divisions, in different years is given in the table on the next page.

Circle	Division	Year of working Plan Period	Inventory Results (volume in million M ³)	Inventory Design	Bamboo Occurance
1. Adilabad	1. Adilabad	1991-92 to 2000-01	2.82	Stratified random sampling	—
	2. Bellampally	1991-92 to 2000-01	4.27	Stratified random sampling	—
	3. Jannaram	1991-92 to 2000-01	3.30	Stratified random sampling	—
	4. Kagaz Nagar	1991-92 to 2000-01	3.15	Stratified random sampling	—
	5. Mancherial	1991-92 to 2000-01	2.74	Stratified random sampling	—
	6. Nirmal	1991-92 to 2000-01	4.84	Stratified random sampling	—
2. Ananthapur	7. Anantapur	1993-94 to 2002-03	1.47	Stratified random sampling	32,208 clumps
	8. Chittoor West	1992-93 to 2001-02	1.37	Stratified random sampling	—
3. Guntur	9. Giddalur	2003-04 to 2012-13	2.37	Stratified random sampling	23000 MTs
	10. Guntur	2004-05 to 2013-14	0.36	Stratified random sampling	—
	11. Nellore	2003-04 to 2012-13	6.76	Stratified random sampling	—
4. Hyderabad	12. Hyderabad	2004-05 to 2013-14	0.15	Stratified random sampling	—
	13. Mahaboobnagar	2003-04 to 2012-13	0.07	Stratified random sampling	—
	14. Nalgonda	2004-05 to 2013-14	0.17	Stratified random sampling	—
5. Khammam	15. Bhadrachalam S	2002-03 to 2011-12	6.43	Stratified random sampling	1681263.6 MT
	16. Badrachalam N	2003-04 to 2012-13	6.84	Stratified random sampling	—
	17. Khammam	2003-04 to 2012-13	2.23	Stratified random sampling	135670 MTs
	18. Kothagudem	2004-05 to 2013-14	6.20	Stratified random sampling	—
	19. Paloncha	2002-03 to 2011-12	4.74	Stratified random sampling	152363 MTs
6. Kurnool	20. Kadapa	1994-95 to 2003-04	2.82	Stratified random sampling	—
	21. Kurnool	2003-04 to 2012-13	0.03	Stratified random sampling	—
	22. Nandyal	1991-92 to 2005-06	3.27	Stratified random sampling	—
	23. Proddutur	1994-95 to 2003-04	1.80	Stratified random sampling	—

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Circle	Division	Year of working Plan Period	Inventory Results (volume in million M ³)	Inventory Design	Bamboo Occurance
7. Nizamabad	24. Kamareddy	2007-08 to 2016-17	0.56	Stratified random sampling	—
	25. Medak	1993-94 to 2002-03	0.50	Stratified random sampling	—
	26. Nizamabad	2007-08 to 2016-17	0.82	Stratified random sampling	—
8. Rajahmundry	27. Eluru	2002-03 to 2011-12	2.86	Stratified random sampling	16370.54 MTs
	28. Kakinada	1991-92 to 2005-06	21.86	Stratified random sampling	—
	29. Krishna	2005-06 to 2014-15	0.76	Stratified random sampling	—
9. Srisailem	30. Achampet	1991-92 to 2001-02	5.32	Stratified random sampling	34,783 MTs
	31. Atmakur	1991-92 to 2005-06	3.37	Stratified random sampling	—
	32. Markapur	2003-04 to 2012-13	0.24	Stratified random sampling	11300 MTs
10. Tirupati	33. Chittoor East	1992-93 to 2001-02	2.19	Stratified random sampling	—
	34. Rajampet	1994-95 to 2003-04	3.16	Stratified random sampling	—
11. Visakhapatnam	35. Narsipatnam	2003-04 to 2012-13	1.32	Stratified random sampling	909382 MTs
	36. Paderu	2006-07 to 2015-16	1.02	Stratified random sampling	—
	37. Srikakulam	2003-04 to 2012-13	0.17	Stratified random sampling	—
	38. Visakhapatnam	2006-07 to 2015-16	5.91	Stratified random sampling	385222.11 MTs
	39. Vizianagaram	2003-04 to 2012-13	1.64	Stratified random sampling	72689.95 MTs
12. Warangal	40. Karimnagar E	1992-93 to 2001-02	1.45	Stratified random sampling	—
	41. Karimnagar W	1992-93 to 2001-02	0.66	Stratified random sampling	—
	42. Warangal N	2003-04 to 2012-13	5.76	Stratified random sampling	36598880 culms
	43. Warangal S	2003-04 to 2012-13	0.07	Stratified random sampling	1384642 culms

2.5.2. Large Scale Inventories

Modern Forest Inventory began in India in 1965, using aerial photography with FAO/UNDP assistance through Pre-Investment Survey of Forest Resources (PIS). Andhra Pradesh became an important part of the large scale Forest Inventory. PIS had carried out systematic assessment of the forest resources in the State in the seventies with a view to find out the sustainability of the wood based Industries in the State on the basis of Catchments of the 5 major Wood based Industries. Brief results of these inventories were as follows:

i. Adilabad District:

Adilabad is one of the well forested districts of Andhra Pradesh, located on its northern border. The total geographical area of Adilabad district is 16,203.81 sqkm and that of notified forests 7,437 sqkm which is 45.9% of the geographic area. PIS carried out inventory of the forests of the district during 1973-74.

The PIS adopted the methodology of two stages Stratified Random Sampling. The size of the plot was 10 m X 40 m. The results of the Inventory gave the total Growing Stock in the district as **33,464** cubic meters; GS per Ha as **52.78** cubic meters and number of stems per ha as **256**.

ii. East Godavari Forest Resources Inventory:

The PIS carried out the Inventory of East Godavari catchment during 1968 to 1970. The geographical area of catchment is 10,416 sqkm of which the forests constituted 6,623 sqkm amounting to 63.6% of the geographical Area.

Systematic cluster sampling method, consisting of two plots at 2 ½' X 2 ½' grid intervals, was adopted. The location of the first plot was at the centre of the grid and that of the second plot was at a distance of 400 m due east of plot No.1. The size of the Sample Plot was 0.1 Ha and sampling intensity 0.01%.

Stratification of the forests was done on the basis of Photo Interpretation. High volume stratum accounted for 50% of the forest area, medium volume stratum occupied 33% and low volume stratum 17% of forests. Topography showed that about 77% of the forest area was under hilly terrain and the remaining under gently rolling and flat land.

The total growing stock was estimated at **53.65** million cubic meters. The GS per Ha was arrived at **51.52** cubic meters. Bamboo stock was estimated to be **105** million Tonnes.

The number of stems in high volume stratum came to 367 per Ha, in the medium volume stratum 334 per ha and in low volume stratum 305 per Ha.

iii. Nallamalai Catchment:

The total geographical area of Nallamalai catchment was 10, 41,676 Ha out of which 5,28,392 Ha, i.e., 51% area was reserved forest. In this 5,16,067 Ha, i.e., 97.7% area was inventoried. The PIS took up Inventory in the year 1974.

The total growing stock was estimated at **13.05** million cubic meters and Volume per Ha as **25.3** cubic meters. Number of stems per Ha was arrived at 203.

iv. Seshachalm Catchment:

The total forest area of the catchment was 5,57,433 Ha. Out of which an area of 5,41,756 Ha i.e. 97.2% was inventoried. In the catchment, **Red Sanders Forests** were reported to occur over an area of 1,67,307 Ha, i.e., 31% of the total area and Bamboo over an area of 1,28,375 Ha, i.e., 24.3% of total forest area.

PIS undertook the Inventory in December 1971 and completed it in June 1974. The methodology adopted was **systematic single stage cluster sampling**. The plot size was 10m x10m i.e. 0.01 Ha.

The total growing stock was assessed to be **61.49 million** cubic meters and the volume per Ha as **56.34** cubic meters. No. of stems per Ha was arrived at 174.

v. Warangal Catchment:

In Warangal catchment, the PIS carried out the Inventory in 1978. The methodology adopted was a stratified inventory and as per volume II of the report the average growing stock per hectare was 30.25 cubic meters for Warangal south division, 36.75 cubic meters for Warangal North division, 41.61 cubic meters for Karimnagar east division and 17.29 cubic meters for Karimnagar West division. The total growing stock in the catchment covering 594171 Ha was assessed as **19.98** cubic meters and the volume per Ha, as **33.62** cubic meters.





2. Methodology for Inventory

Methodology for Inventory

AP FOREST INVENTORY 2006

1. Background

The AP Community Forest Management Project has provided for carrying out of a comprehensive survey of the forest resources of Andhra Pradesh including Non Timber Forest Produce (NTFP) and medicinal plants. Initially, in December 2003, it was proposed to outsource the activity and engage consultants for designing methodology and undertaking forest inventory in the entire State. Draft terms of reference were also prepared. The objective of this consultancy was to design and develop the methodology, formats and procedures for undertaking field inventory to assess the growing stock including the NTFP and medicinal plants and to undertake the field inventory covering entire forest area of Andhra Pradesh, adopting scientific and statistically viable sample size.

Technical and Financial proposals were invited from the short listed firms. Out of the 3 (three) firms short-listed, 2 (two) firms, viz, M/s FRR, United Kingdom and M/s Centre of Consultancy for Biosocial Advancement, Kolkata did not submit the proposals. The proposal of M/s. ATREE, New Delhi, the 3rd short listed firm, was rejected as the rate quoted was found to be too high.

Subsequently in August 2005, it was decided to take up the Inventory by the department itself.

2. Introduction

To begin with, JFM and WP inventory data available with the department was analysed with the objective of using the same for pre-inventory. As the data was found to be inconsistent, after detailed deliberations with the experts at Hyderabad, it was decided not to use it.

Subsequently Dr D Pandey, Director of the Forest Survey of India, Dehradun, Dr. KD Singh, former FAO expert and Dr PS Roy of NRSA were invited to Hyderabad as Experts for finalising the design and methodology of the Inventory. In the meeting of Experts held in September 2006, it was decided to go in for area proportionate **Stratified Random Sampling Technique** using Satellite Imageries (LISS III of IRS 1C) of 2004 season with about 7000 number of sample plots of 0.1 Ha each. The intensity of the inventory came to 0.01% approximately.

3. Objectives

The main objective of the Inventory was to collect **quantitative and qualitative information, about the forest resources** in order to prepare reports on potentiality and other forest based investigations, so as **to serve the data needs of Development Planning at State and District level.**

Information related to **growing stock of timber and its species-wise distribution and volume** was proposed to be generated through this Inventory. So, the main objectives of the Andhra Pradesh Forest Inventory Project were planned to be :

- To collect **qualitative and quantitative information**, about the forest resources.
- To prepare **reports on potentiality and other forest based investigations**.
- To serve the **data needs of development planning** at State and District level.
- To estimate **growing stock and its species-wise distribution**.

An attempt has been made through this Inventory to assess the information regarding **Timber and Bamboo resources, herbs, shrubs & weeds, Soil and the factors causing damage to the forests like incidences of insects, pests, grazing, fire, illicit felling etc.**

4. Design of Forest Inventory

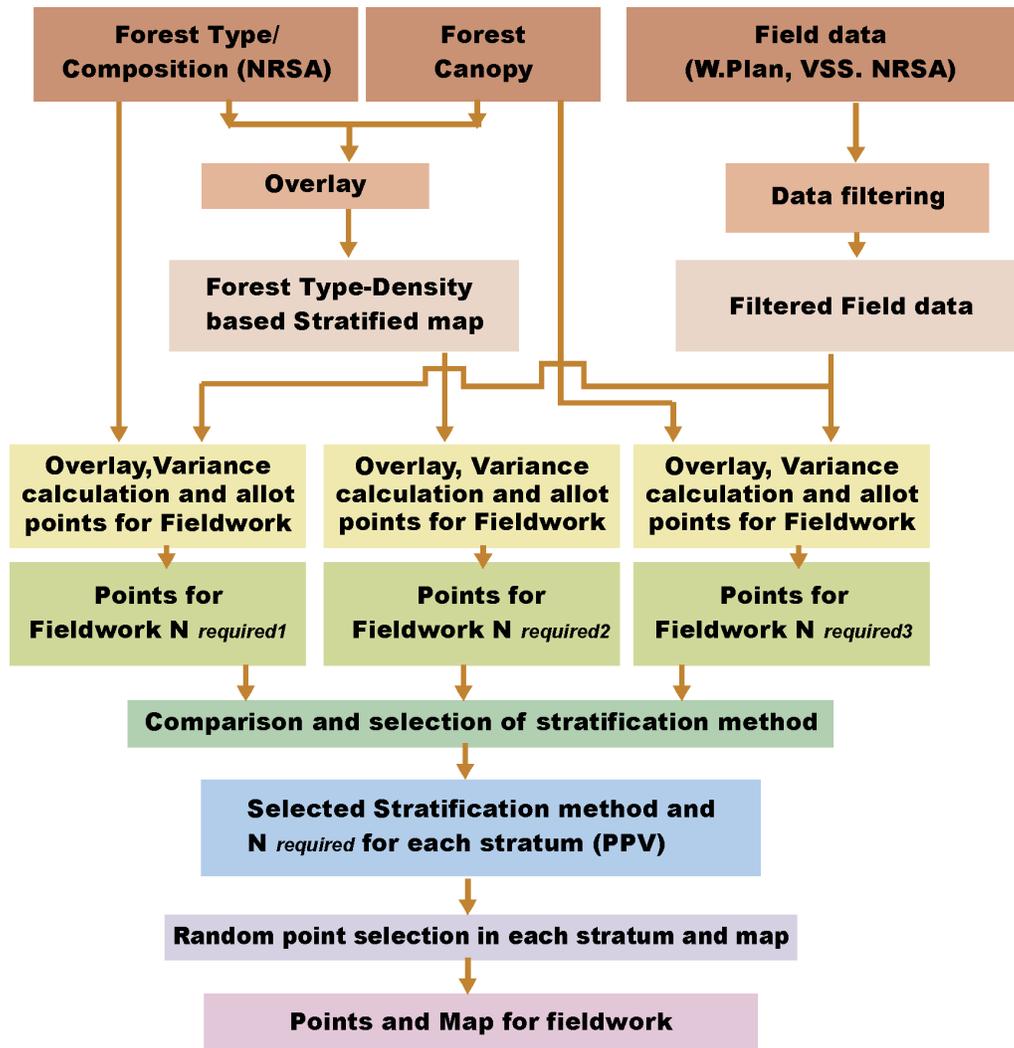
4.1. Sampling Strategy- Zonal Classification & Number of Sampling Points:

As the AP Forest Department was well equipped in Geomatics, **Stratified Random Sampling Technique**, using the classified vegetation cover maps generated from the LISS-III data of 2004 season obtained from the NRSA, was used for locating Sampling Points for data collection. For this purpose in the first stage, entire forest area was divided into **seven Vegetation Zones** based on the **similarity of species composition**, as shown below:



In order to arrive at the above Sampling strategy the following procedure was adopted:

Schematic diagram of Forest Inventory Design



On all the 3 maps (FCD, Type and FCD+Type), 3 sets of field data were overlaid. The first set of field data comprised of the entire field data without any screening for volume basis, the abnormal values were however, removed. It was overlaid on the Zonal map and variance for all **four parameters** – **Volume, BA, Number of trees and BA/No. of trees** - for each zone was calculated. This gave an idea about the variance range without filtering. This unfiltered field dataset was called **SET 1**.

This was followed by filtering the field data for a maximum volume of 30 cubic meters per plot (arrived as per available literature) and minimum volume of 0.05 cubic meters (plot having single tree of 10 cm diameter, 8 m height and 0.8 form factor). This data was overlaid on the Zonal map and variance was calculated for all four parameters – Volume, BA, Number of trees and BA/No. of trees for each zone. This gave an idea about the variance range after filtering and without stratification. This filtered field dataset was called **SET 2**.

Further screening of field data from **SET 2** was done based on probable volume ranges for Dense, Open and Scrub classes and points which were falling beyond this range were removed. The Range used for filtering is given below. This volume range was arrived at by using the field data provided by NRSA for various density classes. This data was overlaid on the Zonal map and variance was calculated for all four parameters – Volume, BA, No. of trees and BA/No. of trees - for each zone. This gave an idea about the variance range after filtering and with stratification. This filtered Set was called **SET 3**.

Density Class	Volume Range
Scrub	Less than 1 m ³ per plot
Open	1-8 m ³ per plot
Dense	More than 8 m ³ per plot

A suggestion was made to have a transition zone between volume ranges for (scrub and open) and (open and dense) and if any point was having volume in this transition zone then it was to be taken as valid if it fell on either of the two classes of the transition zone. However, this suggestion was not implemented.

The number of points required for different datasets for different types of maps by using Volume as a parameter was as follows (@ 20% AE and 0.05 *p*):

Zone	FCD			F Type			FCD +F Type		
	Set 1	Set 2	Set 3	Set 1	Set 2	Set 3	Set 1	Set 2	Set 3
1	882	778	99	3628	2970	1353	4903	4112	1203
2	896	599	77	3058	1200	903	3246	2180	302
3	1618	1350	208	1191	920	704	2181	1820	420
4	2115	1843	96	1876	1747	2043	4519	4215	745
5	39	39	13	46	46	25	72	72	15
6	822	792	47	770	696	998	2485	2564	1554
7	-	-	-	-	-	-	-	-	-
Total	6372	5401	540	10569	7579	6026	17406	14963	4239

After observing the figures given above, it was decided to concentrate on the figures for Total N_{req} for Set 2 on FCD, Set 2 and Set 3 on F Type and Set 3 on FCD+F Type. It was observed that all the three values of Total N_{req} were approximately **6500 points**. Hence it was decided to increase the points to 7000 in order to be on the safer side. Now the distribution of these 7000 points in the Zones was to be done. This was done using the estimated N_{req} figures of Set 3 on

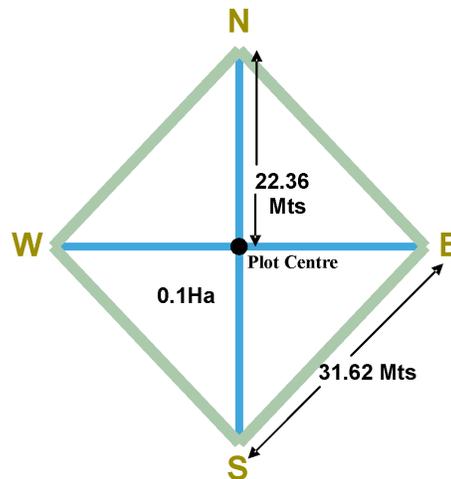
F Type+FCD, while taking care that these figures compared with the forest area of each Zone. The Table used for taking this decision is as follows:

Zone	Forest Area (sqkm)	Distribution proportional to forest area	Distribution as per F Type + FCD on Set 3	Final figure (Max. of 2 or 3 scaled to a total of 7000)
1.	2.	3.	4.	5.
1	21903	2186	1203	2000
2	11875	1311	302	1300
3	2341	251	420	300
4	11930	1311	745	1300
5	3149	273	15	400
6	9258	1093	1554	1400
7	3359	371	~500	300
Total	63821	6796	4766	7000

These 7000 points were distributed on the strata of FCD + F Type map. Here the variance figure was not used for distribution as in many cases in Set 3; the number of points used for calculating variance was very small. Hence, it was decided to distribute these points over the strata based on their respective areas, i.e. based on **Probability Proportional to Area (PPA)**.

4.2 Size of the Sample Plots

Size of the sample point was taken as **0.1 Ha** as in such a sample point size, almost all important species of the region were available. At the outset, 4174sqkm of non forest area out of 63814 sqkm of total forests of AP was blocked and in balance area of 59640 sqkm consisting of Dense, Open & scrub forest, Sample Points were scattered randomly. The dimensions of the Sample Plots of **0.1 Ha** each were as follows:



The layout of the **plot for regeneration** was taken up in the Northern point by taking a 3Mx3M plot. For enumerating herbs and Shrubs a 1Mx1M plot was laid at the centre of the plot for regeneration.

4.3 Number of Sample Plots Division wise

* The Number of inventory points per stratum was calculated using the following formula:

$$N = t^2 \cdot CV^2 / (AE \%)^2$$

Where:-

N = No. of sample plots in the canopy stratum.

CV = Coefficient of Variation of sample plot volumes.

AE = Allowable error percentage (20% in the present design)

t = Constant available in t² table

Existing inventory data (VSS Inventory & Working Plan) was used to arrive at the number of points in each stratum.

The table below shows the scattered points in various canopy cover classes:

S. No	Vegetation & Density	No of Points
1	Dense Forest	2095
2	Open Forest	2587
3	Scrub Forest	2234
	Total:	6916

The following was the distribution of Inventory points in different Divisions of the State:

Circle	Division	No. of sample points			
		Dense	Open	Scrub	Total
1. Adilabad	1 Adilabad	42	52	63	157
	2 Bellampally	60	64	21	145
	3 Jannaram	26	27	10	63
	4 Kagaz Nagar	43	28	14	85
	5 Mancherial	39	37	28	104
	6 Nirmal	38	59	19	116
2. Anantapur	7 Anantapur	40	33	108	181
	8 Chittor West	10	84	92	186
3. Guntur	9 Giddalur	74	108	153	335
	10 Guntur	51	55	19	125
	11 Nellore	59	59	160	278
4. Hyderabad	12 Hyderabad	4	14	62	80
	13 Mahabubnagar	3	21	64	88
	14 Nalgonda	17	28	52	97

Circle	Division	No. of sample points			
5. Khammam	15 Bhadrachalam North	27	40	66	133
	16 Bhadrachalam South	111	69	17	197
	17 Khammam	41	32	30	103
	18 Kothagudem	36	70	37	143
	19 Paloncha	56	72	45	173
	20 Paloncha WLM	5	32	21	58
6. Kurnnool	21 Kadapa	5	110	83	198
	22 Kurnnool	24	6	89	119
	23 Nandyal	27	129	14	170
	24 Proddatur	4	112	74	190
7. Nizamabad	25 Kamareddy	30	27	28	85
	26 Medak	37	45	46	128
	27 Medak WLM	0	1	3	4
	28 Nizamabad	14	26	30	70
8. Rajahmundry	29 Eluru	36	28	9	73
	30 Kakinada	231	98	38	367
	31 Krishna	21	6	22	49
	32 Krishna WLM	1	0	5	6
9. Srisailam	33 Achampet	206	49	141	396
	34 Atmakur	43	127	11	181
	35 Markapur	55	121	150	326
	36 Nagarjuna Sagar	4	13	6	23
10. Tirupati	37 Chittoor East	23	102	87	212
	38 Rajampet	35	126	20	181
	39 Tirupati	14	48	24	86
11. Visakhapatnam	40 Narsipatnam	160	81	16	257
	41 Paderu	31	26	28	85
	42 Srikakulam	11	55	22	88
	43 Vijayanagaram	33	48	23	104
	44 Visakhapatnam	50	65	14	129
12. Warangal	45 Karimnagar East	64	27	28	119
	46 Karimnagar West	11	22	48	81
	47 Warangal North	96	73	56	225
	48 Warangal South	20	18	19	57
A.P.	49 Warangal WLM	27	14	19	60
	Total	2095	2587	2234	6916

4.4 Parameters identified for measurement/assessment :

- 1 **Approach to the Plot:**
The Latitude and Longitude (with the help of hand held GPS) and other details such as mode of travel up to the plot and the time taken in travel and measurements for time and work studies.
- 2 Description of the Plot
- 3 Soil data on depth, Humus, Stoniness & status of erosion
- 4 Data on Forest crop
 - i Origin of stand
 - ii Canopy Density- using Densitometer
 - iii Basal Area – using Wedge Prism
 - iv Number of stories
 - V Status of seedling regeneration
 - Vi Status of Coppice regeneration
 - Vii Occurrence of Bamboo
 - Viii Presence or absence of Bamboo flowering
 - Ix Status of Bamboo regeneration
- 5 Incidence data
 - i Incidence of Weeds
 - ii Incidence of Grass
 - iii Incidence of Fires
 - iv Incidence of Grazing
 - v Incidence of illicit felling
 - vi Pest damage
- 6 Enumeration of Trees - Diameter and Height of all trees, species wise, above 10 cm diameter at breast height
- 7 Enumeration of Bamboos - clump wise & diameter class culm wise
- 8 Enumeration of Herbs & Shrubs
- 9 Status of Regeneration of trees of important species

5. Organisation of the Field work

5.1. Constitution of Field Inventory Teams:

The field inventory was carried out by 70 teams, specially constituted for the purpose. Each Team consisted of a **Team Leader, an Assistant Team Leader, local Forest Officer (FBO or ABO) and 4 Inventory Assistants.**

The recently recruited Forest Section Officers, having the qualification of graduation in Science, Engineering or Computer Science and passed out after completing training from AP Forest Academy, Dulapally in the year 2005 or 2006, were selected for the job of **Team Leaders.**

The Field Botanists, identified by the **Foundation for Revitalisation of Local Health Traditions (FRLHT), Bangalore** or Post-graduate/Graduate students of Botany from the local Universities/Colleges were selected for the task of **Assistant Team Leaders.**

Local members of the **Vana Samrakshana Samities (VSSs)** ie Forest Protection Committees were assigned the task of **Inventory Helpers/Assistants.**

The Team Leaders were kept free of the territorial charges till completion of the Inventory. Each Team was expected to complete the field inventory of 1-2 Sample Plots on an average, per working day. Number of Teams to be allotted to each Forest Division was arrived at depending on the number of Sample Plots falling in each Division. Each team was provided with a vehicle for mobility and a Cell Phone for connectivity.

5.2. Duties of the Field Teams

Following were the responsibilities of the Team Members:

Team Leader	Planning fieldwork in advance. Navigating to the plot and plot layout. Filling plot approach and description form, herbs, shrubs, climbers and regeneration forms. Assigning duties to team members.
Asst. Team Leaders	Navigating to the plot and plot layout. Filling tree enumeration form and bamboo form.
Local Forest Officer	Navigating to the plot and plot layout. Arranging helpers and assisting in fieldwork.
InventoryField Assistants	Assisting in fieldwork.

5.3. Preparation and Communication of the AP Forest Inventory Manual

Before commencement of the field work, a detailed manual of instructions, titled “AP Forest Inventory Manual” covering the objectives, design of the Sample Plots, details of field work to be carried out including the data to be collected, forms to be filled in etc, was prepared and communicated to all the field Officers and Inventory Team leaders.

5.4. A Technical / Inventory Committee for coordinating Inventory work was constituted comprising of

- | | |
|--|-------------------------------|
| 1. Addl. Principal Chief Conservator of Forests (IT) | Chairman |
| 2. Chief Conservator of Forests (CFM) | Member |
| 3. Chief Conservator of Forests (T & E) | Member |
| 4. Chief Conservator of Forests (Res) | Member |
| 5. Chief Conservator of Forests (PF) | Member |
| 6. Conservator of Forests (IT) | Member & Secretary |

5.5. Appointment of Senior Officers from HO as I/C of circles for Inventory work

Each Circle was kept under the overall supervision of a senior Officer in the cadre of Addl. Prl. Chief Conservator of Forest / Chief Conservator of Forest for field check & guidance. They undertook periodic reviews of the Inventory

work and gave necessary guidance to the field Inventory Teams from time to time.

Circle	Officer In-Charge
Adilabad	Sri R.G.Kalghatgi, IFS Chief Conservator of Forests (CFM)
Anantapur	Sri D.Sudhakar, IFS Chief Conservator of Forests (Dev)
Guntur	Sri P.K.Sarangi, IFS Chief Conservator of Forests (Prod)
Hyderabad	Sri S.V.Kumar, IFS Addl. Principal Chief Conservator of Forests (SF)
Khammam	Sri P.S.Rao, IFS Chief Conservator of Forests (Research)
Kurnool	Sri D.K.Pandey, IFS Chief Conservator of Forests (Estt)
Nizamabad	Sri B.Murali Krishna, IFS Chief Conservator of Forests (T & E)
Rajahmundry	Sri B.S.S. Reddy, IFS Addl. Pricipal Chief Conservator of Forests (CFM)
Srisailam	Sri A.V.Joseph, IFS Addl. Pricipal Chief Conservator of Forests (WL)
Tirupati	Sri S.B.L.Misra, IFS, Addl. Pricipal Chief Conservator of Forests (FCA)
Visakhapatnam	Sri Narpat Singh, IFS Addl. Pricipal Chief Conservator of Forests (HRD)
Warangal	Sri Sita Ram Gupta, IFS Addl. Pricipal Chief Conservator of Forests (Admn)

5.6. Appointment of Nodal Officers

For proper monitoring and field co-ordination an Officer of the rank of a Dy.CF or ACF was nominated as **Nodal Officer** for each Forest Division. He was responsible for the monitoring of the Inventory work, arranging transport, lodging & boarding, collecting the Data forms daily and resolving the field problems, if any.

5.7. Navigation to the Plot and marking of Plot Centre & 4 corners

The concerned Territorial Staff (FBO/ABO) were made responsible to navigate and to locate the Sample Plots on the ground using a hand held GPS, much before the commencement of the field work by the Inventory teams so

that the time of Inventory teams was not wasted in locating the Sample Plots on the ground. The Territorial Staff also marked the centre and the four corners of the Sample Plots on the ground.

5.8. Preparation of detailed itinerary of the Field Teams

The DFOs of the concerned divisions were requested to prepare a day-to-day programme for the Field Teams, duly indicating the routes and camping places in such a way that the teams were required to cover minimum distance by vehicle in reaching the Sample Plots. This saved precious time of the teams.

5.9. Workshops and Trainings

A Series of Workshops and Trainings were organised for Senior Officers in the Head Office, Chief-Conservators of Forests/ Conservators of Forests in-charge of Circles, Divisional Forest Officers, Sub-Divisional Forest Officers, Range Officers, Section Officers and the field Inventory Teams before commencement of the field work with a view to internalise the objectives and details of the field work to be carried out in the Inventory, at AP Forest Academy Dulapally and Circle/Division Headquarters and in the field. The details are as follows:

Date	Workshop/Training for	Venue
1. 16.09.2006	Chief-Conservators of Forests/ Conservators of Forests	APFA, Dulapally
2. 28-29.09.2006	Circle/Division level Nodal Officers	APFA, Dulapally
3. 31.10.2006	Chief-Conservators of Forests/ Conservators of Forests	Video-Conference from Hyderabad
4. 7-8.11.2006	Team Leaders and Asst. Team Leaders of Adilabad Circle	Jannaram
5. 7-8.11.2006	Team Leaders and Asst. Team Leaders of Khammam Circle	Kothagudem
6. 7-8.11.2006	Team Leaders and Asst. Team Leaders of Kurnool Circle	Kadapa
7. 9-0.11.2006	Team Leaders and Asst. Team Leaders of Warangal, Hyderabad & Nizamabad Circles	APFA, Dulapally
8. 10-11.11.2006	Team Leaders and Asst. Team Leaders of PT Srisailam Circle	Srisailam
9. 13-14.11.2006	Team Leaders and Asst. Team Leaders of Guntur Circle	Guntur
10. 23.11.2006	Chief-Conservators of Forests/ Conservators of Forests	Video-Conference from Hyderabad
11. 25.11.2006	Addl. Prl. Chief-Conservators of Forests/ Chief-Conservators of Forests in-charge of Circles	APFA, Dulapally

5.10. Supply of Field Equipments:

The following equipments were supplied to each field Inventory Team: The Wedge Prisms & Densitometers were used for the first time in the Forest Inventory.

Equipment	No.	Use
Hand Held GPS	1	For navigating to the plot and recording at plot centre and corner.
Wedge Prism*	1	For Calculating Basal Area
Densitometer	1	For Calculating Canopy Density
Compass	1	Plot layout
Measuring line	1	For plot layout
Flags	5	For marking corners and centre.
Callipers	2	For measuring diameter of the trees.
Altimeters	1	For measuring height of the trees.
Tape	1	For plot layout
Crow bar	1	For planting flags at corners For collecting soil sample
Axe/Bill hooks	2	For clearing bushes
Marking pens/ paint		As per requirement
Field forms and board, field manual, Maps/ imageries, Bag/haversack, Note book, pencil, ball pen, Scale, protractor, Sleeping bag, Torch Light		As per requirement

* The Wedge Prism was used to calculate the basal area in Inventory.

5.11. Supply of Maps:

The maps were generated using 2004 Satellite data & provided to each Forest Beat by the Geomatics Centre with the randomly generated inventory points overlaid on topographic maps of 50K scale. The Team Leaders were to ensure that all the maps were returned duly filled to the Nodal Officer after the Inventory was completed.



Measuring Canopy Density with Spherical Densitometer



Use of Altimeter



5.12. Commencement and period of field work

The field work was commenced in November 2006 and continued till the end of November 2007. The field work was carried out as per the movement plan prepared by the Divisional Forest Officer.

Execution of the Field Work:

The field work consisted of the following:

- i. Marking of the Sample Plot Centres
- ii. Fixing up of the 4 corners of the Plots on the ground
- iii. Collection of data and filling up of forms



Inventory in progress

The Team Leaders were responsible for carrying adequate number of field forms to the field and filling them up. Each member had understood their work as per the Manual and carried out duties as reflected in the duty-chart. The Team leaders had distributed the work of inventory to the Team members and made suitable modifications in the duty-chart, if necessary.

The Team Leaders kept good liaison with the local forest staff and ensured that the camps were properly, neatly and systematically arranged and the members maintained decorum and proper discipline in the camps.

6. Data Collection Mechanism

For ensuring accuracy of data collection, one Sub-Divisional Forest Officer was made Nodal Officer in charge of a Circle/Division to supervise and



Training of Senior Officers

coordinate the Inventory work. The Range Officers, Sub Divisional Forest Officers and Conservators were fully involved in the exercise and specifically in the data collection. The Conservators of Forests were requested to constitute a team headed by a Sub-DFO for each Division for Test Checking of the data collected. These teams were to re-record the data pertaining to 5% of the total number of Sample Plots in their jurisdiction. Besides, the Divisional Forest Officers were directed to testcheck 2% of the data and Conservators of Forests, 1% of the data in the field.

They extensively toured in the field during the period of data collection and ensured the accuracy of the data collected by the Teams.

While the Plot was being laid and data being collected, the Team Leaders were required to fill the Plot Approach Form (PAF) and Plot Description Form (PDF). On completion of the work in a Plot, the Team Leaders scrutinised the Forms to find out if any information was missing or was doubtful. All equipments were collected by the Team Leaders from the head quarters. The Team then proceeded to the next Plot and repeated the work. After completing the work, all the Team members returned to the head quarters. Once in the camp, the Team Leaders once again scrutinised the forms to ensure that no information was missing before sending it to the Designated Officer for Forest Inventory.

6.1 Recording of the Data

Data was recorded in the prescribed forms, given below:

- Form 1 - Plot Approach Form and Plot Description Form
- Form 2 - Tree enumeration form
- Form 3 - Herbs form
- Form 4 - Shrubs & Regeneration Form
- Form 5 - Climbers Form
- Form 6 - Bamboo Enumeration Form

The field forms were filled up using the correct codes which are given in the Manual.



Identification of Herbs

6.2 Messengers for Transfer of Data

All the Divisional Forest Officers made arrangements for engaging Messengers for collecting all the field forms from the Team Leaders, from wherever they were camping and handing these over to the Data Entry Operators in the Circle/Division Offices.

The Divisional Forest Officers were requested to make 3 sets of all the Field Data Forms and bind them in the form of books. The book containing original Field Data Forms were sent to the Geomatics Centre for checking and record. The duplicate and triplicate books were kept in the Division and Circle Offices respectively.

6.3 Development of Software for Data Entry

A Customised software was developed for entry of data collected by the field Inventory Teams. The Circle/Division level data entry operators were given training in handling the software at APFA Dulapally, before taking up the data entry. Subsequently, they entered the data at Circle/Division levels using the above mentioned software.

6.4 Data entry

On receipt of the field forms, the data was verified in the office of the DFO and entered in the computers using the customised data entry software. Screens of various field data forms were developed in the software for easy data entry. The field staff was trained in data entry of the forms in inventory software developed.

The data so entered was transmitted to the Geomatics Centre at Hyderabad for further processing, i.e., checking and generating results.

7. Data Processing

The Forest Survey of India, Dehradun was requested to organise a special training in “Forest Inventory Data Processing” for the Officers of Andhra Pradesh Forest Department, so as to help them in processing the data collected during the field work. Accordingly, the FSI Dehradun organised the training for 8 Officers of the ranks of Addl. PCCF, CCF, DCF, ACF and FROs from 23rd to 27th July 2007 at FSI, Dehradun. This training helped the Officers in properly checking processing and analysing the data collected.

7.1 Data Checking

A team of Officers and Project Scientists undertook the painstaking task of checking the data (sent through the Software) thoroughly by comparing it with the data entered in the original field forms. Mistakes in the locations (Lat-Long), botanical names of the plants and spellings were rectified in the first step. The logical checks were applied in the second step and mistakes in the diameters and heights of the trees etc. were rectified.

7.2 Volume Equations used

Once the entire data was entered correctly (using the software), the trees found in each Division were ranked based on occurrence and importance.



Marking the plot centre

For calculation of the growing stock using Volume Equations, the following principle was adopted:

- i. Adopt the **Local Volume Table** for the species from the Working Plan concerned,
- ii. If the Local Volume Table for the species is not available, look for Volume Table for the species in the similar eco-system elsewhere in the country,
- iii. If the Volume Table for the species is not available in the similar eco-system, adopt the **General Volume Table** for the species and
- iv. If none of the Volume Tables are available for a species, then look for a tree species which is phyto-morphologically similar to the species and adopt its Volume Table or use others.



7.3 Outputs of the Inventory

Outputs of the Inventory were as follows:

- Estimates of Growing Stock in Cubic meters by species and diameter class
- Estimate of number of stems by species and diameter Class
- Regeneration status, overall and species wise
- Estimate of stock of Bamboo & Bamboo bearing areas
- Regeneration Status of Bamboo

Besides, the above mentioned information, the tables, charts and graphs have also been generated for the State and each of the Division depicting Forest area, Growing Stock (Total, per Ha & diameter and species wise), Number of Stems (Total & per Ha), Top 15 Species based on Volume and Number of Stems of each (diameter class wise), basal area, status of Bamboo regeneration, distribution and availability of Bamboo (Diameter Class & age wise), status of regeneration through seedlings & coppices, various soil characteristics such as distribution of soil depth, Humus & stoniness, extents of acidic, alkaline & neutral soils(pH) and extent of Organic Carbon; incidences of weeds, grasses, fire, grazing, illicit felling and pests etc.

The results of the inventory have been prepared for the State as a whole and each Division wise separately, which are given in chapters III & IV of this book.







3. Growing Stock

Growing Stock

1. Estimation of growing stock of the State

The area of the notified forests in the state is 63,814 sqkm and the total growing stock comes to **232.08 million Cu M**. The growing stock per ha comes to **36.37 Cu M**.

The distribution of growing stock in different canopy cover classes, as derived by the Geomatics Centre of the AP Forest Department, is as follows:

Canopy cover class	Area in Km ²	Total growing stock in million M ³	Growing stock per ha in M ³
1. Dense (> 0.4)	28,309	168.66	59.58
2. Open (0.1 – 0.4)	19,498	56.89	29.18
3. Scrub (< 0.1)	4,898	6.53	13.34
Total	52,705	232.08	

A tabular statement summarising the details of the forest area in Andhra Pradesh canopy cover class wise, as estimated after inventory completed as per densitometer readings is given in the appendix 2. The table shows that Khammam circle covering Khammam district has maximum forest area of 7945.34 sqkm followed by Adilabad circle covering Adilabad district. The state has 28,309.33 sqkm Dense Forest of over 40% canopy density, 19,498 sqkm of Open Forest of canopy of density between 10% to 40% , 4898 sqkm of Scrub Forest with less than, 10% canopy density, and 11,107 sqkm of blanks including water bodies in a total of 63,814.26 sqkm of notified forest blocks (Appendix 1 & 2). The details of the Circle and Division-wise Growing Stock is as follows:



1.1. GROWING STOCK IN A.P. CIRCLE AND DIVISION WISE

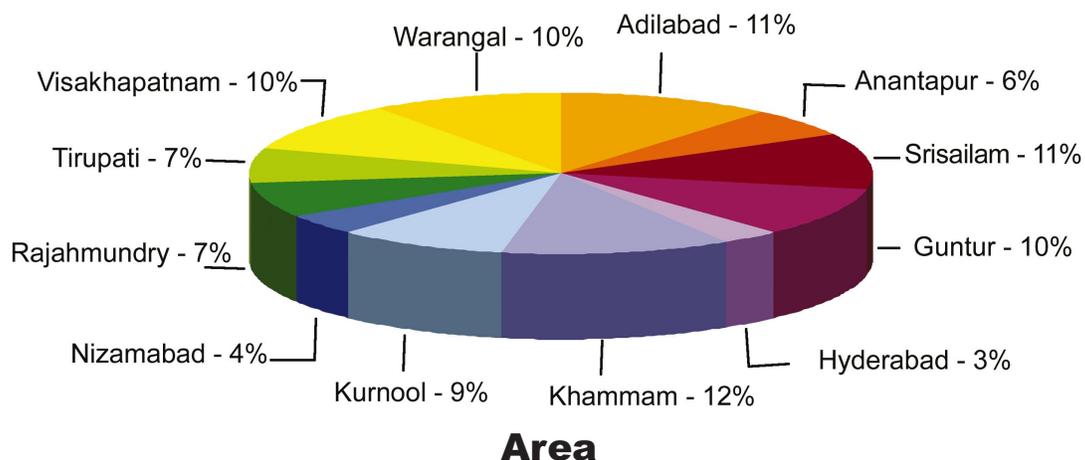
CIRCLE	Division	Dense Total Volume	Open Total Volume	Scrub Total Volume	Total Volume	Division Average
		(in million m ³)				(in m ³)
1. Adilabad	Adilabad	6.87	0.94	0.03	7.84	41.27
	Bellampally	3.81	2.33	0.23	6.37	41.80
	Jannaram	4.28	0.26	0.00	4.55	70.64
	Kagaz Nagar	0.92	1.77	0.10	2.80	31.31
	Mancherial	2.88	0.93	0.07	3.88	34.78
	Nirmal	6.33	1.37	0.01	7.71	75.20
	Total	25.08	7.62	0.44	33.14	46.67
2. Anantapur	Anantapur	0.64	0.80	0.30	1.74	8.95
	Chittoor West	1.55	0.79	0.17	2.51	12.01
	Total	2.19	1.59	0.47	4.25	10.53
3. Guntur	Giddalur	6.37	0.57	0.08	7.02	31.81
	Guntur	0.62	0.98	0.04	1.64	11.09
	Nellore	0.80	0.58	0.13	1.51	6.37
	Total	7.80	2.12	0.25	10.17	16.79
4. Hyderabad	Hyderabad	0.44	0.26	0.06	0.75	9.93
	Mahabubnagar	0.03	0.21	0.19	0.44	7.04
	Nalgonda	0.04	0.16	0.03	0.23	5.23
	Total	0.51	0.63	0.28	1.42	7.80
5. Khammam	Bhadrachalam North	0.88	4.73	0.23	5.83	40.50
	Bhadrachalam South	9.80	0.08	0.01	9.90	76.51
	Khammam	3.03	2.16	0.05	5.24	39.83
	Kothagudem	7.91	0.55	0.07	8.53	50.63
	Paloncha	4.81	4.90	0.05	9.76	64.02
	Paloncha WLM	2.79	0.53	0.01	3.33	48.46
	Total	29.22	12.95	0.41	42.59	53.60

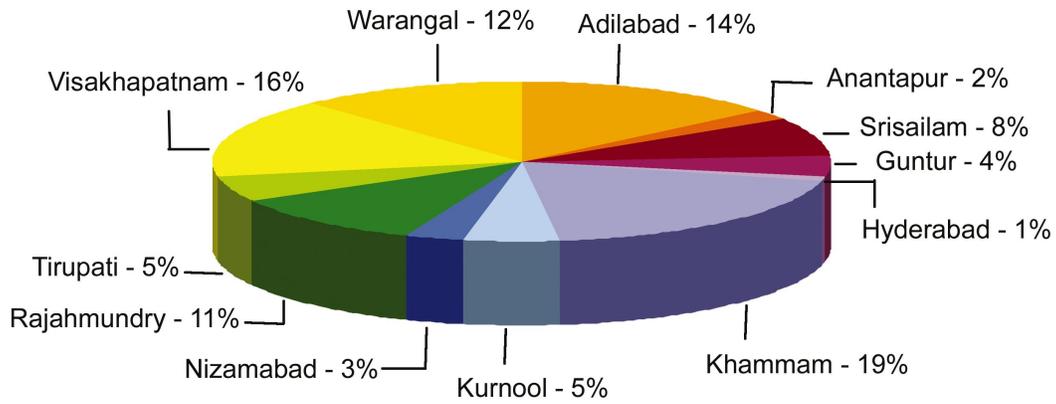
S.No/ Circle	Division	Dense Total Volume	Open Total Volume	Scrub Total Volume	Total Volume	Division Average
		(in million m ³)				(in m ³)
6. Kurnool	Kadapa	2.30	0.86	0.04	3.20	18.64
	Kurnool	0.09	0.39	0.43	0.91	7.57
	Nandyal	3.56	0.48	0.00	4.04	37.87
	Proddutur	2.05	0.52	0.00	2.57	16.32
	Total	8.00	2.25	0.47	10.72	19.27
7. Nizamabad	Kamareddy	0.40	3.41	0.17	3.98	40.56
	Medak	0.25	0.76	0.06	1.06	11.05
	Nizamabad	2.40	0.29	0.02	2.71	34.44
	Total	3.06	4.46	0.24	7.76	28.39
8. Rajahmundry	Eluru	4.81	0.42	0.04	5.27	68.22
	Kakinada	18.53	1.72	0.16	20.40	63.07
	Krishna	0.55	0.19	0.00	0.74	11.54
	Total	23.90	2.33	0.20	26.42	56.79
9. Srisailam	Achampet	2.54	3.50	0.29	6.34	26.15
	Atmakur	4.08	0.94	0.05	5.07	39.40
	Markapur	4.46	1.09	0.26	5.81	25.54
	Nagarjuna Sagar	0.03	0.44	0.16	0.63	7.91
	Total	11.11	5.97	0.76	17.84	26.33
10. Tirupati	Tirupati	1.77	0.92	0.07	2.75	36.77
	Chittoor East	3.66	1.29	0.10	5.05	25.67
	Rajampet	2.33	1.71	0.04	4.08	28.12
	Total	7.76	3.92	0.21	11.89	28.52

S.No/ Circle	Division	Dense Total Volume	Open Total Volume	Scrub Total Volume	Total Volume	Division Average
		(in million m ³)				(in m ³)
11. Visakhapatnam	Narsipatnam	17.51	1.46	0.21	19.18	81.50
	Paderu	0.01	1.00	1.51	2.52	24.88
	Srikakulam	1.13	0.25	0.02	1.40	19.38
	Visakhapatnam	2.55	1.18	0.24	3.98	31.42
	Vizianagaram	8.36	2.23	0.35	10.94	89.70
	Total	29.57	6.12	2.33	38.01	57.84
12. Warngal	Karimnagar East	3.74	0.81	0.16	4.71	33.96
	Karimnagar West	3.57	0.64	0.01	4.22	43.27
	Warangal WLM	1.33	0.99	0.04	2.36	43.74
	Warangal North	10.09	2.69	0.18	12.96	56.09
	Warangal South	1.74	1.82	0.08	3.63	30.93
	Total	20.46	6.94	0.47	27.87	43.66
Andhra Pradesh	Total	168.66	56.89	6.53	232.08	36.37

The above table shows that the state has a growing stock of **232.08 million Cu M** out of which **168.66 million Cu M** is contributed by **Dense Forests @ 59.58 Cu M per Ha**, **56.89 million Cu M** is contributed by **Open Forests @ 29.18 Cu M per Ha** and **6.53 million Cu M** is contributed by **Scrub Forests @ 13.34 Cu M per Ha**.

The **Distribution of forest area and growing stock in the 12 circles of the state** is represented by the following pie diagrams:



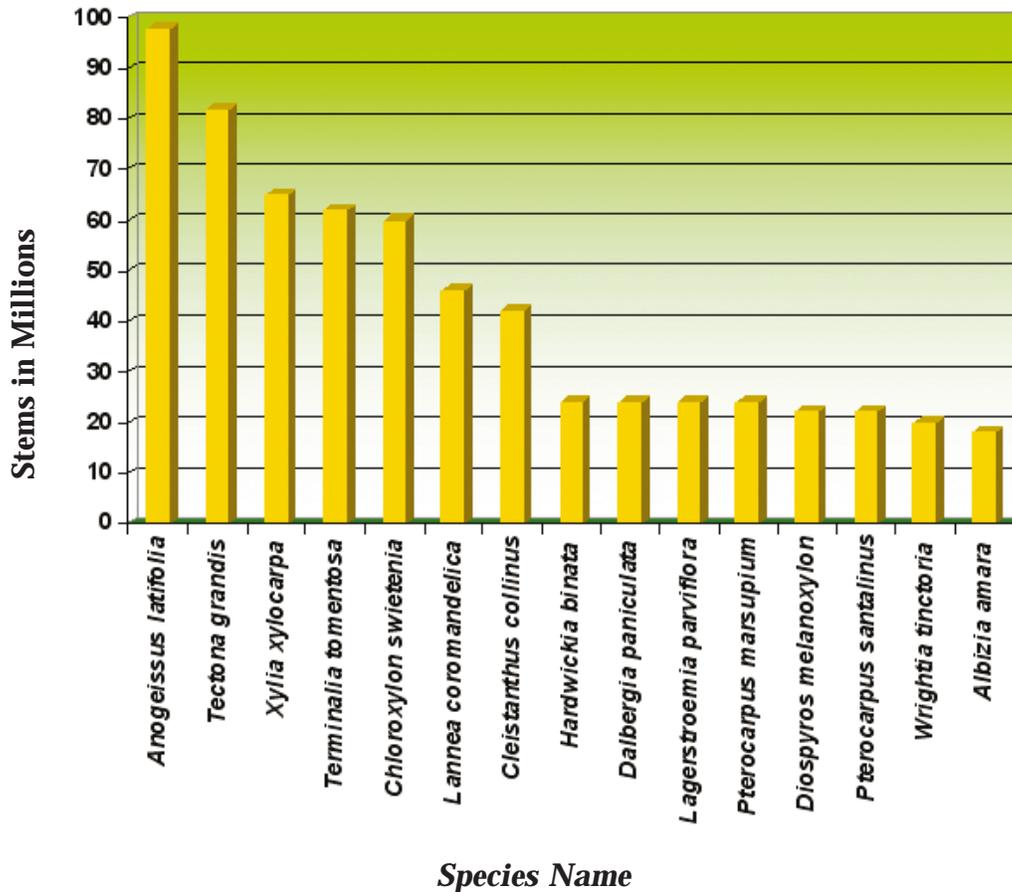


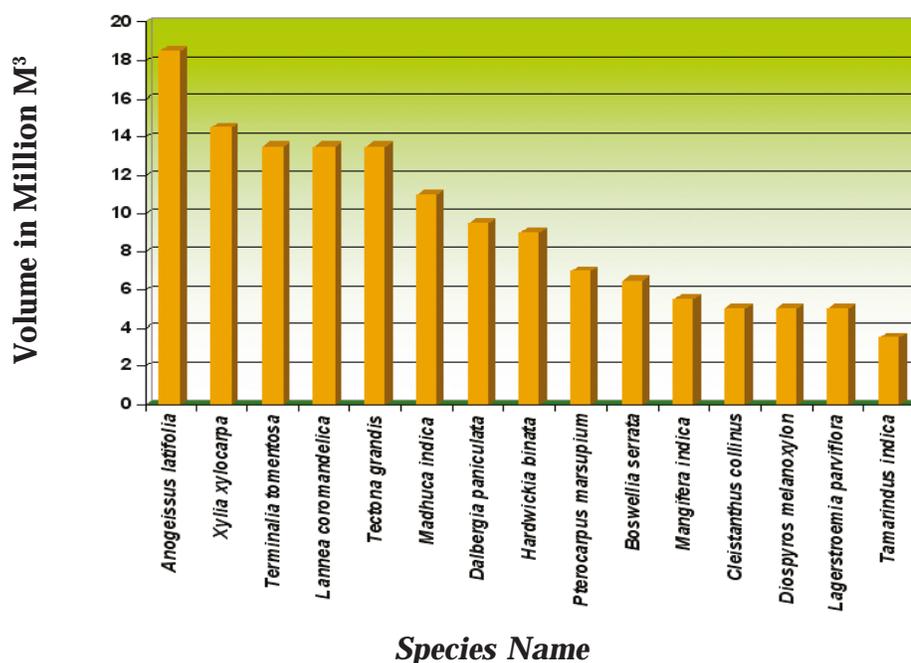
Volume

The two pie charts shows that Khammam circle with 12% of total forest area contributes to 19% of growing stock of the state. Visakhapatnam circle with 10% forest area contributes to 16% of the growing stock and ranks second.

1.2. Estimation of stems

The following bar diagrams show Top 15 species in AP based on the number of stems & volume:





The above diagram shows that *Anogeissus latifolia* contributes maximum to the growing stock (18.48 Million M³) followed by *Xylia xylocarpa* (14.50 million M³) in the entire state. The Contribution of others are *Terminalia tomentosa* (13.76 million M³), *Lannea coromandelica* (12.49 million M³), *Tectona grandis* (12.44 million M³), *Madhuca indica* (10.48 million M³), *Dalbergia paniculata* (9.37 million M³), *Hardwickia binata* (9.07 million M³), *Pterocarpus marsupium* (7.22 million M³), *Boswellia serrata* (6.86 million M³), *Mangifera indica* (5.70 million M³), *Cleistanthus collinus* (5.04 million M³), *Diospyros melanoxylon* (4.98 million M³), *Lagerstroemia parviflora* (4.85 Million M³) and *Tamarindus indica* (3.27 million M³).

The following table and diagram depict Stems per Ha Circle-wise:

Circle	Stems per Ha
Adilabad	186
Anantapur	82
Guntur	143
Hyderabad	89
Khammam	244
Kurnool	153
Nizamabad	176
Rajahmundry	195
Srisailam	155
Tirupati	263
Visakhapatnam	169
Warangal	207
Andhra Pradesh	179

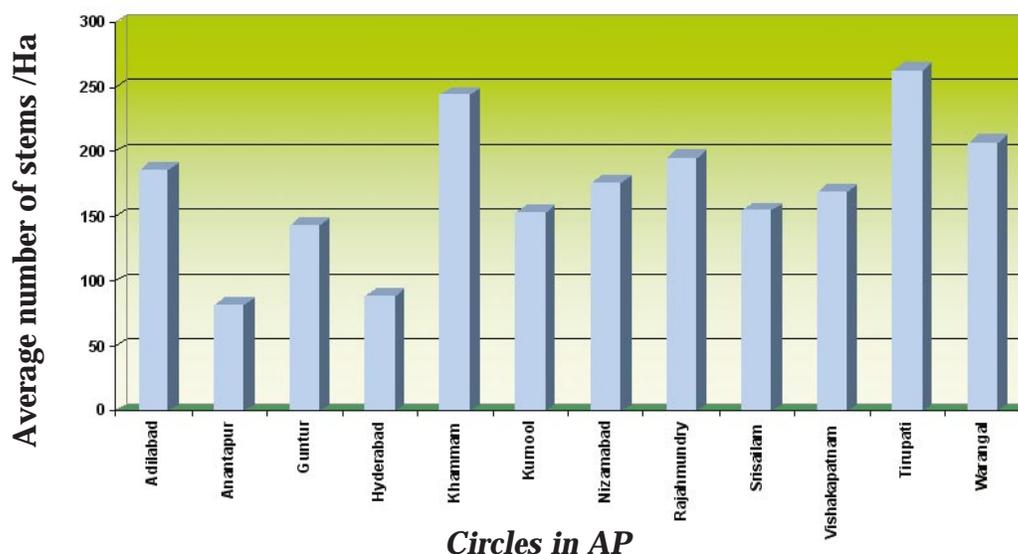
The table on **Stems per Ha(Circle-wise)** shows that the state has 179 trees/Ha, Tirupati WL circle has a maximum of 263 trees/Ha, followed by Khammam circle with 244 trees/Ha, and Anantapur with 82 trees/Ha is the lowest.

The following table represents **stems per Ha by density class in each circle**:

Circle	Dense	Open	Scrub	Total
Adilabad	262	160	60	186
Anantapur	179	108	50	82
Guntur	274	113	197	143
Hyderabad	215	114	63	89
Khammam	319	224	78	244
Kurnool	261	144	67	153
Nizamabad	300	197	71	176
Rajahmundry	237	195	75	195
Srisailem	237	147	60	155
Tirupati	370	251	97	263
Visakhapatnam	251	181	72	169
Warangal	277	194	70	207
Andhra Pradesh	271	174	76	179

From the above table, it is seen that except Guntur circle, Dense Forests have more number of trees than open forests and open forests have more number of trees than scrub forests. The average number of trees in Dense Forests of the state is 271/ Ha, whereas the figure is 174/Ha in Open Forests, and 76/Ha in Scrub forests.

The following graph represents the **Number of stems/Ha in various circles**:

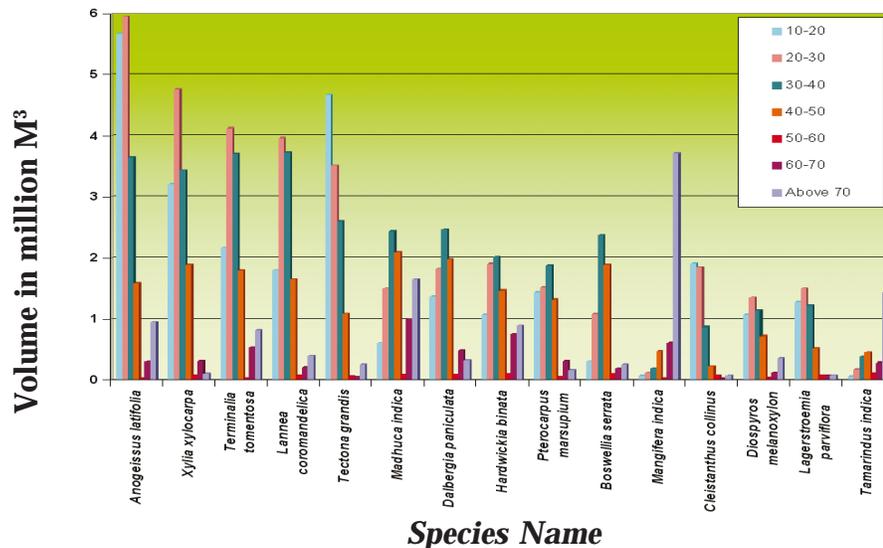


This table gives **Diameter class-wise volumes of top 15 species in AP :**

SPECIES	10-20	20-30	30-40	40-50	50-60	60-70	ABOVE 70	TOTAL
	in million cubic meters							
1. <i>Anogeissus latifolia</i>	5.67	5.95	3.65	1.59	0.02	0.30	0.95	18.48
2. <i>Xylia xylocarpa</i>	3.21	4.76	3.43	1.89	0.07	0.31	0.11	14.50
3. <i>Terminalia tomentosa</i>	2.17	4.12	3.70	1.79	0.02	0.54	0.82	13.76
4. <i>Lannea coromandelica</i>	1.80	3.96	3.72	1.65	0.07	0.21	0.40	12.49
5. <i>Tectona grandis</i>	4.67	3.52	2.60	1.09	0.06	0.05	0.26	12.44
6. <i>Madhuca indica</i>	0.60	1.50	2.44	2.09	0.09	1.00	1.65	10.48
7. <i>Dalbergia paniculata</i>	1.37	1.82	2.47	1.98	0.09	0.48	0.32	9.37
8. <i>Hardwickia binata</i>	1.07	1.90	2.02	1.47	0.10	0.75	0.89	9.07
9. <i>Pterocarpus marsupium</i>	1.44	1.52	1.88	1.32	0.05	0.31	0.16	7.22
10. <i>Boswellia serrata</i>	0.30	1.08	2.37	1.89	0.10	0.19	0.26	6.86
11. <i>Mangifera indica</i>	0.07	0.13	0.19	0.47	0.02	0.61	3.71	5.70
12. <i>Cleistanthus collinus</i>	1.91	1.85	0.87	0.23	0.08	0.02	0.08	5.04
13. <i>Diospyros melanoxylon</i>	1.07	1.35	1.14	0.72	0.04	0.13	0.36	4.98
14. <i>Lagerstroemia parviflora</i>	1.28	1.50	1.22	0.52	0.07	0.07	0.08	4.85
15. <i>Tamarindus indica</i>	0.06	0.17	0.39	0.45	0.11	0.28	1.44	3.27

Above table shows that there is higher prevalence of lower diameter classes of 10-20 cm, 20-30 cm and 30-40 cm except trees like *Mangifera indica*, *Maduca indica* and *Tamarindus indica*. The existence of higher DBH classes is less prevalent.

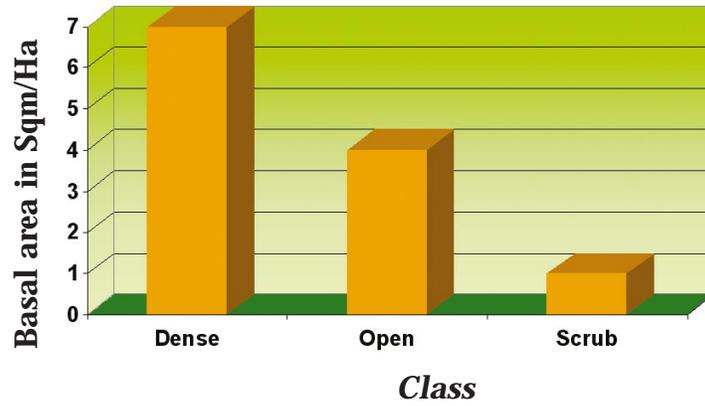
A diagram showing **Diameter class wise volumes distribution of above 15 species** is given below:



1.3. Estimation of Basal Area

The Basal area is an index of the status of growth. The following table & bar diagram show the Basal area in dense, open & Scrub Forests.

Class	Basal Area in Sq.M/Ha
Dense	7
Open	4
Scrub	1





4. Health of Forests

Health of Forests

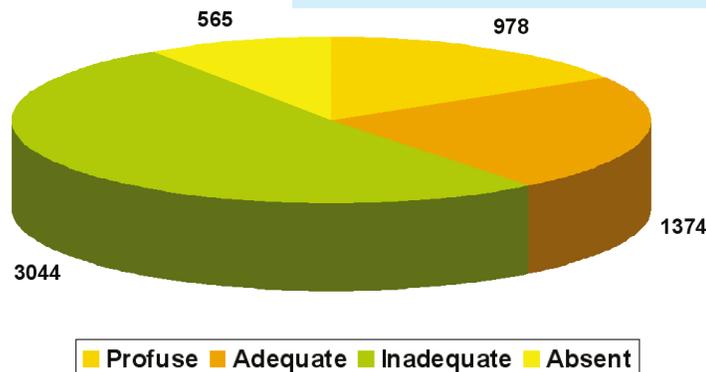
The health of forests is observed in terms of its Regeneration status, Incidences of fire, Illicit felling, Grazing, Grasses, Weeds and Pests. When these factors are taken care of, the forest cover grows in volume well. They are studied well in this Inventory exercise, the outcome of which is as follows:

1. Status of Regeneration

a) Seedling Regeneration: The following table and pie chart shows the **Status of seedling regeneration**.

It is seen from the pie chart below, that in an area of 565 thousand Ha, regeneration of seedlings is absent and in an area of 3044 thousand Ha, it is inadequate in the state.

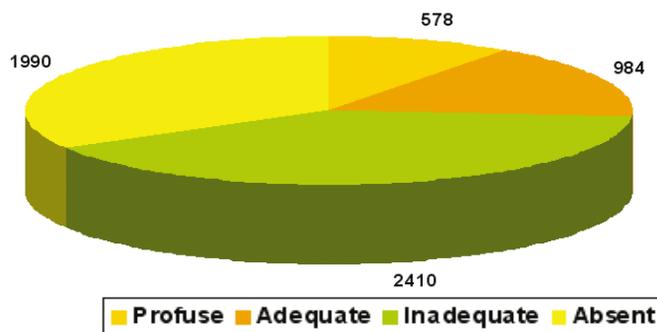
Description	Area (in Thousand Ha)
Profuse (More than 62 seedlings)	978
Adequate (31- 62 seedlings)	1374
Inadequate (Less than 31 seedlings)	3044
Absent	565



b) Coppice Regeneration: The following table and pie chart shows the **Status of Coppice regeneration**.

It is evident from the table and pie chart below, that Coppice regeneration is absent in an area of 1990 thousand Ha and inadequate in an area of 2410 thousand Ha in the state.

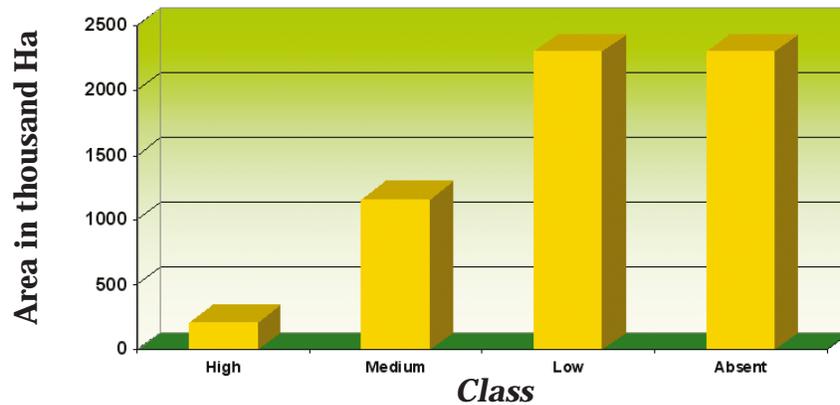
Description	Area (in Thousand Ha)
Profuse (More than 12 stumps)	578
Adequate (6-12 stumps)	984
Inadequate (Less than 6 stumps)	2410
Absent	1990



2. Incidence of Fire

Fire is a major threat to forests and following table and bar diagram indicate Fire incidence in the state.

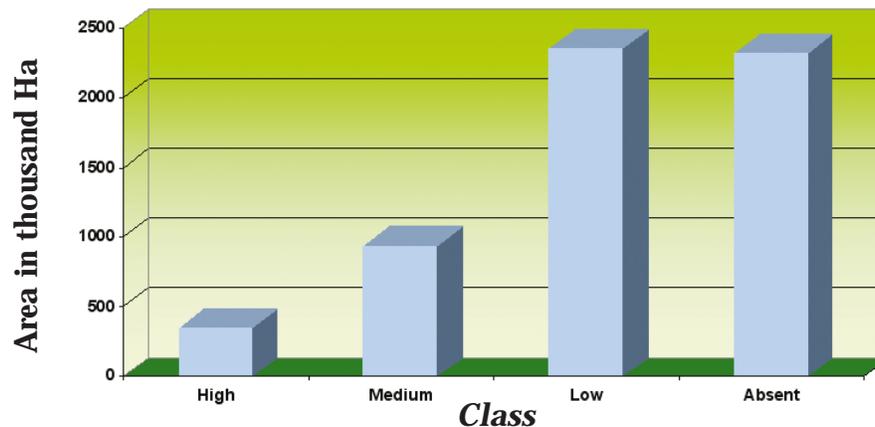
Description	Area (in Thousand Ha)
High (Stems are blackened, bark is burnt, crown is burnt and some trees dead. Undergrowth burnt. Soil is charred.)	211
Medium (Stems are blackened, bark is burnt, crown not burnt and trees not dead. Undergrowth burnt. Soil is charred. Bark may be slightly blackened (charred).)	1164
Low (Undergrowth burnt. Burnt twigs found. Soil may be charred.)	2294
Absent	2293



3. Incidence of Illicit Felling

The table and bar diagram below show the Incidence of illicit felling in the state:

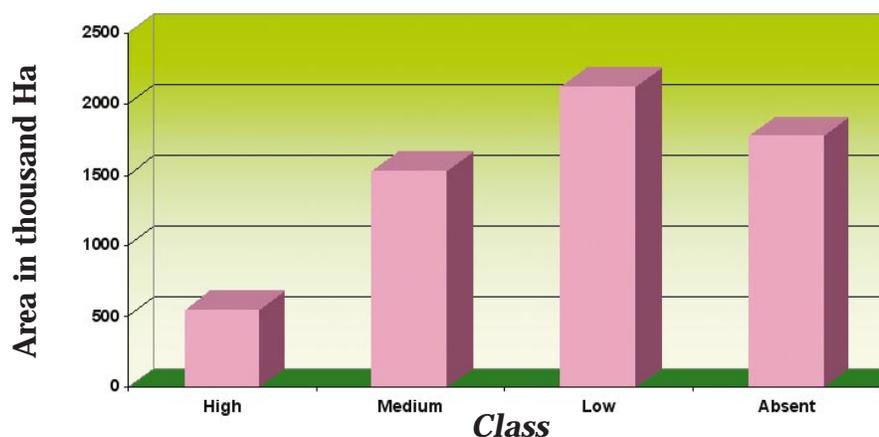
Description	Area (in Thousand Ha)
High (Most of the trees are badly mutilated may be resulting in bushy growth)	350
Medium (Trees only partially damaged with the main stem in general intact)	938
Low (Signs same as above but on a sporadic scale)	2356
Absent	2317



4. Incidence of Grazing

The following table & bar diagram show the **Incidence of grazing in the state:**

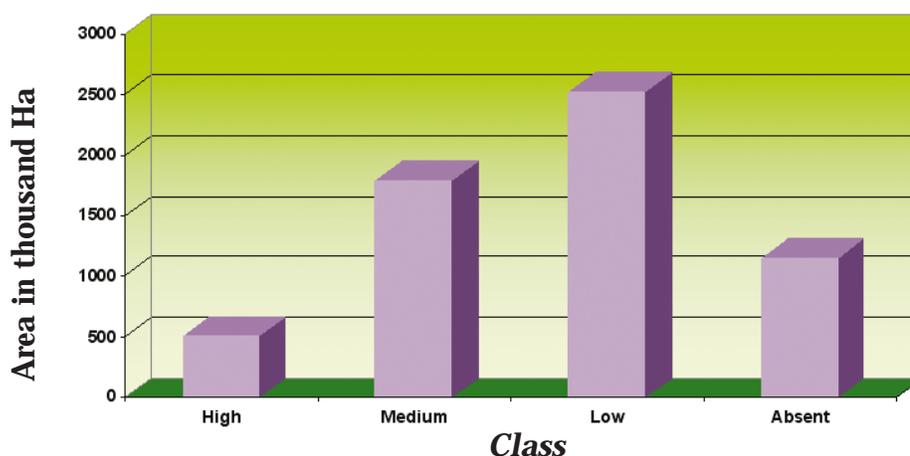
Description	Area (in Thousand Ha)
High (Cattle seen or fresh cow-dung seen and hoof-marks visible. Soil compacted due to trampling, plants also trampled. Grass eaten.)	546
Medium (Cow-dung seen at one or two places, hoof marks visible. Soil not compacted, grass also visible)	1524
Low (Hoof marks and cow-dung not visible. Soil not compacted. Some signs of grazing however visible.)	2119
Absent	1773



5. Incidence of weeds

The following table & bar diagram show the **Incidence of weeds in the state:**

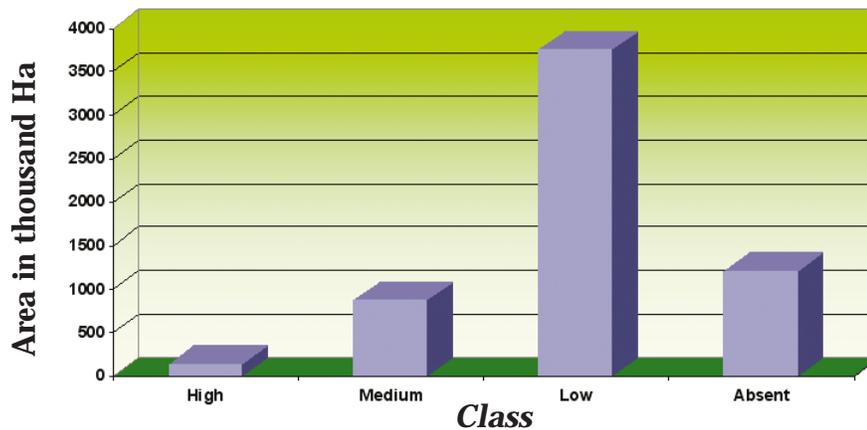
Description	Area (in Thousand Ha)
Dense (Where weeds occupy more than 50% of the area)	505
Medium (Where weeds occupy approximately 10-50% of the area)	1791
Low (Where weeds occupied less than 10% of the area)	2521
Absent	1145



6. Incidence of Pest

The following table & bar diagram show the **Incidence of pests in the state:**

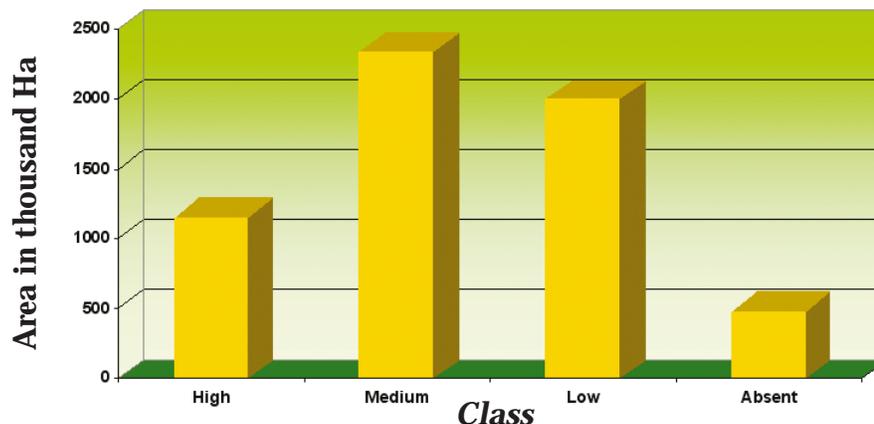
Description	Area (in Thousand Ha)
High (More than 50% of trees affected)	130
Medium (25-50% of trees affected)	871
Low (<25% trees affected)	3754
Absent	1207



7. Incidence of Grass

The following table gives the **availability of the grass in the forest areas of the state.** It can be seen that dense & medium grass is available in 1152 thousand Ha & 2336 Ha, which are highly suitable for herbivores. However, grass is absent in 478 thousand Ha. The existence of grass is closely related to fire incidents.

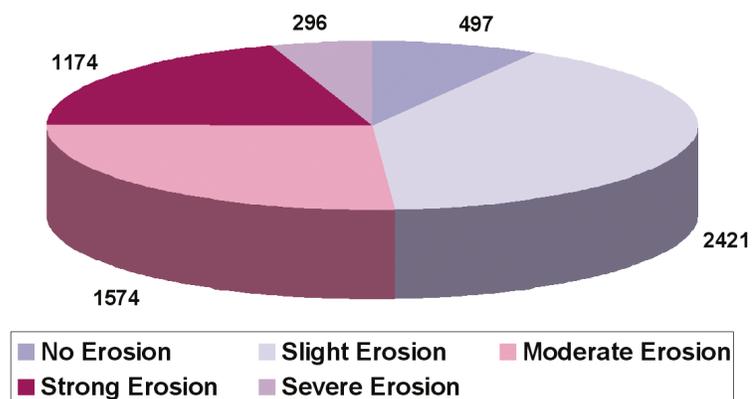
Description	Area (in Thousand Ha)
Dense (More than 50% of the area covered by grass)	1152
Medium (10-50% of the area covered by grass)	2336
Low (Less than 10% of the area covered by grass)	1995
Absent	478



8. Soil Erosion Status

The following table & pie chart show **Incidence of soil erosion in the forest areas of the state:**

Description	Area (in Thousand Ha)
No Erosion	497
Slight Erosion (Sheet erosion, Only surface erosion is seen)	2421
Moderate Erosion (Rills are seen)	1574
Strong Erosion (Gullies are seen)	1174
Severe Erosion (Gullies, ravines and landslips are seen)	296





5. Status of Forest Soils

Status of Forest Soils

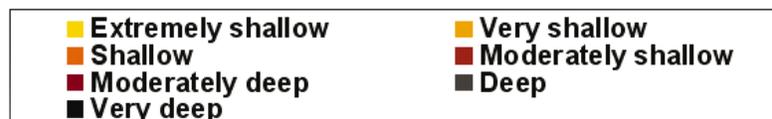
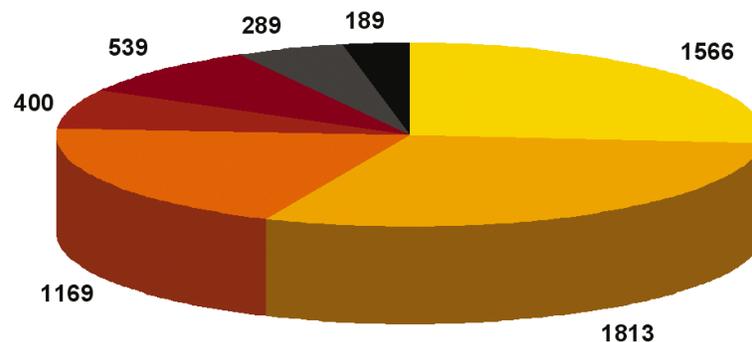
During the Inventory exercise, the soil samples were collected at each plot to study the status of the forest soil. From each plot, covering each quadrant of the plot, four V-Shaped pits of 15cm x 15cm dimension each were dug with 15cm depth at each plot. Using a *Thapi* about 250 gm of soil was scraped from each of the four pits. The soil so collected from all subplots was mixed thoroughly and the sample of 1 kg was taken.

The soil samples were analysed in the field laboratories at Rajahmundry, Srisailam, Warangal, Hyderabad and Tirupati.

1. Distribution of Soil Depth

The following table & diagram give **Soil depth distribution in the state**. 1516 thousand Ha of area is extremely shallow & 1813 thousand Ha of area is very shallow & thus unsuitable for artificial regeneration.

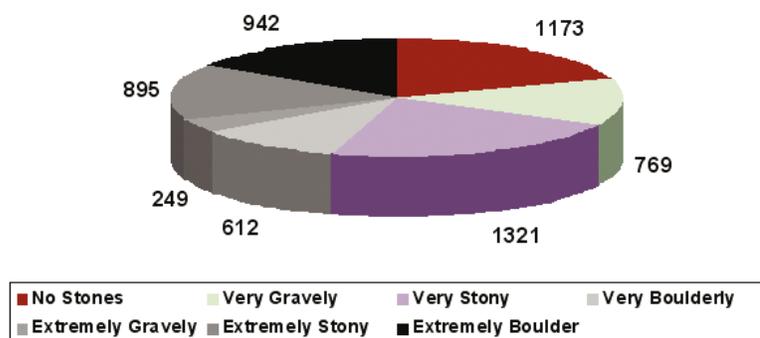
Description	Area (in Thousand Ha)
Extremely shallow (Soil less than 10 cm depth)	1566
Very shallow (10 – 25 cm)	1813
Shallow (10 – 25 cm)	1169
Moderately shallow (50 – 75 cm)	400
Moderately deep (75 – 100 cm)	539
Deep (100 – 150 cm)	289
Very deep (Soil more than 150 cm depth)	189



2. Distribution of Stoniness

The following table & diagram show the **Distribution of stoniness**. Large tracts of area in the state which are extremely stony are unsuitable for artificial regeneration.

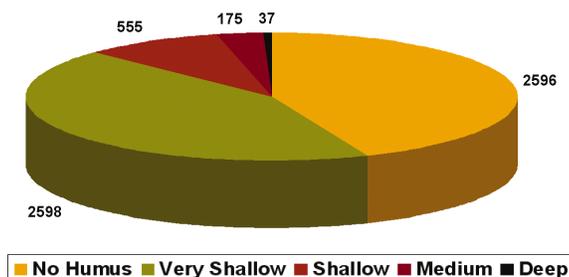
Description	Area (in Thousand Ha)
No Stones (Where rock fragments occupy less than 10% of the ground)	1173
Very Gravely (Where gravel occupies 10-50% of the ground)	769
Very Stony (Where stones occupy 10-50% of the ground)	1321
Very Boulderly (Where boulders occupy 10-50% of the ground)	612
Extremely Gravely (Where gravel occupies more than 50% of the ground)	249
Extremely Stony (Where stones occupy more than 50% of the ground)	895
Extremely Boulderly (Where boulders occupy more than 50% of the ground)	942



3. Distribution of Humus

The following table shows **Distribution of humus** in thousands of Ha. Medium & deep humus are extremely good for artificial regeneration.

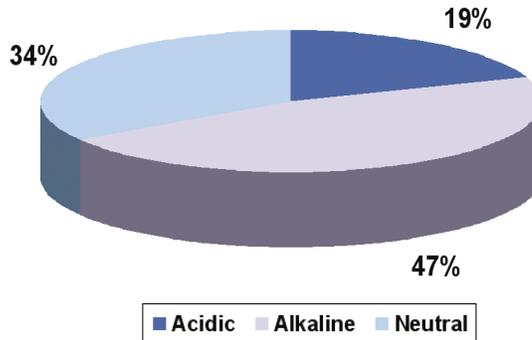
Description	Area (in Thousand Ha)
No Humus (No humus at all)	2596
Very Shallow (Humus less than 2 cm)	2598
Shallow (Humus 2 - 5 cm)	555
Medium (Humus 5 - 10 cm)	175
Deep (Humus more than 10 cm)	37



4. Distribution of Soil pH

The Distribution of soil pH in the state is as follows:

pH Description	No. of plots	Area (in Thousand Ha)
Acidic	1065	1159
Alkaline	2529	2752
Neutral	1874	2039

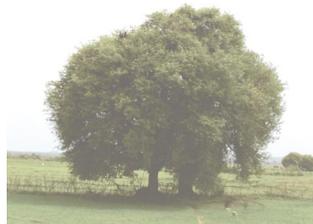
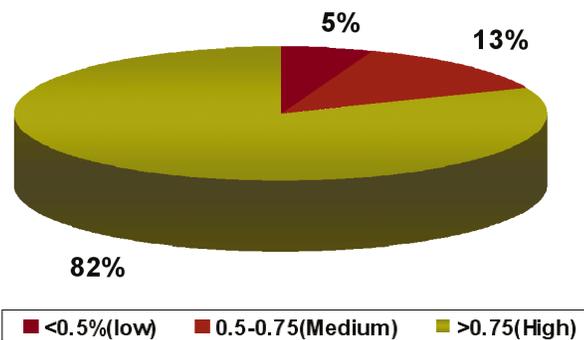


The Neutral soils are good for artificial regeneration.

5. Distribution of Organic Carbon

The following table & diagram shows the Distribution of organic carbon in the state:

Organic-Carbon	No. of Plots	Area (in Thousand Ha)
<0.5%(low)	298	324
0.5-0.75(Medium)	727	791
>0.75(High)	4450	4843





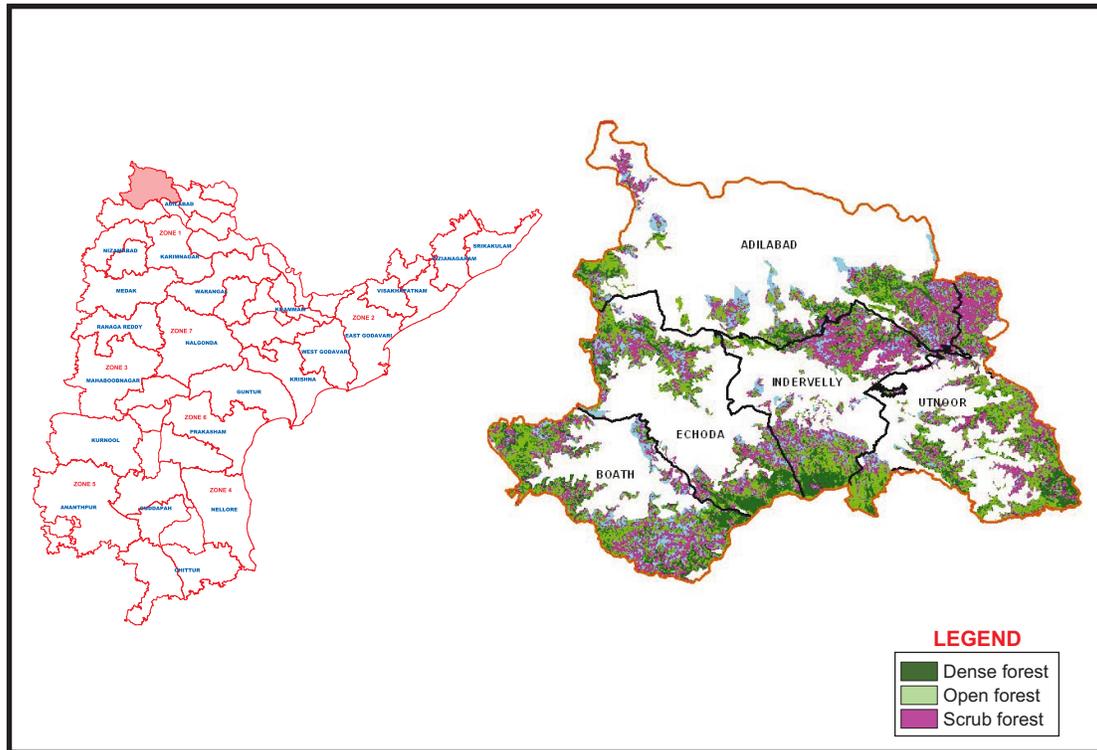
6. Division-wise Growing Stock of Timber



Tectona grandis

1. Adilabad Circle

Adilabad Division



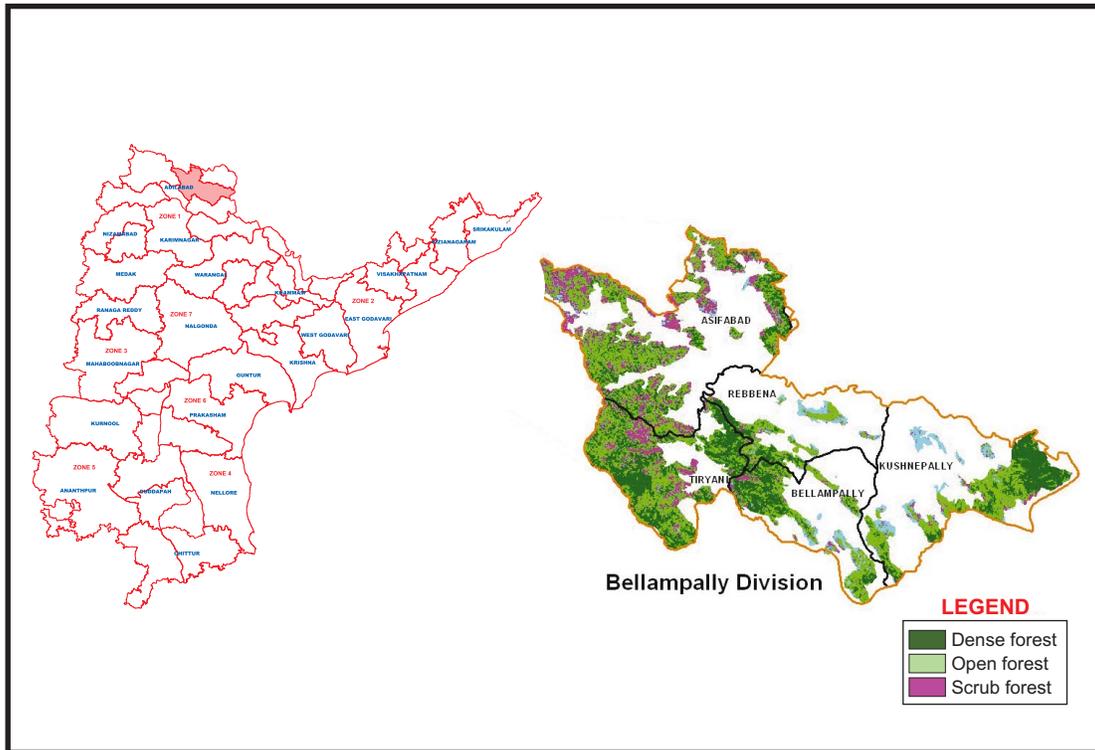
- **Total Growing Stock** is 7.84 million M³. Of this, 6.87 million M³ is in Dense Forest, 0.94 million M³ in Open and 0.03 million M³ in Scrub Forest. **Average Growing stock** of the division is 41.27 M³/ha. Canopy class-wise Average Growing stocks are 62.38 M³/Ha in Dense, 32.06 M³/Ha in Open and 8.03 M³/Ha in Scrub Forest.
- **The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.
- **The total number of stems** in the division is 27.42 million. Of these, 23.67 million fall in Dense, 3.65 million in Open, and 0.10 million in Scrub Forest. **Average Number of stems** per Ha in the division is 144. They are in Dense Forest - 215 /Ha, Open Forest - 124 /Ha and Scrub Forest - 30 /Ha.
- **Top 5 prominent Species in terms of Number of stems** in the division are *Tectona grandis*, *Boswellia serrata*, *Anogeissus latifolia*, *Madhuca indica* and *Lagerstroemia parviflora*.

Species Name	Volume in Million M ³
<i>Tectona grandis</i>	1.77
<i>Madhuca indica</i>	1.25
<i>Boswellia serrata</i>	1.23
<i>Anogeissus latifolia</i>	0.51
<i>Terminalia arjuna</i>	0.36

Bellampally Division



Boswellia serrata



- **Total growing stock** is 6.37 million M³. Of this 3.81 million M³ is in Dense Forest, 2.33 million M³ in Open, 0.23 million M³ in the Scrub Forest. **Average growing stock** of the division is 41.80 M³/ha. Canopy class wise average growing stocks are 58.55 M³/ha in Dense, 45.74 M³/ha in Open and 15.55 M³/ha in Scrub Forest.

- **The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.

Species Name	Volume in Million M ³
<i>Boswellia serrata</i>	1.05
<i>Tectona grandis</i>	1.04
<i>Anogeissus latifolia</i>	0.70
<i>Terminalia tomentosa</i>	0.37
<i>Madhuca indica</i>	0.36

- **The total number of stems** in the division is 27.30 million. Of these, 15.70 million fall in Dense-

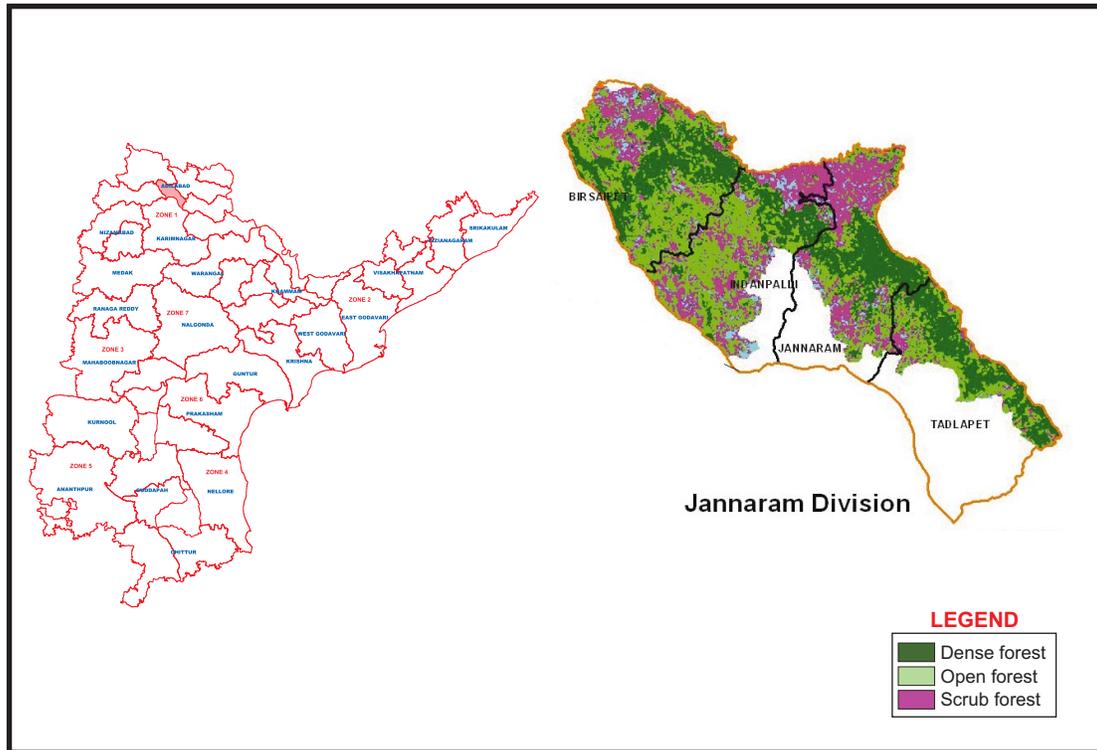
10.85 million in Open, and 0.74 million are in Scrub Forest. **Average number of stems** per ha in division is 179. They are in Dense Forest - 242 per ha, Open Forest - 213 per ha and in Scrub Forest - 49 per ha.

- **Top 5 prominent Species in terms of Number of stems** in the division are *Tectona grandis*, *Anogeissus latifolia*, *Boswellia serrata*, *Cleistanthus collinus* and *Terminalia tomentosa*.



Dalbergia latifolia

Jannaram Division



- **Total growing stock** is 4.55 million M³. Of this, 4.28 million M³ is in Dense Forest, 0.26 million M³ in Open Forest, 0 million M³ in the Scrub Forest. **Average growing stock** of the division is 70.64 M³/Ha. Canopy class-wise average growing stocks are 75.06 M³Ha in Dense, 66.08 M³Ha in Open and 1.78 M³Ha in Scrub Forest.

- **The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.
- **The total number of Stems** in the division is 17.86 millions. Of these 17.21 million fall in Dense-

Species Name	Volume in Million M ³
<i>Tectona grandis</i>	2.03
<i>Cleistanthus collinus</i>	0.28
<i>Anogeissus latifolia</i>	0.27
<i>Lannea coromandelica</i>	0.24
<i>Boswellia serrata</i>	0.22

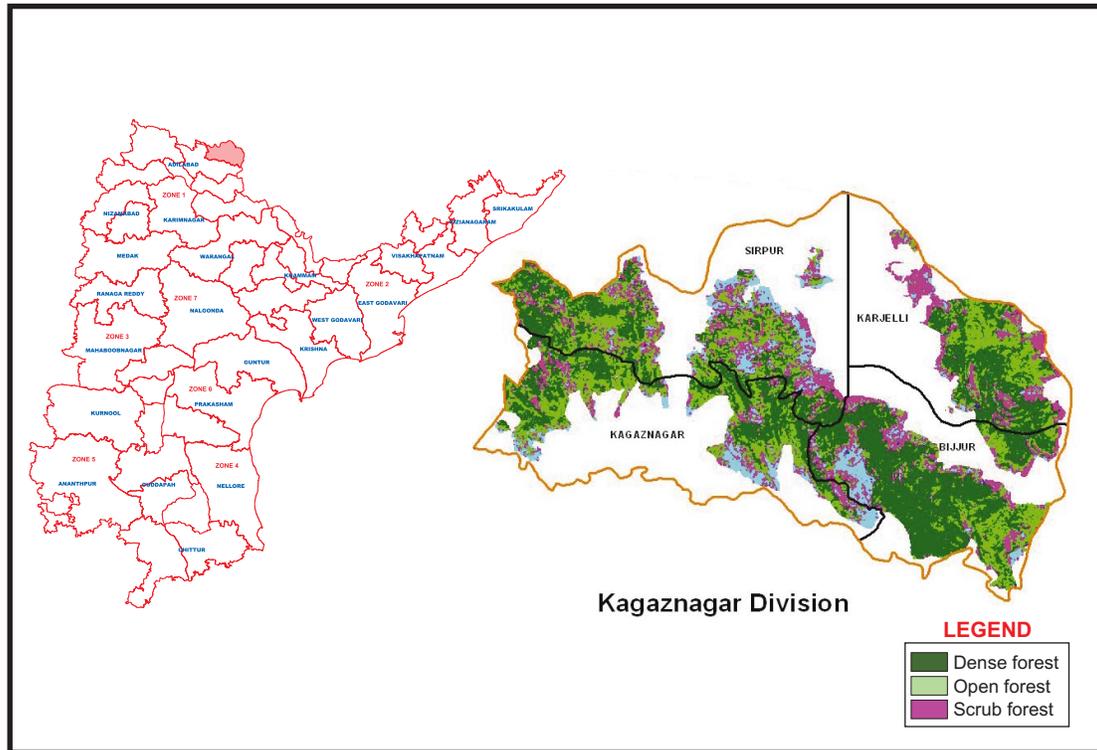
0.64 million in Open, 0.01 million are in Scrub Forests. **Average number of stems** per Ha in division is 277. They are in Dense Forest - 302 /Ha, Open Forest - 160 /Ha and Scrub Forest - 10 /Ha

- **Top 5 prominent Species in terms of Number of Stems** in the division are *Tectona grandis*, *Cleistanthus collinus*, *Anogeissus latifolia*, *Lagerstroemia parviflora* and *Wrightia tomentosa*.

Kagaz Nagar Division



Albizia odoratissima



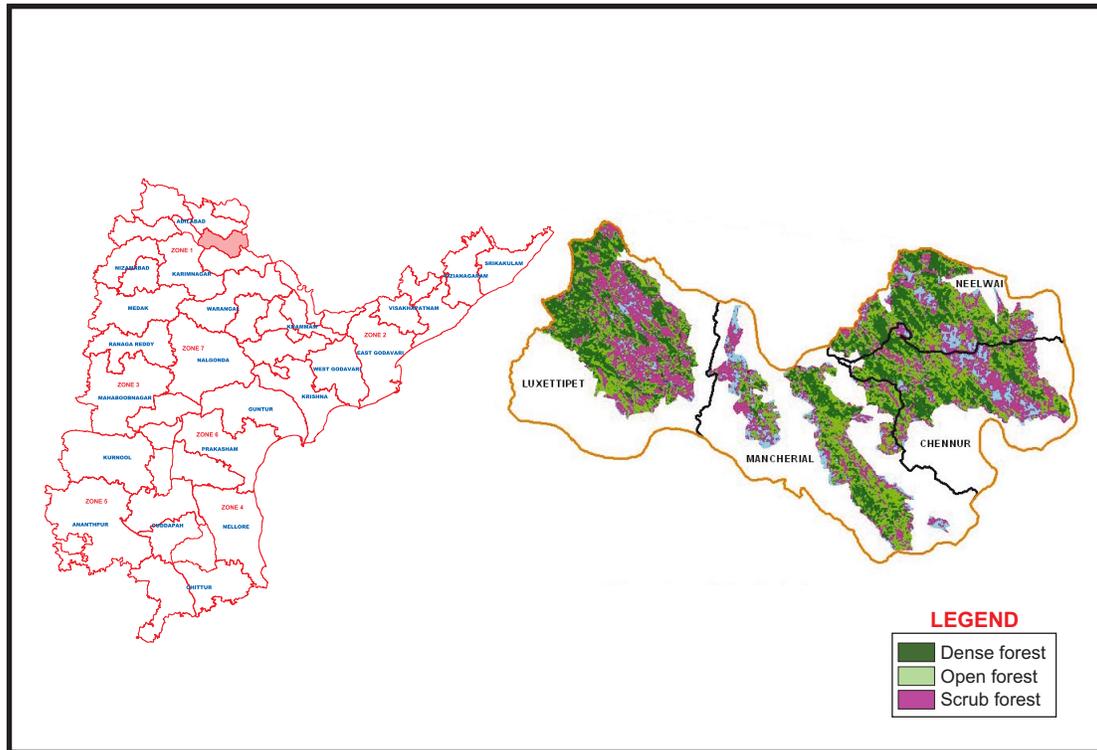
- **Total growing stock** is 2.80 million M³. Of this, 0.92 million M³ is in Dense Forest, 1.77 million M³ in Open, 0.10 million M³ in the Scrub Forest. **Average growing stock** of the division is 31.31 M³/Ha. Canopy class-wise average growing stocks are 55.33 M³/Ha in Dense, 33.44 M³/Ha in Open and 11.81 M³/Ha in Scrub Forest.
- **The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.
- **The total number of stems** in the division is 10.91 million. Of these, 3.73 millions fall in Dense Forest, 6.57 million in Open, and 0.62 million in Scrub Forest. **Average Number of Stems** per Ha in division is 122. They are in Dense Forest - 224 /Ha, Open Forest - 124 /Ha and in Scrub Forest - 70 /Ha.
- **Top 5 prominent species in terms of number of stems** in the division are *Cleistanthus collinus*, *Anogeissus latifolia*, *Terminalia tomentosa*, *Tectona grandis* and *Xylia xylocarpa*.

Species Name	Volume in Million M ³
<i>Anogeissus latifolia</i>	0.38
<i>Madhuca indica</i>	0.29
<i>Terminalia tomentosa</i>	0.29
<i>Dalbergia paniculata</i>	0.23
<i>Boswellia serrata</i>	0.21



Mitragyna parvifolia

Mancherial Division



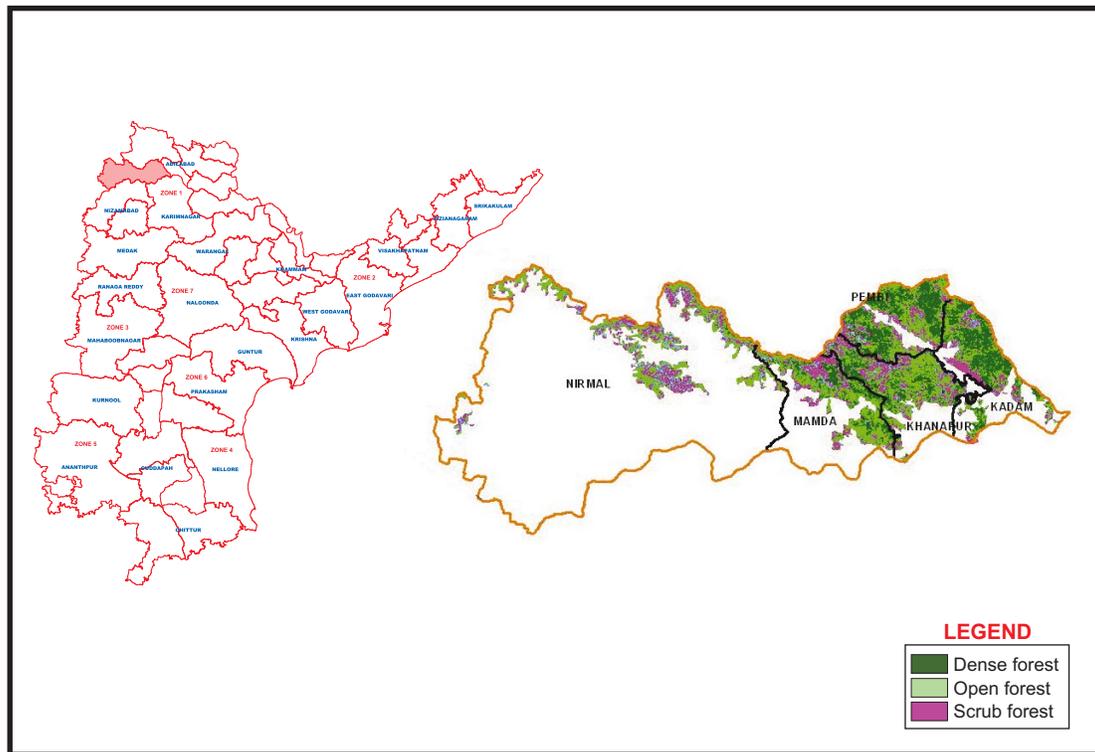
- **Total growing stock** is 3.88 million M³. Of this, 2.88 million M³ is in Dense Forest, 0.93 million M³ in Open, 0.07 million M³ in the Scrub Forests. **Average growing stock** of the division is 34.78 M³/Ha. Canopy class-wise average growing stocks are 50.82 M³/Ha in Dense, 24.94 M³/Ha in Open and 9.81 M³/Ha in Scrub Forest.
- **The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.
- **The total number of stems** in the division is 19.19 million. Of these, 13.87 million fall in Dense-4.68 million in Open, and 0.64 million in Scrub Forest. **Average number of stems** per Ha in division is 172. They are in Dense Forest - 245 /Ha, Open Forest - 125 /Ha and in Scrub Forest - 90 /Ha.
- **Top 5 prominent species in terms of number of stems** in the division are *Tectona grandis*, *Lannea coromandelica*, *Terminalia tomentosa*, *Wrightia tinctoria* and *Anogeissus latifolia*.

Species Name	Volume in Million M ³
<i>Boswellia serrata</i>	0.47
<i>Lannea coromandelica</i>	0.41
<i>Anogeissus latifolia</i>	0.30
<i>Terminalia tomentosa</i>	0.29
<i>Madhuca indica</i>	0.22

Nirmal Division



Terminalia tomentosa



- **Total growing stock** is 7.71 million M³. Of this, 6.33 million M³ is in Dense Forest, 1.37 million M³ in Open and 0.01 million M³ in the Scrub Forest. **Average growing stock** of the division is 75.20 M³/Ha. Canopy class-wise average growing stocks are 101.22 M³ /Ha in dense, 42.80 M³ /Ha in Open and 8.62 M³ /Ha in Scrub Forest.

- **The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.
- **The total number of stems** in the division is 29.15 million. Of these, 22.40 million fall in Dense, 6.68

Species Name	Volume in Million M ³
<i>Tectona grandis</i>	3.00
<i>Anogeissus latifolia</i>	0.61
<i>Lannea coromandelica</i>	0.49
<i>Madhuca indica</i>	0.42
<i>Dalbergia paniculata</i>	0.37

million in Open, and 0.08 million in Scrub Forest. **Average number of stems** per Ha in division is 284. They are in Dense Forest - 358 /Ha, Open Forest - 208 /Ha and in Scrub Forest - 90 /Ha.

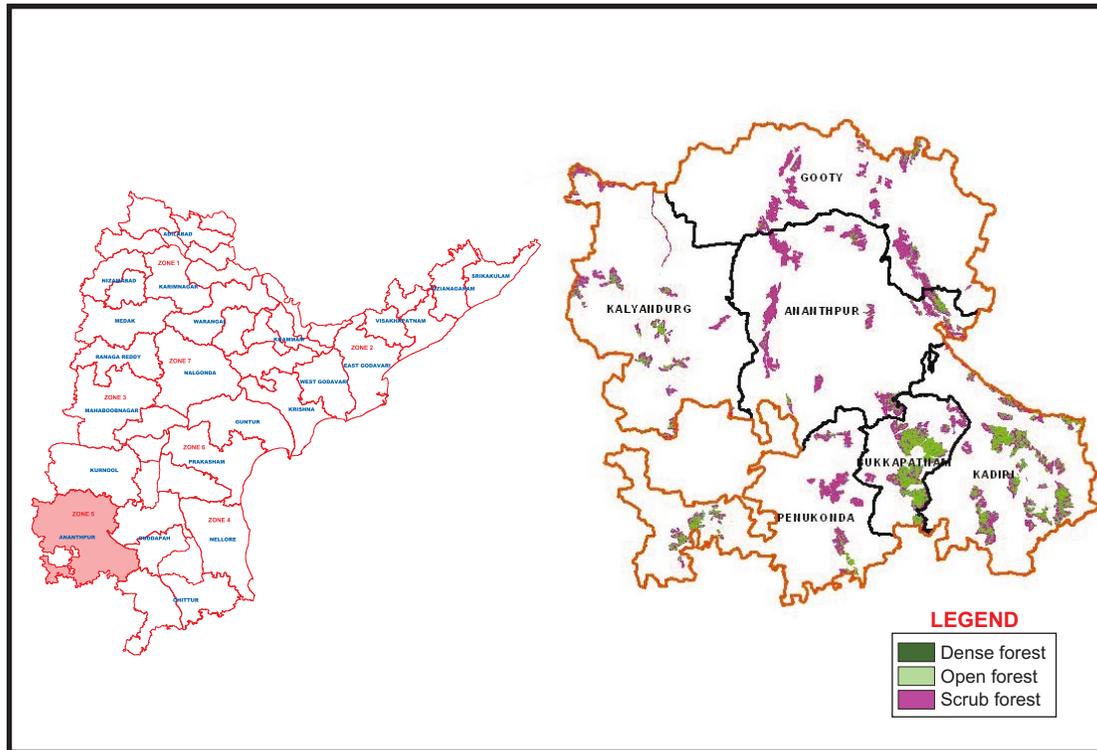
- **Top 5 prominent species in terms of number of stems** in the division are *Tectona grandis*, *Anogeissus latifolia*, *Wrightia tinctoria*, *Cleistanthus collinus* and *Butea monosperma*.

2. Anantapur Circle

Anantapur Division



Hildegardia populifolia



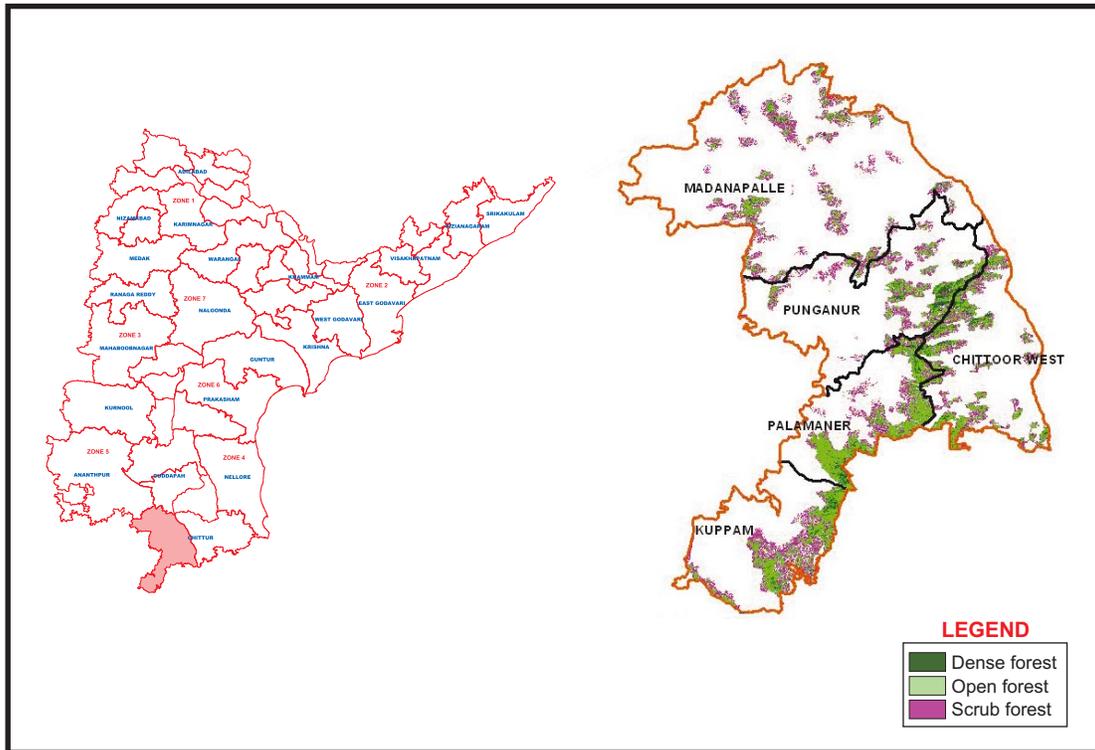
- Total growing stock** is 1.74 million M³. Of this, 0.64 million M³ is in Dense Forest, 0.80 million M³ in Open, and 0.30 million M³ in Scrub Forest. **Average growing stock** of the division is 8.95 M³/Ha. Canopy class-wise average growing stocks are 22.24 M³/Ha in Dense, 12.11 M³/Ha in Open and 7.93 M³/Ha in Scrub Forest.
- The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.

Species Name	Volume in Million M ³
<i>Dalbergia paniculata</i>	0.22
<i>Albizia amara</i>	0.22
<i>Hardwickia binata</i>	0.15
<i>Gyrocarpus americanus</i>	0.12
<i>Terminalia arjuna</i>	0.09
- The total number of stems** in the division is 13.46 million. Of these, 5.33 million fall in Dense, 6.33 million in open, and 1.80 million in Scrub Forests. **Average number of stems** per Ha in division is 69. They are in Dense Forest - 185 /Ha, Open Forest - 95 /Ha and Scrub Forest - 48 /Ha.
- Top 5 prominent Species in terms of number of stems** in the division are *Albizia amara*, *Dalbergia paniculata*, *Gyrocarpus americanus*, *Chloroxylon swietenia* and *Dolichandrone crispera*.

Chittoor West Division



Santalum album



- Total growing stock** is 2.51 million M^3 . Of this, 1.55 million M^3 is in Dense Forest, 0.79 million M^3 in Open and 0.17 million M^3 in the Scrub Forest. **Average growing stock** of the division is 12.01 M^3 /Ha. Canopy class-wise average growing stocks are 23.56 M^3 /Ha in Dense, 14.28 M^3 /Ha in Open and 8.47 M^3 /Ha in Scrub Forest.
- The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.

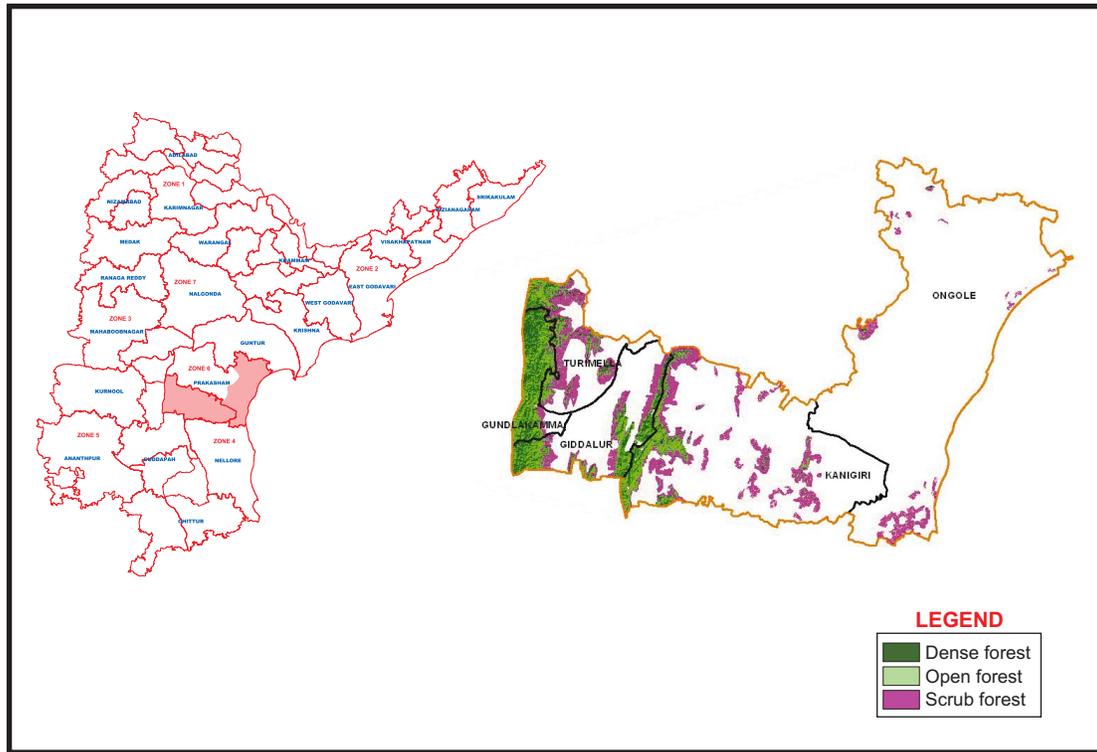
Species Name	Volume in Million M^3
<i>Dalbergia paniculata</i>	0.21
<i>Wrightia tinctoria</i>	0.17
<i>Ficus benjamina</i>	0.13
<i>Albizia amara</i>	0.12
<i>Tamarindus indica</i>	0.10
- The total number of stems** in the division is 19.51 million. Of these, 11.64 million fall in Dense, 6.78 million in open, and 1.09 million in Scrub Forest. **Average number of stems** per Ha in division is 93. They are in Dense Forest - 177 /Ha, Open Forest - 123 /Ha and in Scrub Forest - 54 /Ha.
- Top 5 prominent Species in terms of number of stems** in the division are *Wrightia tinctoria*, *Albizia amara*, *Anogeissus latifolia*, *Acacia chundra* and *Dalbergia paniculata*.



Lagerostroemia parviflora

3. GUNTUR CIRCLE

Giddalur Division



- **Total growing stock** is 7.02 million M³. Of this, 6.37 million M³ is in Dense Forest, 0.57 million M³ in Open and 0.08 million M³ in the Scrub Forest. **Average growing stock** of the division is 31.81 M³/Ha. Canopy class-wise average growing stocks are 46.72 M³/Ha in Dense Forest, 13.60 M³/Ha in Open Forest and 8.32 M³/Ha in Scrub Forest.

- **The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.
- **The total number of stems** in the division is 54.92 million. Of these, 48.15 million fall in dense 5.95

Species Name	Volume in Million M ³
<i>Terminalia tomentosa</i>	1.07
<i>Anogeissus latifolia</i>	0.61
<i>Pterocarpus marsupium</i>	0.51
<i>Hardwickia binata</i>	0.51
<i>Dalbergia paniculata</i>	0.30

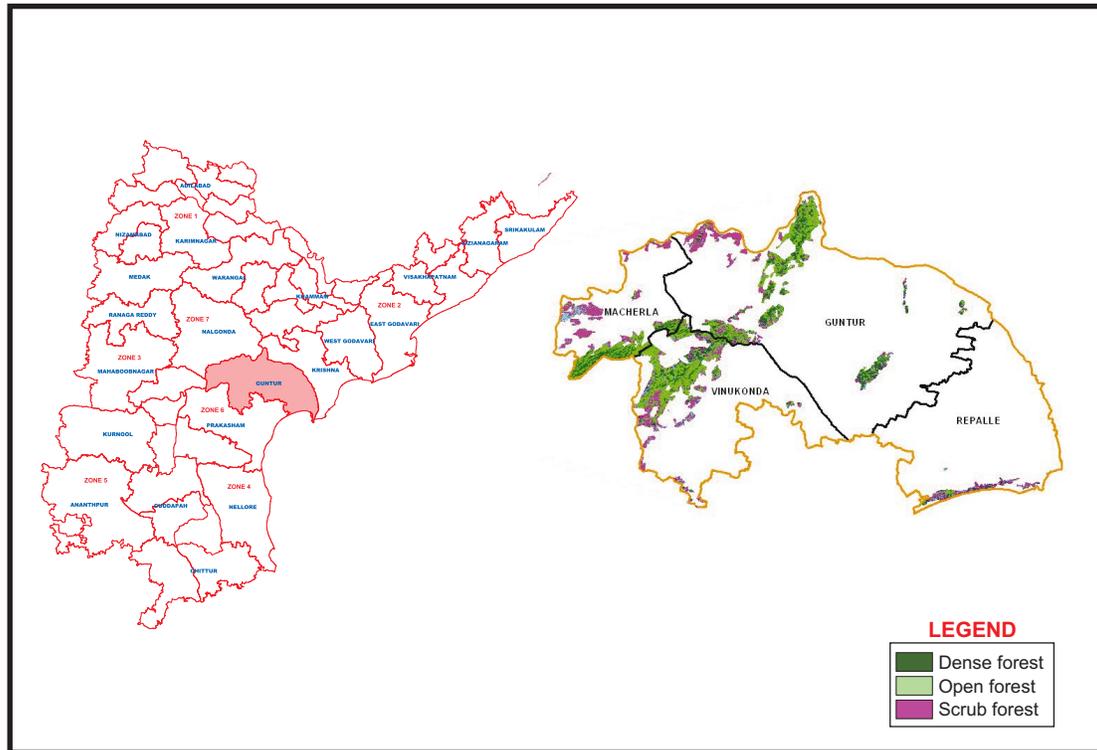
million in Open and 0.83 million in Scrub Forest. **Average number of stems** per Ha in division is 249. They are in Dense Forest - 353 /Ha, Open Forest - 142 Ha and in Scrub Forest - 86 /Ha.

- **Top 5 prominent species in terms of number of stems** in the division are *Terminalia tomentosa*, *Anogeissus latifolia*, *Pterocarpus marsupium*, *Chloroxylon swietenia* and *Cleistanthus collinus*.

Guntur Division



Hardwickia binnata



- **Total growing stock** is 1.64 million M³. Of this, 0.62 million M³ is in Dense Forest, 0.98 million M³ in Open and 0.04 million M³ in the Scrub Forest. **Average growing stock** of the division is 11.09 M³/Ha. Canopy class-wise average growing stocks are 19.22 M³/Ha in Dense, 13.62 M³/Ha in open and 3.44 M³/Ha in Scrub Forest.

- **The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.

Species Name	Volume in Million M ³
<i>Hardwickia binata</i>	0.80
<i>Albizia amara</i>	0.15
<i>Anogeissus latifolia</i>	0.08
<i>Holarrhena antidysenterica</i>	0.07
<i>Chloroxylon swietenia</i>	0.07

- **The total number of stems** in the division is 13.88 million. Of these, 5.46 million fall in Dense

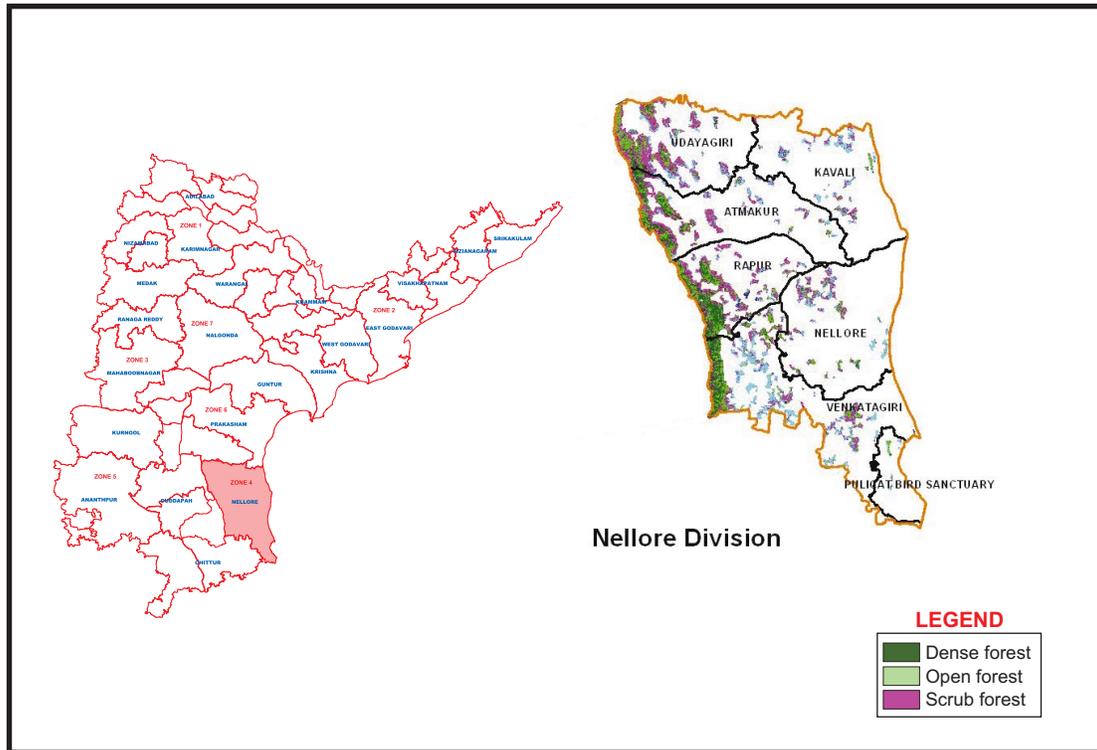
7.92 million in Open and 0.49 million in Scrub Forest. **Average number of stems** per Ha in division is 94. They are in Dense Forest - 168 /Ha, in Open Forest - 111 /Ha and in Scrub Forest - 44 /Ha.

- **Top 5 prominent species in terms of number of stems** in the division are *Hardwickia binata*, *Albizia amara*, *Chloroxylon swietenia*, *Anogeissus latifolia* and *Gyrocarpus americanus*.



Drypetes sepiaria

Nellore Division



- **Total growing stock** is 1.51 million M³. Of this, 0.80 million M³ is in Dense Forest, 0.58 million M³ in Open and 0.13 million M³ in the Scrub Forest. **Average growing stock** of the division is 6.37 M³/Ha. Canopy class-wise average growing stocks are 14.79 M³/Ha in Dense, 11.29 M³/Ha in Open and 10.12 M³/Ha in Scrub Forest.

- **The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.
- **The total number of stems** in the division is 17.68 millions. Of these, 7.53 million fall in Dense

Species Name	Volume in Million M ³
<i>Pterocarpus santalinus</i>	0.16
<i>Dalbergia paniculata</i>	0.10
<i>Eucalyptus camaldulensis</i>	0.10
<i>Anogeissus latifolia</i>	0.09
<i>Hardwickia binata</i>	0.09

4.81 million in open and 5.35 million in Scrub Forest. **Average number of stems** per Ha in division is 74. They are in Dense Forest - 139 /Ha, Open Forest - 93 /Ha and in Scrub Forest - 109 /Ha.

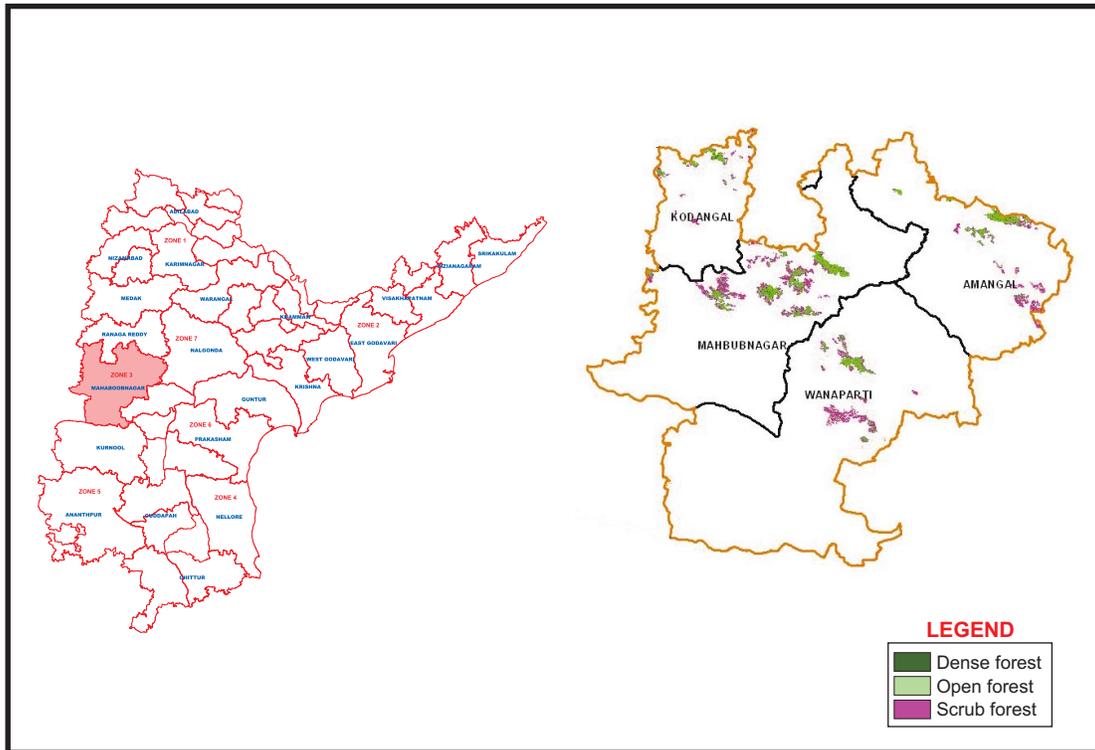
- **Top 5 prominent Species in terms of number of stems** in the division are *Anogeissus latifolia*, *Chloroxylon swietenia*, *Pterocarpus santalinus*, *Eucalyptus camaldulensis* and *Albizia amara*.

4. HYDERABAD CIRCLE

Mahaboobnagar Division



Decalepis hamiltonii



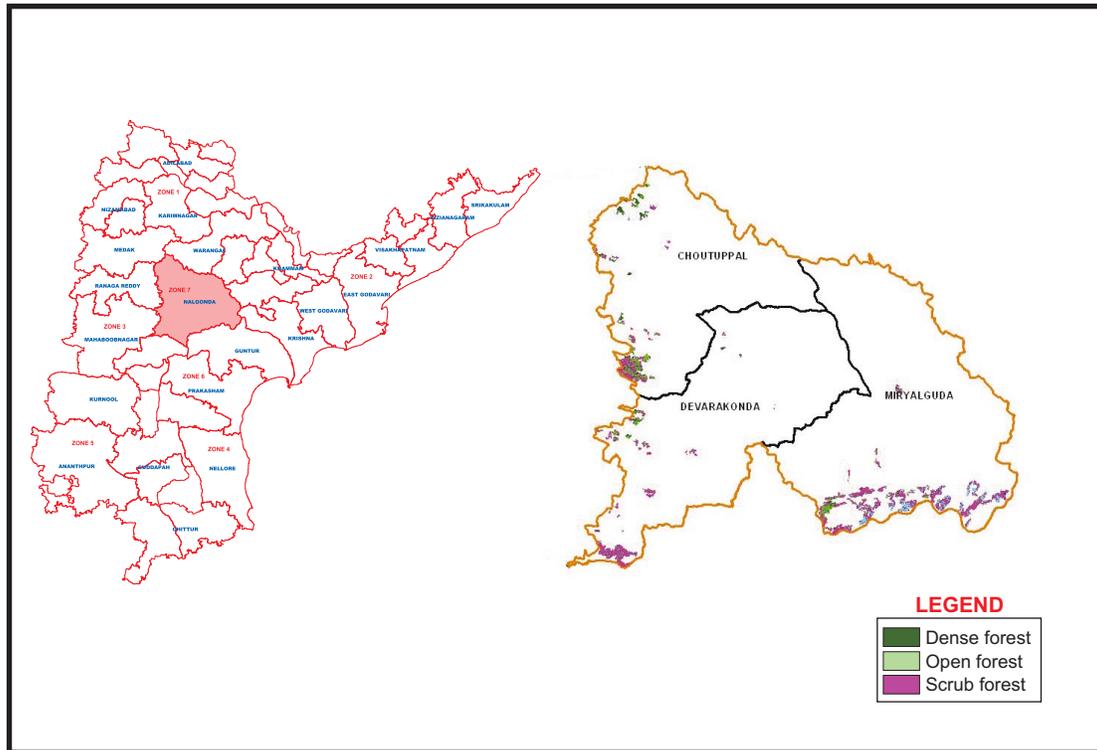
- **Total growing stock** is 0.44 million M³. Of this, 0.03 million M³ is in Dense Forest, 0.21 million M³ in Open and 0.19 million M³ in the Scrub Forest. **Average growing stock** of the division is 7.04 M³/Ha. Canopy class-wise average growing stocks are 8.38 M³/Ha in Dense, 9.09 M³/Ha in open and 9.32 M³/Ha in Scrub Forest.
- **The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.
- **The total number of stems** in the division is 4.37 million. Of these, 0.60 million fall in Dense 2.40 million in Open and 1.37 million are in Scrub Forest. **Average number of stems** per Ha in Division is 71. They are in Dense Forest - 150 /Ha, Open Forest - 103 /Ha and in Scrub Forest - 67 /Ha.
- **Top 5 prominent species in terms of number of stems** in the division are *Albizia amara*, *Wrightia tinctoria*, *Chloroxylon swietenia*, *Azadirachta indica* and *Gyrocarpus americanus*.

Species Name	Volume in Million M ³
<i>Hardwickia binata</i>	0.09
<i>Holoptelea integrifolia</i>	0.05
<i>Wrightia tinctoria</i>	0.04
<i>Ficus mollis</i>	0.04
<i>Albizia amara</i>	0.03



Albizia amara

Nalgonda Division



- **Total growing stock** is 0.23 million M³. Of this, 0.04 million M³ is in Dense Forest, 0.16 million M³ in Open and 0.03 million M³ in the Scrub Forest. **Average growing stock** of the division is 5.23 M³/Ha. Canopy class-wise average growing stocks are 26.34 M³ /Ha in Dense, 9.88 M³ /Ha in Open and 3.79 M³ /Ha in Scrub Forest.

- **The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.

Species Name	Volume in Million M ³
<i>Hardwickia binata</i>	0.06
<i>Manilkara hexandra</i>	0.03
<i>Gyrocarpus americanus</i>	0.03
<i>Ficus mollis</i>	0.03
<i>Grewia rotundifolia</i>	0.02

- **The total number of stems** in the division is 2.10 million. Of these, 0.26 million fall in Dense

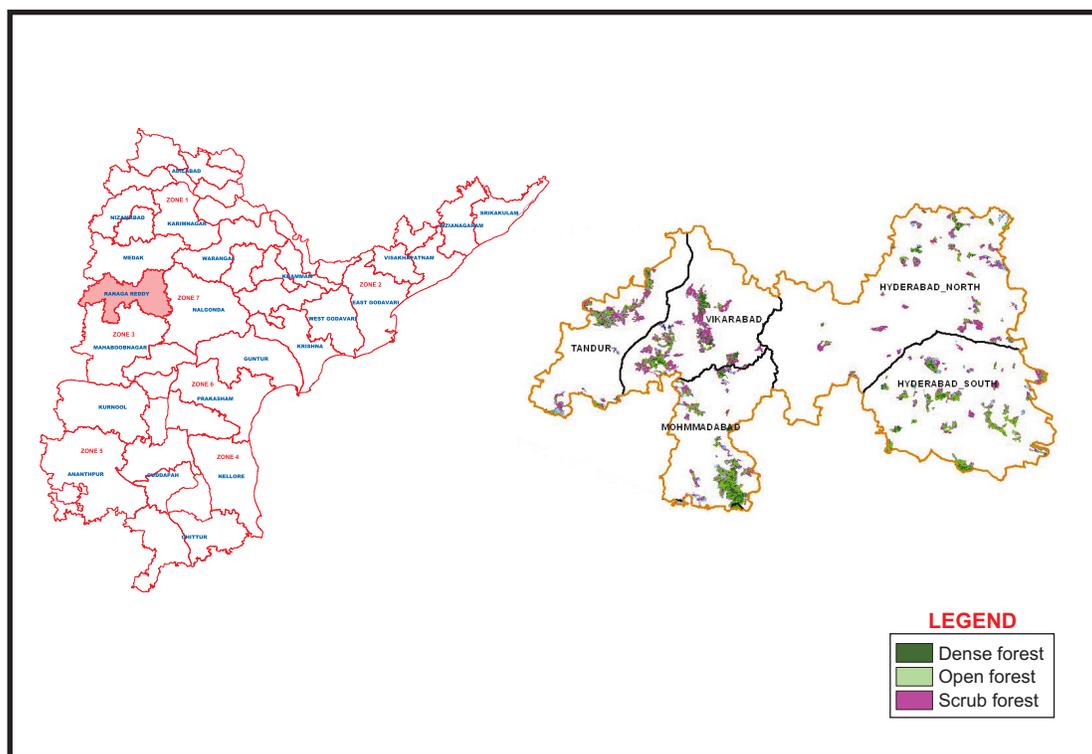
1.38 million in Open and 0.47 million are in Scrub Forest. **Average number of stems** per Ha in division is 47. They are in Dense Forest - 170 /Ha, Open Forest - 87 Ha and in Scrub Forest - 48 /Ha.

- **Top 5 prominent species in terms of number of stems** in the division are *Chloroxylon swietenia*, *Grewia rotundifolia*, *Wrightia tinctoria*, *Hardwickia binata* and *Gyrocarpus americanus*.

Hyderabad Division



Eucalyptus tereticornis



- **Total growing stock** is 0.75 million M³. Of this, 0.44 million M³ is in Dense Forest, 0.26 million M³ in Open and 0.06 million M³ in the Scrub Forest. **Average growing stock** of the division is 9.93 M³/Ha. Canopy class-wise average growing stocks are 19.96 M³ /Ha in Dense, 9.40 M³ /Ha in Open and 4.70 M³ /Ha in Scrub Forest.
- **The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.
- **The total number of stems** in the division is 9.72 million. Of these, 5.08 million are in dense 3.77 million in Open and 0.88 million in Scrub Forest. **Average number of stems** per Ha in division is 128. They are in Dense Forest - 231 /Ha, in Open Forest - 138 /Ha and in Scrub Forest - 71 /Ha.
- **Top 5 prominent species in terms of number of stems** in the division are *Anogeissus latifolia*, *Eucalyptus tereticornis*, *Tectona grandis*, *Dalbergia paniculata* and *Lagerstroemia parviflora*.

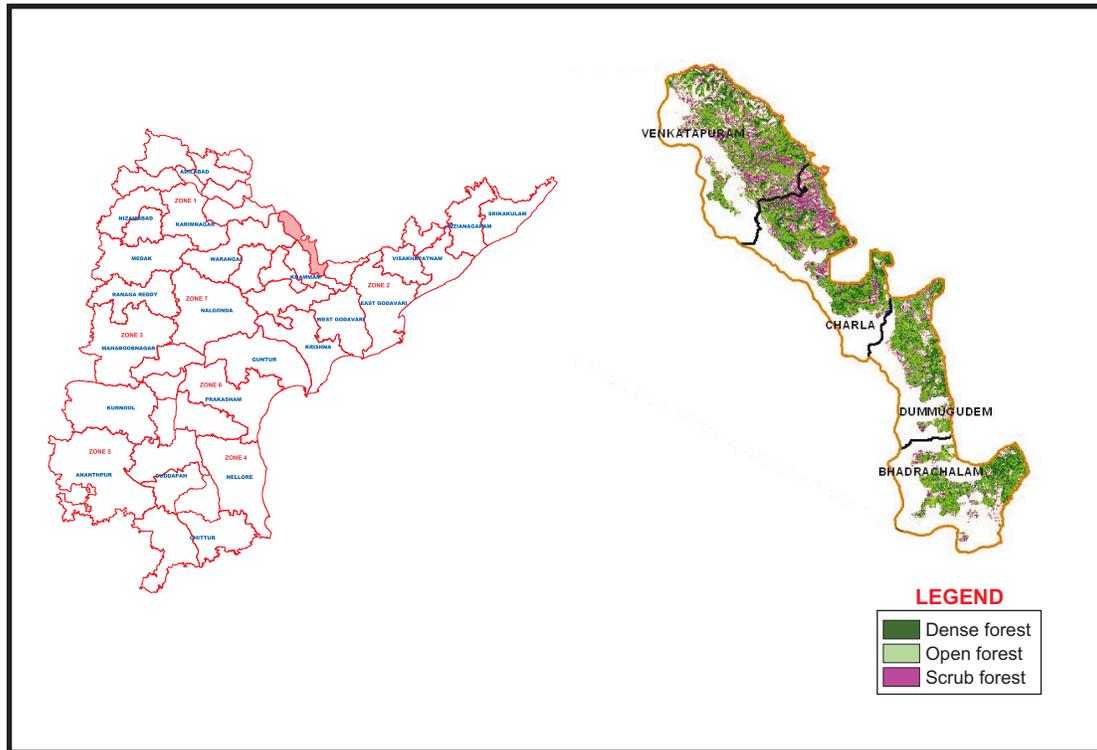
Species Name	Volume in Million M ³
<i>Anogeissus latifolia</i>	0.09
<i>Bombax ceiba</i>	0.06
<i>Eucalyptus tereticornis</i>	0.06
<i>Lannea coromandelica</i>	0.05
<i>Dalbergia paniculata</i>	0.05

5. Khammam Circle

Bhadrachalam North Division



Anogeissus latifolia



- **Total growing stock** is 5.83 million M³. Of this, 0.88 million M³ is in Dense Forest, 4.73million M³ in Open and 0.23 million M³ in the Scrub Forest. **Average growing stock** of the division is 40.50 M³/Ha. Canopy class-wise average growing stocks are 85.11 M³ /Ha in Dense, 43.32 M³ /Ha in Open and 13.80 M³ /Ha in Scrub Forest.

- **The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.
- **The total number of stems** in the division is 29.32 million. Of these, 3.47 millions fall in Dense-

Species Name	Volume in Million M ³
<i>Terminalia tomentosa</i>	0.83
<i>Anogeissus latifolia</i>	0.65
<i>Xylia xylocarpa</i>	0.57
<i>Diospyros melanoxylon</i>	0.47
<i>Madhuca indica</i>	0.38

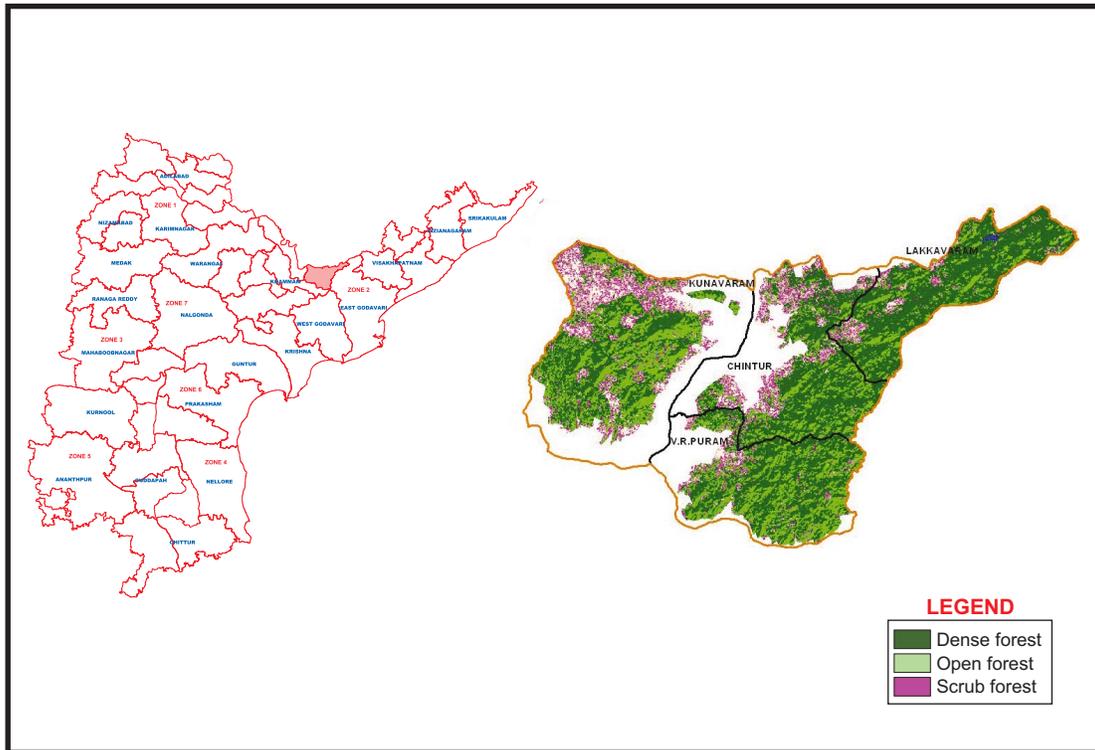
24.51 million in Open and 1.33 million in Scrub Forest. **Average number of stems** per Ha in Division is 204. They are in Dense Forest - 337 /Ha, Open Forest - 225 /Ha and in Scrub Forest - 81 Ha.

- **Top 5 prominent species in terms of number of stems** in the division are *Xylia xylocarpa*, *Terminalia tomentosa*, *Anogeissus latifolia*, *Diospyros melanoxylon* and *Cleistanthus collinus*.

Bhadrachalam South Division



Madhuca indica



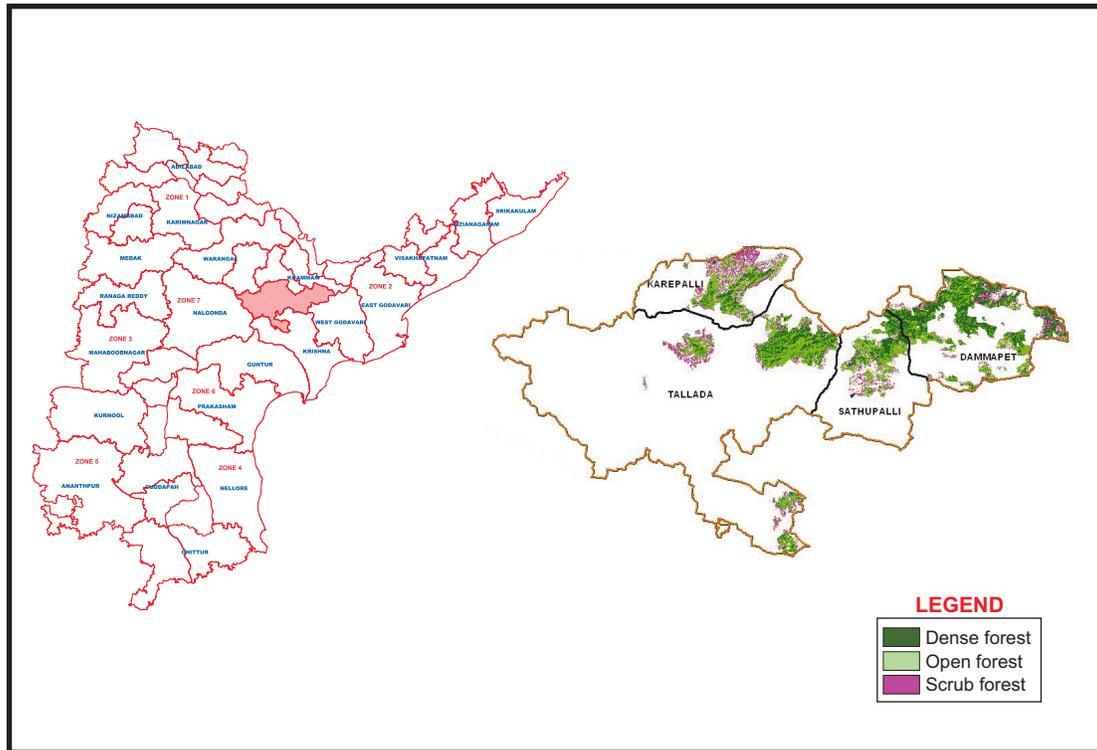
- Total growing stock** is 9.90 million M³. Of this, 9.80 million M³ is in Dense Forest, 0.08 million M³ in Open and 0.01 million M³ in the Scrub Forest. **Average growing stock** of the division is 76.51 M³/Ha. Canopy class-wise average growing stocks are 81.25 M³/Ha in Dense, 29.66 M³/Ha in Open and 16.57 M³/Ha in Scrub Forest.
- The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.

Species Name	Volume in Million M ³
<i>Xylia xylocarpa</i>	1.70
<i>Terminalia tomentosa</i>	0.97
<i>Anogeissus latifolia</i>	0.62
<i>Madhuca indica</i>	0.57
<i>Dillenia pentagyna</i>	0.50
- The total number of stems** in the division is 32.52 million. Of these, 32.07 million fall in Dense, 0.43 million in Open and 0.02 million in Scrub Forest. **Average number of stems per Ha** in division is 251. They are in Dense Forest - 266 /Ha, in Open Forest - 155 /Ha and in Scrub Forest - 30 /Ha.
- Top 5 prominent species in terms of number of stems** in the division are *Xylia xylocarpa*, *Cleistanthus collinus*, *Terminalia tomentosa*, *Anogeissus latifolia* and *Lannea coromandelica*.



Radermachera xylocarpa

Khammam Division



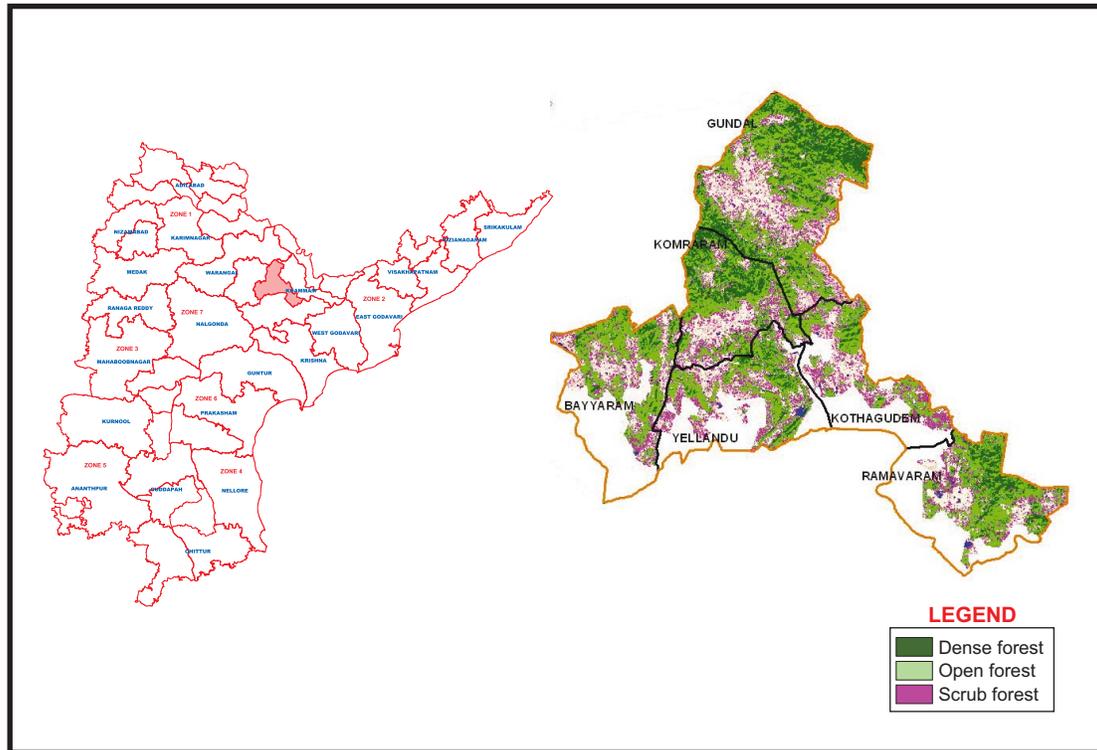
- **Total growing stock** is 5.24 million M³. Of this, 3.03 million M³ is in Dense Forest, 2.16 million M³ in Open and 0.05 million M³ in the Scrub Forest. **Average growing stock** of the division is 39.83 M³/Ha. Canopy class-wise average growing stocks are 64.99 M³/Ha in Dense, 34.61 M³/Ha in Open and 40.67 M³/Ha (average of one plot) in Scrub Forest.
- **The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.
- **The total number of stems** in the division is 25.14 million. Of these, 13.26 million fall in Dense, 11.77 million in Open, and 0.12 million in Scrub Forest. **Average number of stems** per Ha in division is 191. They are in Dense Forest - 284 /Ha, Open Forest - 189 /Ha and in Scrub Forest 100 /Ha.
- **Top 5 prominent species in terms of number of stems** in the division are *Xylia xylocarpa*, *Anogeissus latifolia*, *Lannea coromandelica*, *Garuga Pinnata* and *Cleistanthus Collinus*.

Species Name	Volume in Million M ³
<i>Anogeissus latifolia</i>	0.42
<i>Xylia xylocarpa</i>	0.42
<i>Dalbergia paniculata</i>	0.40
<i>Lannea coromandelica</i>	0.29
<i>Garuga pinnata</i>	0.26

Kothagudem Division



Terminalia chebula



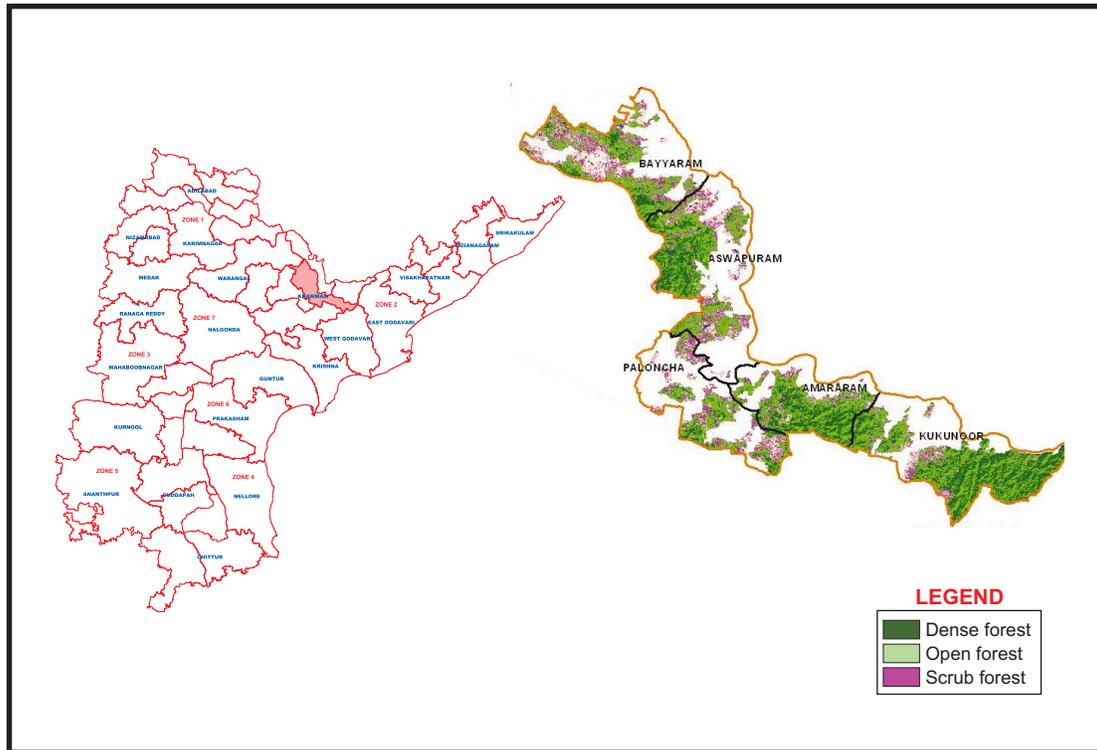
- Total growing stock** is 8.53 million M³. Of this, 7.91 million M³ is in Dense Forest, 0.55 million M³ in Open Forest, 0.07 million M³ in the Scrub Forest. **Average growing stock** of the division is 50.63 M³/Ha. Canopy class-wise average growing stocks are 65.27 M³/Ha in Dense, 32.76 M³/Ha in Open and 14.16 M³/Ha in Scrub Forest.
- The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.

Species Name	Volume in Million M ³
<i>Anogeissus latifolia</i>	1.08
<i>Xylia xylocarpa</i>	0.70
<i>Terminalia tomentosa</i>	0.68
<i>Diospyros melanoxylon</i>	0.58
<i>Lannea coromandelica</i>	0.53
- The total number of stems** in the division is 51.59 million. Of these, 47.58 million fall in Dense, 3.76 million in Open and 0.25 million in Scrub Forest. **Average number of stems** per Ha in division is 306. They are in Dense Forest - 393 /Ha, Open Forest - 223 /Ha and in Scrub Forest - 48 /Ha.
- Top 5 prominent species in terms of number of stems** in the division are *Xylia xylocarpa*, *Anogeissus latifolia*, *Cleistanthus collinus*, *Diospyros melanoxylon* and *Terminalia tomentosa*.



Terminalia bellirica

Paloncha Division



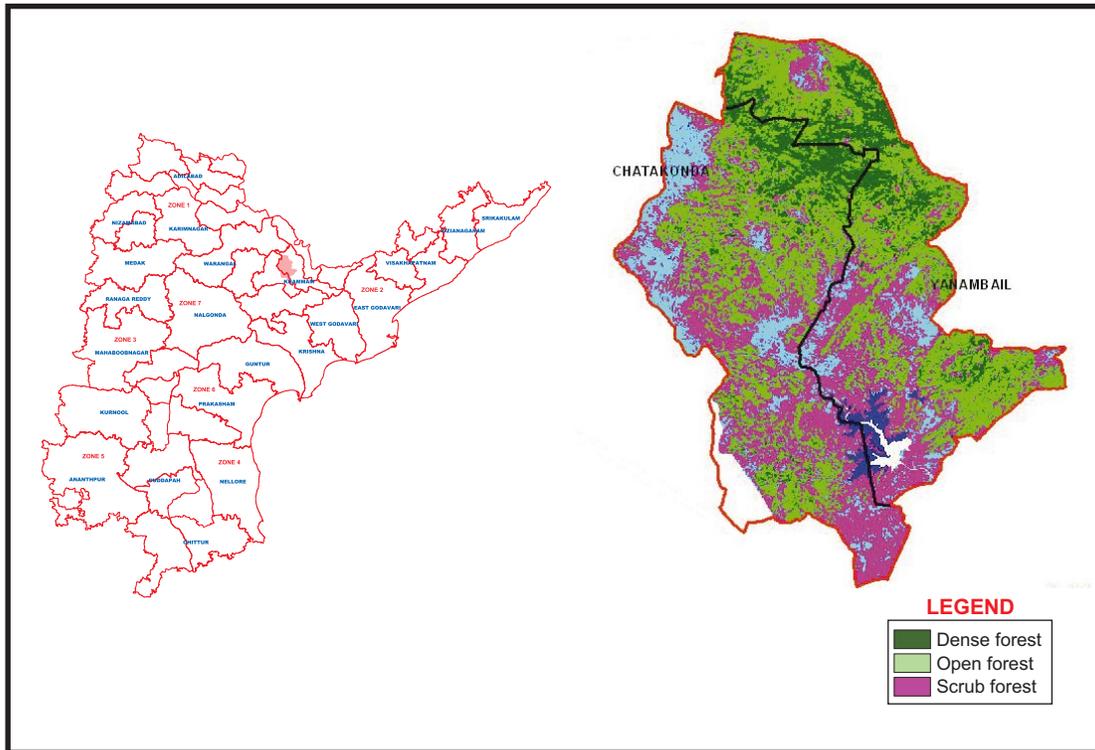
- **Total growing stock** is 9.76 million M³. Of this, 4.81 million M³ is in Dense Forest, 4.90 million M³ in Open and 0.05 million M³ in the Scrub Forest. **Average growing stock** of the division is 64.02 M³/Ha. Canopy class-wise average growing stocks are 81.32 M³/Ha in Dense, 62.97 M³/Ha in Open and 56.31 M³/Ha in Scrub Forest.
- **The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.
- **The total number of stems** in the division is 38.84 million. Of these 19.04 million fall in Dense, 19.53 million in the Open, and 0.25 million in Scrub Forest. **Average number of stems** per Ha in division is 255. They are in Dense Forests - 322 /Ha, in Open Forest - 251 /Ha, and in Scrub Forest - 300 /Ha (average of one plot).
- **Top 5 prominent species in terms of number of stems** in the division are *Xylia xylocarpa*, *Anogeissus latifolia*, *Terminalia tomentosa*, *Lannea coromandelica* and *Diospyros melanoxylon*.

Species Name	Volume in Million M ³
<i>Anogeissus latifolia</i>	1.28
<i>Xylia xylocarpa</i>	1.22
<i>Madhuca indica</i>	0.99
<i>Lannea coromandelica</i>	0.90
<i>Terminalia tomentosa</i>	0.88

Paloncha WLM Division



Cleistanthus collinus



- Total growing stock** is 3.33 million M³. Of this, 2.79 million M³ is in Dense Forest, 0.53 million M³ in Open and 0.01 million M³ in the Scrub Forest. **Average growing stock** of the division is 48.46 M³/Ha. Canopy class-wise average growing stocks are 67.03 M³/Ha in Dense, 33.00 M³/Ha in Open and 5.65 M³/Ha in Scrub Forest.
- The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.

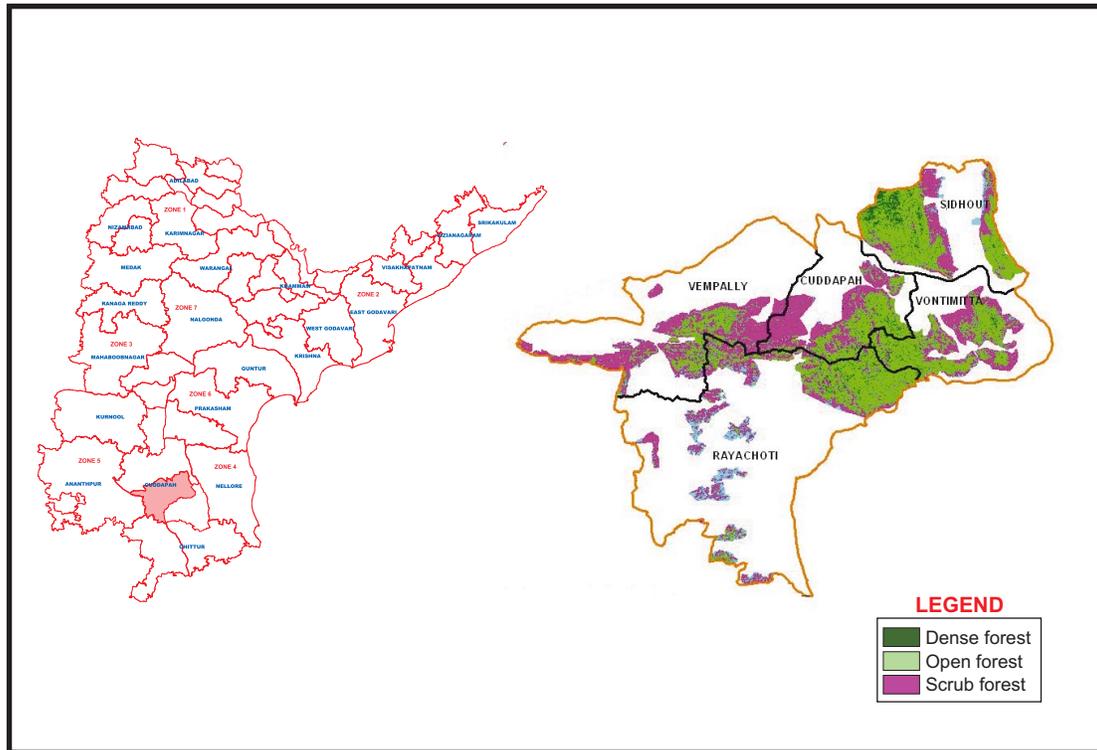
Species Name	Volume in Million M ³
<i>Anogeissus latifolia</i>	0.47
<i>Xylia xylocarpa</i>	0.38
<i>Lannea coromandelica</i>	0.27
<i>Terminalia tomentosa</i>	0.22
<i>Diospyros melanoxylon</i>	0.20
- The total number of stems** in the division is 16.18 million. Of these, 12.19 million fall in Dense 3.97 million in Open and 0.01 million in the Scrub Forest. **Average number of stems** per Ha in division is 236. They are in Dense Forest - 293 /Ha, Open Forests - 246 /Ha and in Scrub Forest - 10 /Ha.
- Top 5 prominent species in terms of number of stems** in the division are *Xylia xylocarpa*, *Anogeissus latifolia*, *Diospyros melanoxylon*, *Cleistanthus collinus* and *Terminalia tomentosa*.



Pterocarpus santalinus

6. Kurnool Circle

Kadapa Division



- **Total growing stock** is 3.20 million M³. Of this, 2.30 million M³ is in Dense Forest, 0.86 million M³ in Open and 0.04 million M³ in the Scrub Forest. **Average growing stock** of the division is 18.64 M³/Ha. Canopy class-wise average growing stocks are 32.75 M³/Ha in Dense, 14.67 M³/Ha in Open and 8.77 M³/Ha in Scrub Forest.

- **The 4 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.

Species Name	Volume in Million M ³
<i>Pterocarpus santalinus</i>	0.58
<i>Anogeissus latifolia</i>	0.34
<i>Dalbergia paniculata</i>	0.17
<i>Hardwickia binata</i>	0.16

- **The total number of stems** in the division is 33.16 million. Of these, 23.46 million fall in Dense,

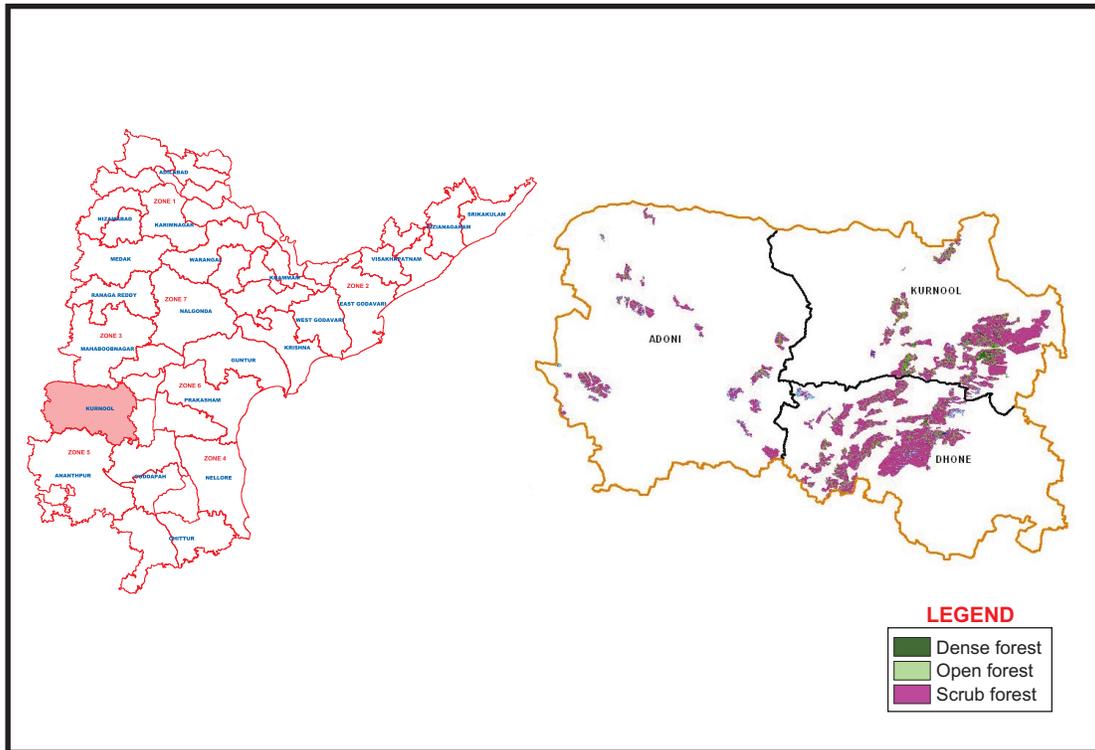
9.39 million in the Open, and 0.31 million in Scrub Forest. They are in division is 193. **Average number of stems** in Dense Forest - 334 /Ha, in Open Forest - 160 /Ha and in Scrub Forest - 74 /Ha.

- **Top 5 prominent species in terms of number of stems** in the division are *Pterocarpus santalinus*, *Anogeissus latifolia*, *Chloroxylon swietenia*, *Dolichandrone crispera* and *Hardwickia binata*.

Kurnool Division



Dalbergia paniculata



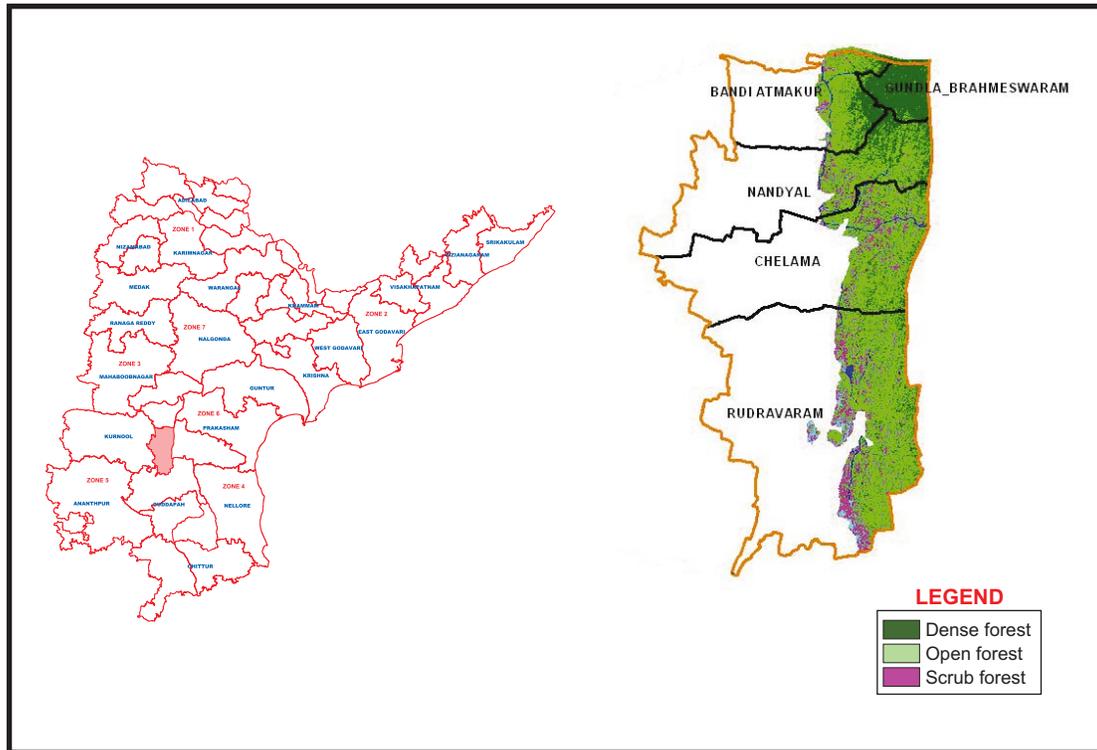
- Total growing stock** is 0.91 million M^3 . Of this, 0.09 million M^3 is in Dense Forest, 0.39 million M^3 in Open and 0.43 million M^3 in the Scrub Forest. **Average growing stock** of the division is 7.57 M^3 /Ha. Canopy class-wise average growing stocks are 30.22 M^3 /Ha in Dense, 12.96 M^3 /Ha in Open and 10.81 M^3 /Ha in Scrub Forest.
- The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.

Species Name	Volume in Million M^3
<i>Hardwickia binata</i>	0.33
<i>Gyrocarpus americanus</i>	0.11
<i>Anogeissus latifolia</i>	0.07
<i>Holarrhena antidysenterica</i>	0.04
<i>Albizia amara</i>	0.04
- The total number of stems** in the division is 6.72 million. Of these, 0.79 million fall in Dense 3.19 million in the Open, and 2.73 million in Scrub Forest. **Average number of stems** per Ha in division is 56. They are in Dense Forest - 263 /Ha, Open Forest - 107 /Ha and in Scrub Forest - 69 /Ha.
- Top 5 prominent species in terms of number of stems** in the division are *Hardwickia binata*, *Anogeissus latifolia*, *Gyrocarpus americanus*, *Albizia amara* and *Holarrhena antidysenterica*.



Memecylon umbellatum

Nandyal Division



- **Total growing stock** is 4.04 million M³. Of this, 3.56 million M³ is in Dense Forest, 0.48 million M³ in Open and 0.0001 million M³ in the Scrub Forest. **Average growing stock** of the division is 37.87 M³/Ha. Canopy class-wise average growing stocks are 43.15 M³/Ha in Dense, 30.24 M³/Ha in Open and 1.09 M³/Ha in Scrub Forest.

- **The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.
- **The total number of stems** in the division is 19.73 million. Of these, 17.15 million fall in Dense,

Species Name	Volume in Million M ³
<i>Lannea coromandelica</i>	0.45
<i>Anogeissus latifolia</i>	0.28
<i>Dalbergia paniculata</i>	0.25
<i>Pterocarpus marsupium</i>	0.23
<i>Boswellia serrata</i>	0.23

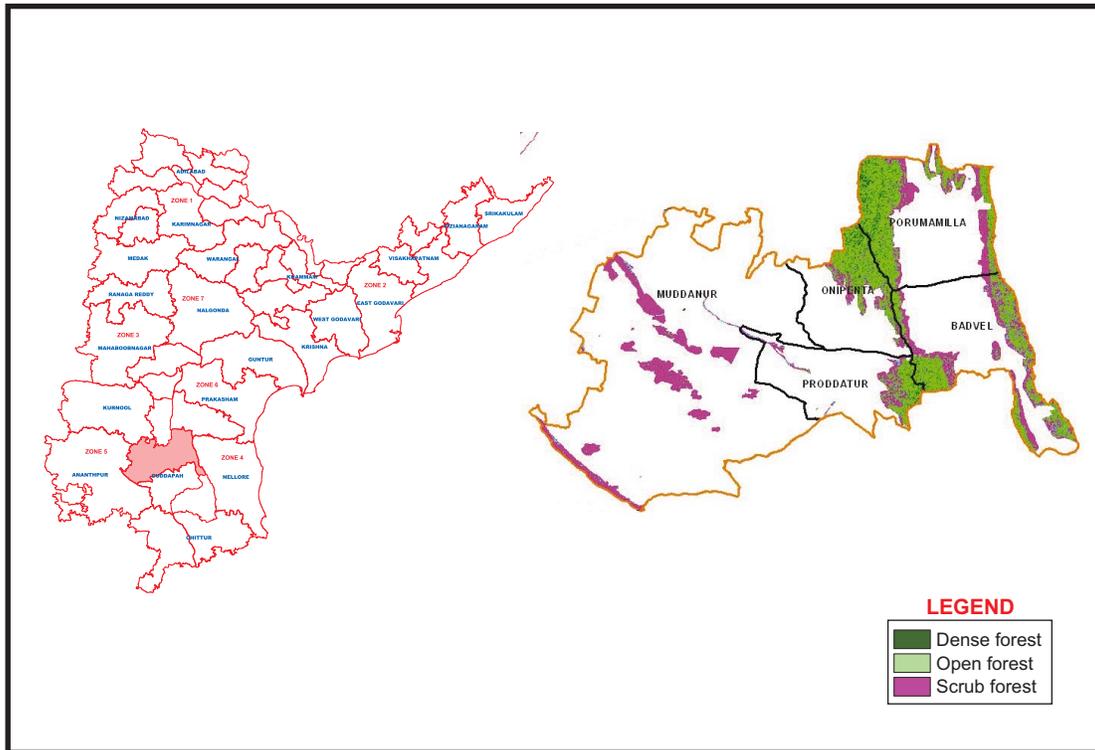
2.57 million in the Open, and 0.01 million in Scrub Forest. **Average number of stems** per Ha in division is 185. They are in Dense Forest - 208 /Ha, in Open Forest - 162 /Ha and in Scrub Forest 10 /Ha.

- **Top 5 prominent species in terms of number of stems** in the division are *Anogeissus latifolia*, *Lannea coromandelica*, *Pterocarpus marsupium*, *Cleistanthus collinus* and *Dalbergia paniculata*.

Proddatur Division



Soymida febrifuga



- Total growing stock** is 2.57 million M³. Of this, 2.05 million M³ is in Dense Forest, 0.52 million M³ in Open and 0.00 million M³ in the Scrub Forest. **Average growing stock** of the division is 16.32 M³/Ha. Canopy class-wise average growing stocks are 27.70 M³/Ha in Dense, 11.08 M³/Ha in Open and 0.80 M³/Ha in Scrub Forest.
- The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.

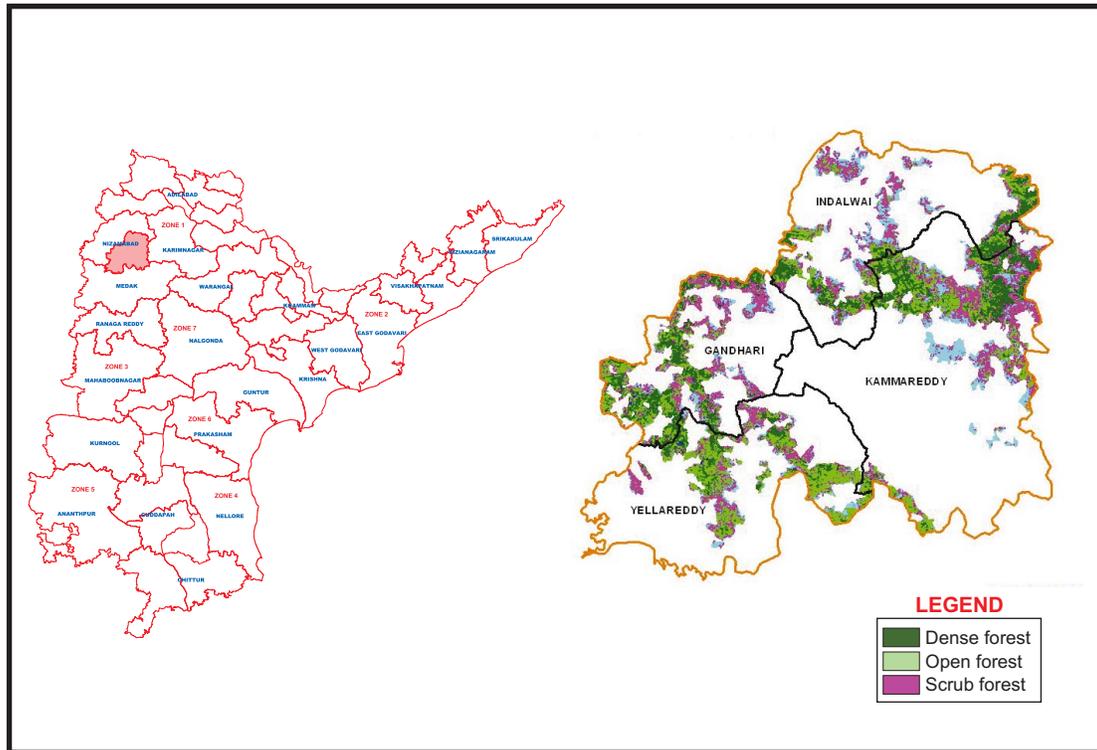
Species Name	Volume in Million M ³
<i>Anogeissus latifolia</i>	0.34
<i>Pterocarpus marsupium</i>	0.18
<i>Hardwickia binata</i>	0.18
<i>Pterocarpus santalinus</i>	0.17
<i>Lannea coromandelica</i>	0.14
- The total number of stems** in the division is 25.25 million. Of these, 18.57 million fall in Dense 6.64 million in the Open and 0.04 million in Scrub Forest. **Average number of stems** per Ha in division is 160. They are in Dense Forest -251 /Ha, in Open Forest - 142 /Ha and in Scrub Forest - 25 /Ha.
- Top 5 prominent species in terms of number of stems** in the division are *Anogeissus latifolia*, *Pterocarpus santalinus*, *Terminalia tomentosa*, *Chloroxylon swietenia* and *Hardwickia binata*.

7. Nizamabad Circle

Kamareddy Division



Hymenodictyon excelsa



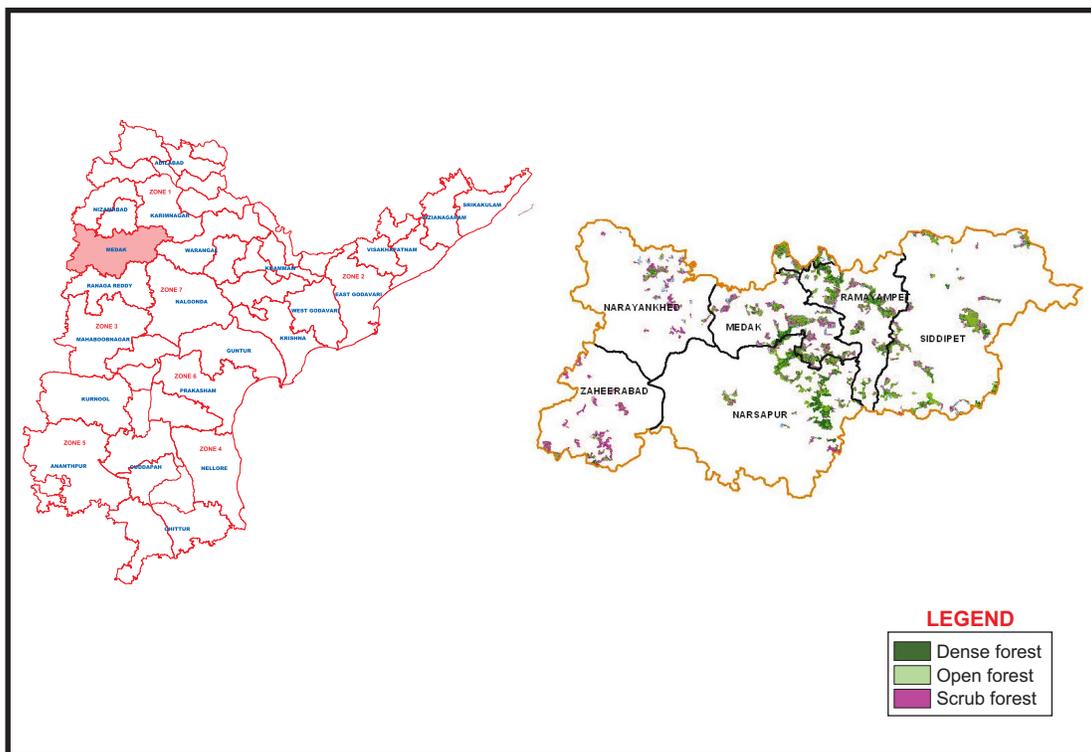
- **Total growing stock** is 3.98 million M³. Of this, 0.40 million M³ is in Dense Forest, 3.41 million M³ in Open and 0.17 million M³ in the Scrub Forest. **Average growing stock** of the division is 40.56 M³/Ha. Canopy class-wise average growing stocks are 95.80 M³/Ha in Dense, 49.15 M³/Ha in Open and 11.23 M³/Ha in Scrub Forest.
- **The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.
- **The total number of stems** in the division is 18.36 million. Of these, 1.67 million fall in Dense 15.65 million in the Open and 1.04 million in Scrub Forest. **Average number of stems per Ha** in division is 187. They are in Dense Forest - 397 /Ha, Open Forest - 225 /Ha and in Scrub Forest - 71 /Ha.
- **Top 5 prominent species in terms of number of stems** in the division are *Tectona grandis*, *Lagerstoemia parviflora*, *Chloroxylon swietenia*, *Dalbergia paniculata* and *Butea monosperma*.

Species Name	Volume in Million M ³
<i>Madhuca indica</i>	0.86
<i>Dalbergia paniculata</i>	0.59
<i>Tectona grandis</i>	0.44
<i>Lannea coromandelica</i>	0.31
<i>Boswellia serrata</i>	0.28

Medak Division



Lannea coromandelica



- **Total growing stock** is 1.06 million M^3 . Of this, 0.25 million M^3 is in Dense Forest, 0.76 million M^3 in Open and 0.06 million M^3 in the Scrub Forest. **Average growing stock** of the division is 11.05 M^3 /Ha. Canopy class-wise average growing stocks are 30.37 M^3 /Ha in Dense, 15.17 M^3 /Ha in Open and 4.63 M^3 /Ha in Scrub Forest.

- **The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.

Species Name	Volume in Million M^3
<i>Lannea coromandelica</i>	0.18
<i>Tectona grandis</i>	0.15
<i>Dalbergia paniculata</i>	0.14
<i>Chloroxylon swietenia</i>	0.07
<i>Butea monosperma</i>	0.06

- **The total number of stems** in the division is 11.58 million. Of these, 2.30 million fall in Dense

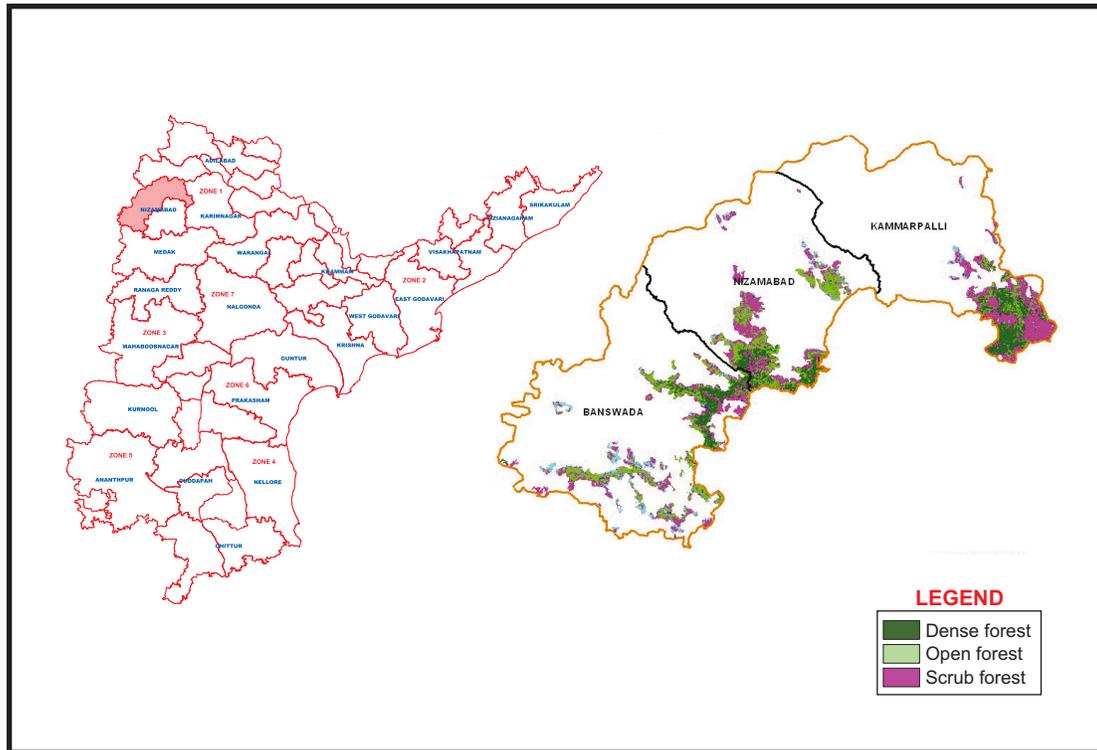
8.32 million in the Open and 0.95 million in Scrub Forest. **Average number of stems** per Ha in division is 120. They are in Dense Forest - 277 /Ha, Open Forest - 167 /Ha and in Scrub Forest - 77 /Ha.

- **Top 5 prominent Species in terms of number of stems** in the division are *Tectona grandis*, *Lannea coromandelica*, *Chloroxylon swietenia*, *Dalbergia paniculata* and *Butea monosperma*.



Buchanania lanzan

Nizamabad Division



- **Total growing stock** is 2.71 million M³. Of this, 2.40 million M³ is in Dense Forest, 0.29 million M³ in Open and 0.02 million M³ in the Scrub Forest. **Average growing stock** of the division is 34.44 M³/Ha. Canopy class-wise average growing stocks are 48.28 M³/Ha in Dense, 15.12 M³/Ha in Open and 8.65 M³/Ha in Scrub Forest.

- **The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.

Species Name	Volume in Million M ³
<i>Dalbergia paniculata</i>	0.42
<i>Boswellia serrata</i>	0.33
<i>Madhuca indica</i>	0.31
<i>Tectona grandis</i>	0.28
<i>Lannea coromandelica</i>	0.27

- **The total number of stems** in the division is 18.11 million. Of these, 14.74 million fall in Dense,

3.27 million in the Open and 0.10 million in Scrub Forest. **Average number of stems** per Ha in division is 230. They are in Dense Forest - 296 /Ha, in Open Forest - 172 /Ha and in Scrub Forest - 45 /Ha.

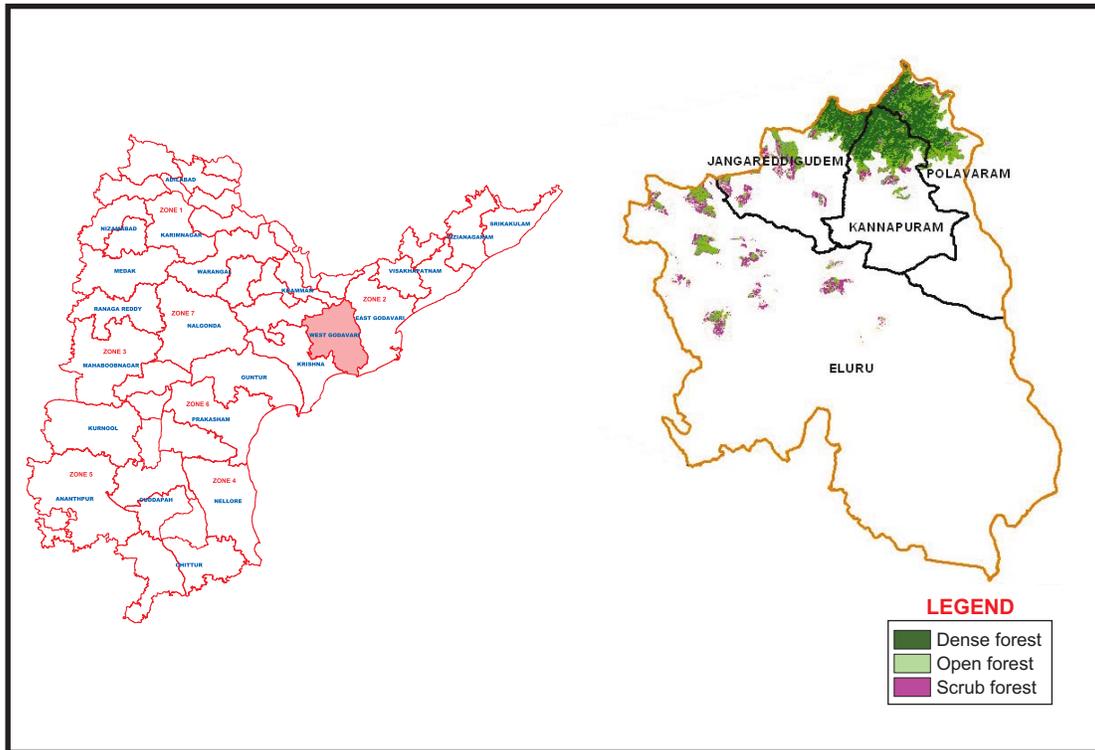
- **Top 5 prominent species in terms of number of stems** in the division are *Tectona grandis*, *Lagerstroemia parviflora*, *Terminalia tomentosa*, *Chloroxylon swietenia* and *Lannea coromandelica*.

8. Rajahmundry Circle

Eluru Division



Spondias pinnata



- **Total growing stock** is 5.27 million M³. Of this, 4.81 million M³ is in Dense Forest, 0.42 million M³ in Open and 0.04 million M³ in the Scrub Forest. **Average growing stock** of the division is 68.22 M³/Ha. Canopy class-wise average growing stocks are 85.32 M³/Ha in Dense, 33.61 M³/Ha in Open and 19.07 M³/Ha in Scrub Forest.

- **The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.

Species Name	Volume in Million M ³
<i>Xylia xylocarpa</i>	1.46
<i>Anogeissus latifolia</i>	0.49
<i>Lannea coromandelica</i>	0.24
<i>Terminalia tomentosa</i>	0.18
<i>Dalbergia paniculata</i>	0.17

- The total number of stems in the division is 21.46 million. Of these, 18.05 million fall in Dense,

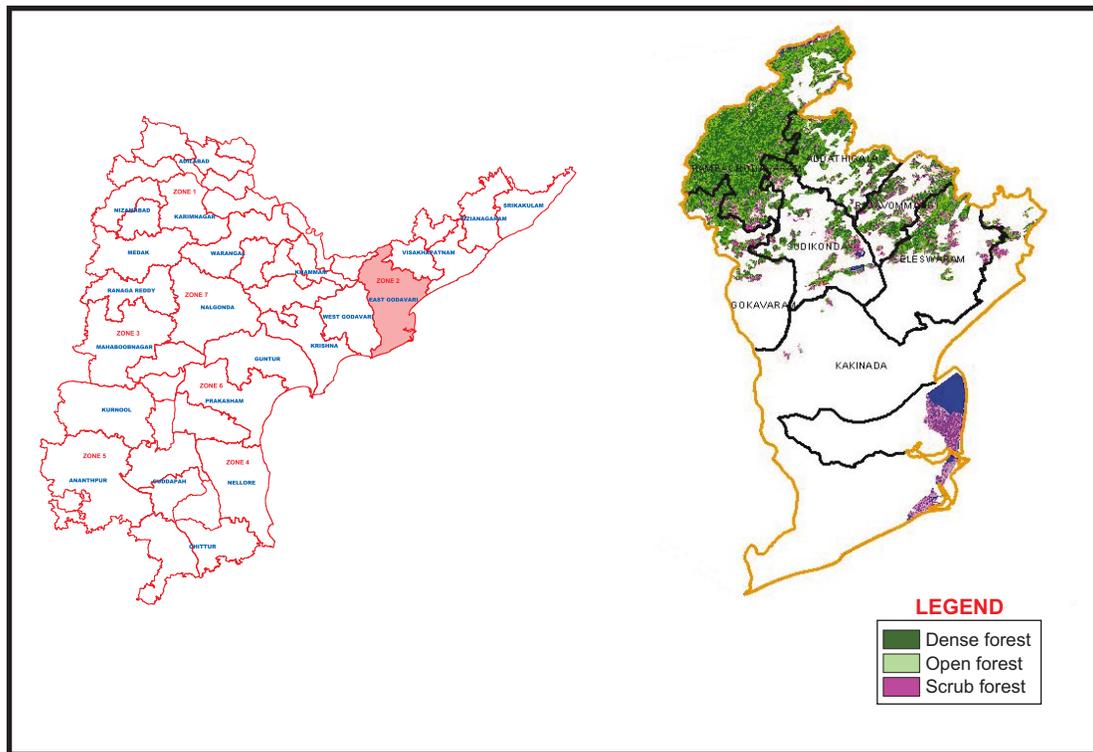
3.21 million in the Open and 0.20 million in Scrub Forest. **Average number of stems** per Ha in division is 278. They are in Dense Forest - 320 /Ha, in Open Forest - 254 /Ha and in Scrub Forest - 105 /Ha.

- **Top 5 prominent species in terms of number of stems** in the division are *Xylia xylocarpa*, *Anogeissus latifolia*, *Cleistanthus collinus*, *Eucalyptus tereticornis* and *Wrightia tomentosa*.



Xylia xylocarpa

Kakinada Division



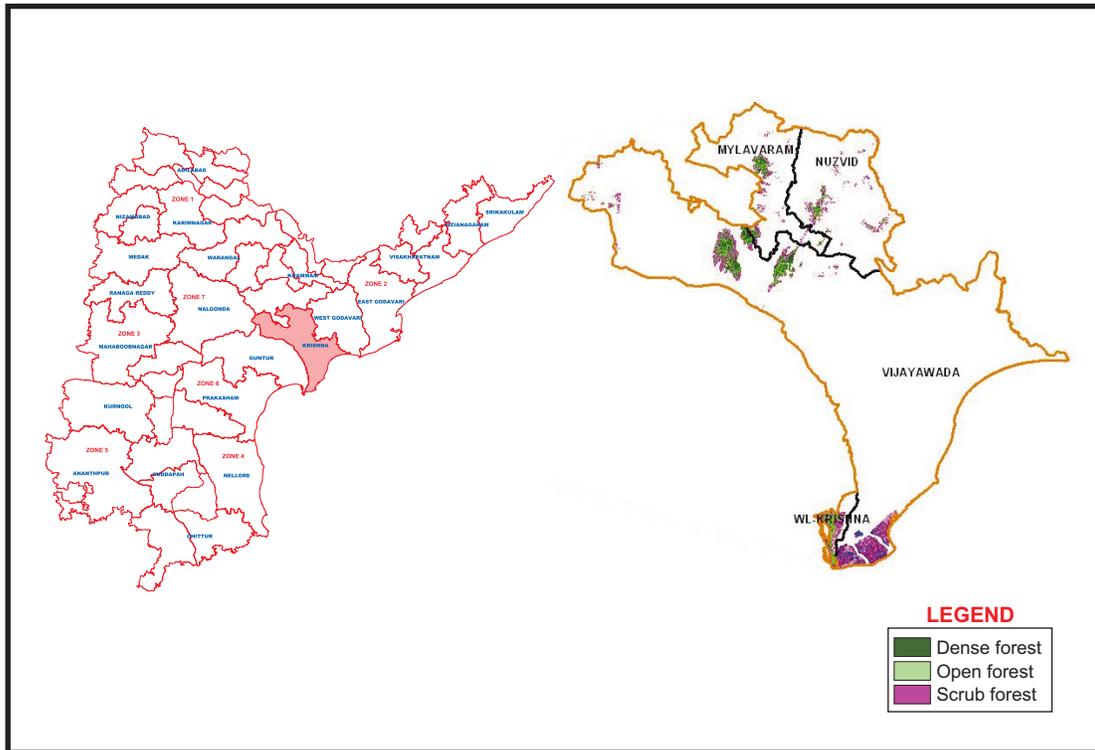
- Total growing stock** is 20.40 million M³. Of this, 18.53 million M³ is in Dense Forest, 1.72 million M³ in Open and 0.16 million M³ in the Scrub Forest. **Average growing stock** of the division is 63.07 M³/Ha. Canopy class-wise average growing stocks are 75.79 M³/Ha in Dense, 41.36 M³/Ha in Open and 22.81 M³/Ha in Scrub Forest.
- The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.

Species Name	Volume in Million M ³
<i>Xylia xylocarpa</i>	3.92
<i>Mangifera indica</i>	1.33
<i>Anogeissus latifolia</i>	1.24
<i>Pterocarpus marsupium</i>	0.98
<i>Terminalia tomentosa</i>	0.81
- The total number of stems** in the division is 64.76 million. Of these, 56.44 million fall in Dense, 7.74 million in the Open and 0.58 million in Scrub Forest. **Average number of stems** per Ha in division is 200. They are in Dense Forest - 231 /Ha, Open Forest - 187 /Ha and in Scrub Forest - 84 /Ha.
- Top 5 prominent species in terms of number of stems** in the division are *Xylia xylocarpa*, *Anogeissus latifolia*, *Terminalia tomentosa*, *Tectona grandis* and *Cassia siamea*.

Krishna Division



Gyrocarpus americanus



- **Total growing stock** is 0.74 million M³. Of this, 0.55 million M³ is in Dense Forest, 0.19 million M³ in Open and 0.00 million M³ in the Scrub Forest. **Average growing stock** of the division is 11.54 M³/Ha. Canopy class-wise average growing stocks are 19.95 M³/Ha in Dense, 30.46 M³/Ha in Open and 1.11 M³/Ha in Scrub Forest.
 - **The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.
- | Species Name | Volume in Million M ³ |
|------------------------------|----------------------------------|
| <i>Garuga pinnata</i> | 0.07 |
| <i>Mangifera indica</i> | 0.07 |
| <i>Lannea coromandelica</i> | 0.06 |
| <i>Gyrocarpus americanus</i> | 0.05 |
| <i>Borassus flabellifer</i> | 0.04 |

million in the Open and 0.02 million in Scrub Forest. **Average number of stems** per Ha in division is 68. They are in Dense Forest - 128 /Ha, Open Forest - 130 /Ha and in Scrub Forest -10 /Ha.

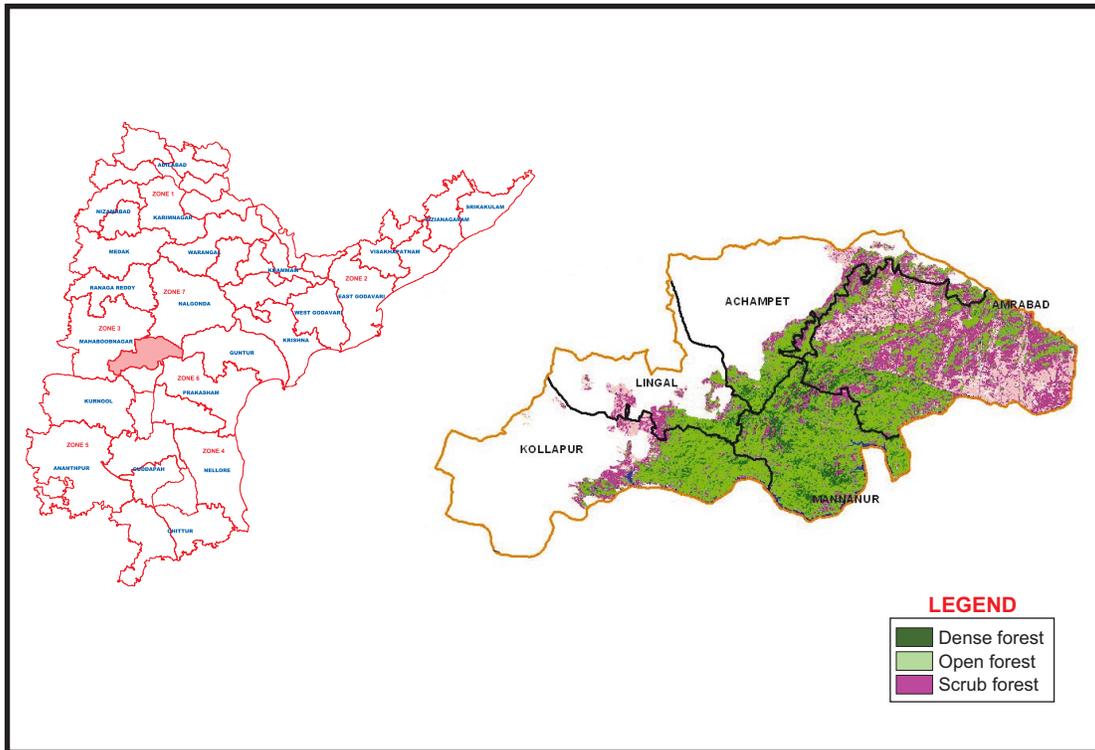
- **Top 5 prominent species in terms of number of stems** in the division are *Grewia tiliaefolia*, *Anogeissus latifolia*, *Bridellia retusa*, *Mangifera indica* and *Wrightia tinctoria*.



Cochlospermum religiosum

9. Srisailam Circle

Achampet Division



- **Total growing stock** is 6.34 million M³. Of this, 2.54 million M³ is in Dense Forest, 3.50 million M³ in Open and 0.29 million M³ in the Scrub Forest. **Average growing stock** of the division is 26.15 M³/Ha. Canopy class-wise average growing stocks are 40.64 M³/Ha in Dense, 25.84 M³/Ha in Open and 14.23 M³/Ha in Scrub Forest.

- **The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.
- **The total number of stems** in the division is 35.01 million. Of these, 14.15 million fall in Dense, 19.63

Species Name	Volume in Million M ³
<i>Hardwickia binata</i>	1.40
<i>Terminalia tomentosa</i>	0.49
<i>Anogeissus latifolia</i>	0.35
<i>Chloroxylon swietenia</i>	0.33
<i>Dalbergia paniculata</i>	0.33

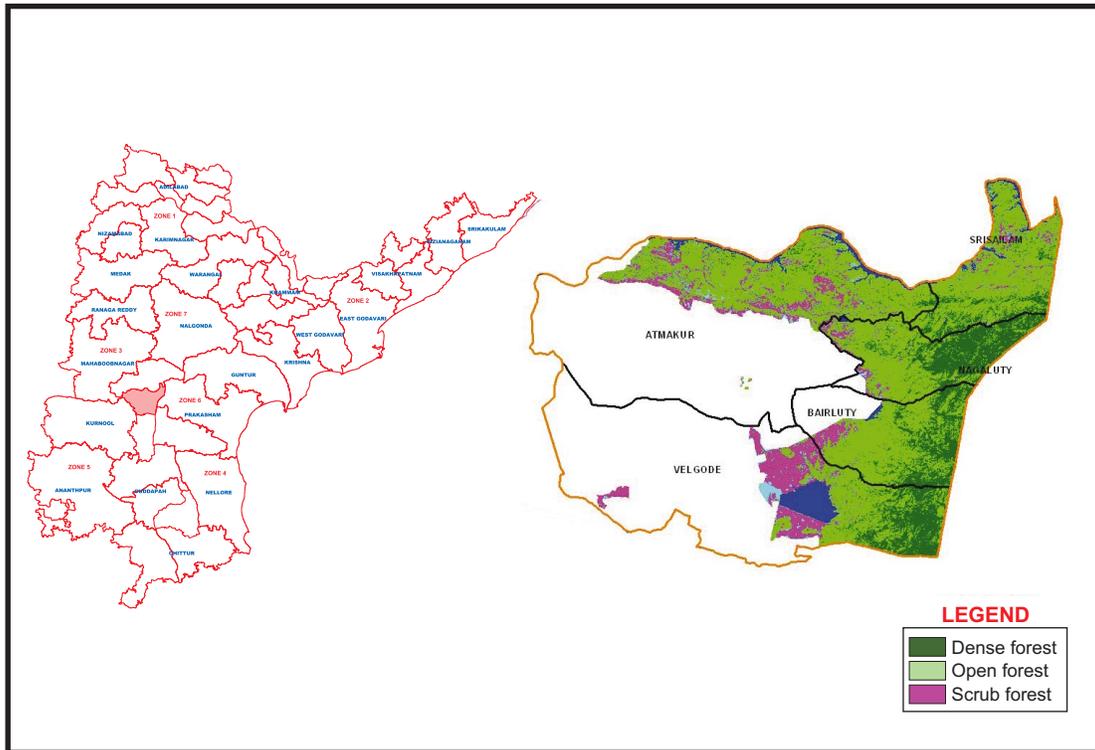
million in Open and 1.23 million in Scrub Forest. **Average number of stems** per Ha in division is 144. They are in Dense Forest - 226 /Ha, Open Forest - 145 /Ha and in Scrub Forest - 60 /Ha.

- **Top 5 prominent species in terms of number of stems** in the division are *Chloroxylon swietenia*, *Anogeissus latifolia*, *Terminalia tomentosa*, *Hardwickia binata* and *Dalbergia paniculata*

Atmakur Division



Pterocarpus marsupium



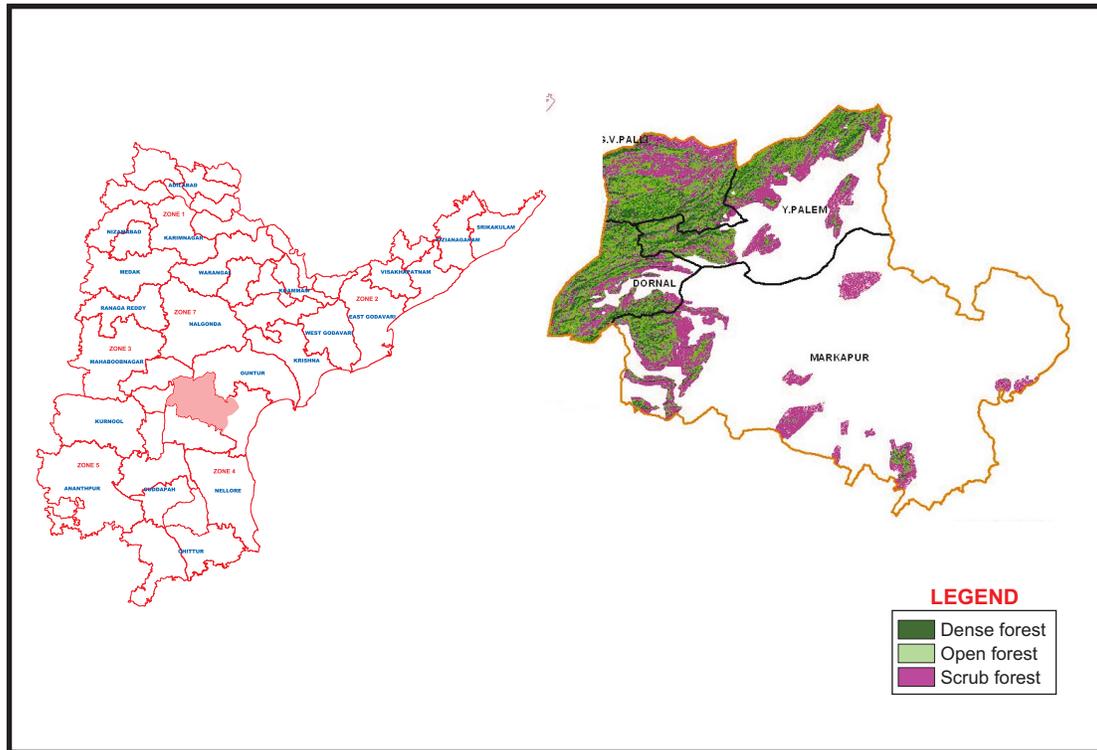
- Total growing stock** is 5.07 million M³. Of this, 4.08 million M³ is in Dense Forest, 0.94 million M³ in Open and 0.05 million M³ in the Scrub Forest. **Average growing stock** of the division is 39.40 M³/Ha. Canopy class-wise average growing stocks are 54.04 M³/Ha in Dense, 24.89 M³/Ha in Open and 9.08 M³/Ha in Scrub Forest.
- The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.

Species Name	Volume in Million M ³
<i>Anogeissus latifolia</i>	0.36
<i>Lannea coromandelica</i>	0.36
<i>Hardwickia binata</i>	0.36
<i>Terminalia tomentosa</i>	0.35
<i>Pterocarpus marsupium</i>	0.33
- The total number of stems** in the division is 29.85 million. Of these, 21.77 million fall in Dense, 7.61 million in Open and 0.47 million are in Scrub Forest. Average number of stems per Ha in Division is 232. They are in Dense Forest - 289 /Ha, Open Forest - 202 /Ha and Scrub Forest - 81 /Ha.
- Top 5 prominent species in terms of number of stems** in the division are *Anogeissus latifolia*, *Pterocarpus marsupium*, *Terminalia tomentosa*, *Lannea coromandelica* and *Hardwickia binata*



Schleicheria oleosa

Markapur Division



- **Total growing stock** is 5.81 million M³. Of this, 4.46 million M³ is in Dense Forest, 1.09 million M³ in Open and 0.26 million M³ in the Scrub Forest. **Average growing stock** of the division is 25.54 M³/Ha. Canopy class-wise average growing stocks are 35.91 M³/Ha in Dense, 17.70 M³/Ha in Open and 17.10 M³/Ha in Scrub Forest.

- **The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.
- **The total number of stems** in the division is 35.00 million. Of these, 26.15 million fall in Dense- 7.71

Species Name	Volume in Million M ³
<i>Hardwickia binata</i>	1.46
<i>Anogeissus latifolia</i>	0.58
<i>Tamarindus indica</i>	0.56
<i>Pterocarpus marsupium</i>	0.33
<i>Chloroxylon swietenia</i>	0.25

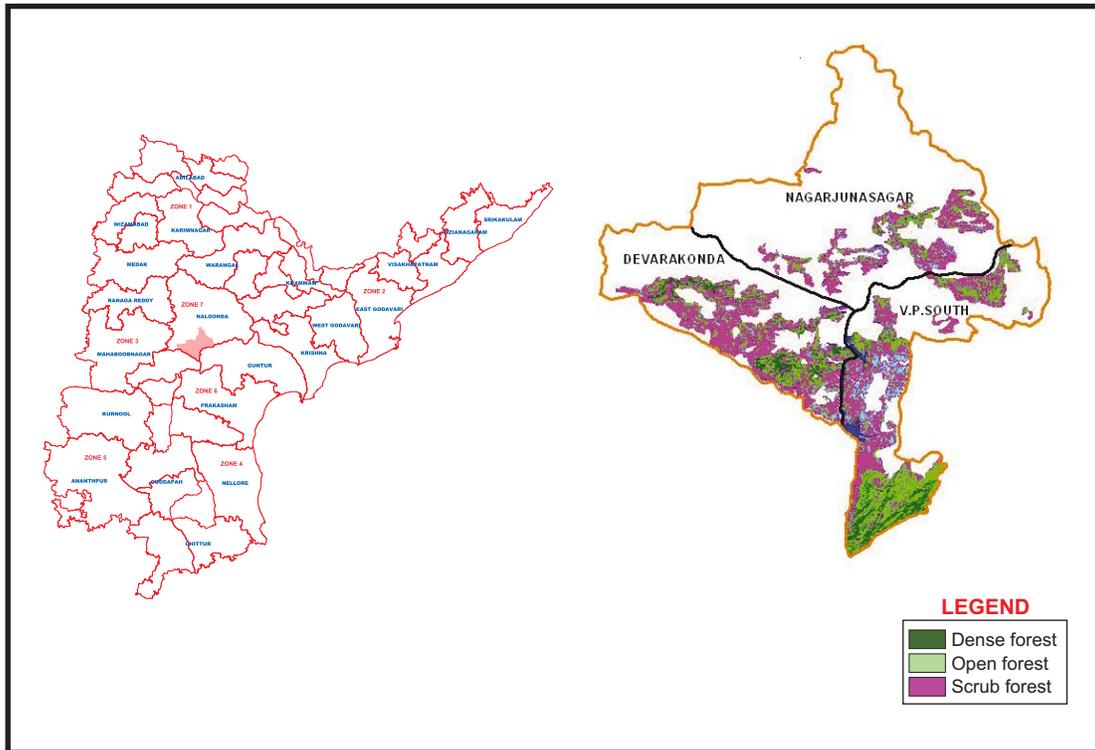
million in Open and 1.14 million in Scrub Forest. **Average number of stems** per Ha in division is 154. They are in Dense Forest - 210 /Ha, Open Forest - 126 /Ha and in Scrub Forest - 76 /Ha.

- **Top 5 prominent species in terms of number of stems** in the division are *Anogeissus latifolia*, *Chloroxylon swietenia*, *Hardwickia binata*, *Pterocarpus marsupium* and *Albizia amara*.

Nagarjunasagar Division



Acacia ferruginea



- **Total growing stock** is 0.63 million M³. Of this, 0.03 million M³ is in Dense Forest, 0.44 million M³ in Open and 0.16 million M³ in the Scrub Forest. **Average growing stock** of the division is 7.91 M³/Ha. Canopy class-wise average growing stocks are 12.55 M³/Ha in Dense, 14.52 M³/Ha in Open and 6.76 M³/Ha in Scrub Forest.

- **The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.

Species Name	Volume in Million M ³
<i>Hardwickia binata</i>	0.31
<i>Albizia amara</i>	0.07
<i>Chloroxylon swietenia</i>	0.04
<i>Anogeissus latifolia</i>	0.03
<i>Manilkara hexandra</i>	0.03

- **The total number of stems** in the division is 5.52 million. Of these, 0.11 million are in Dense, 4.15

million in Open and 1.26 million in Scrub Forests. **Average number of stems** per Ha in Division is 68. They are in Dense Forest - 53 /Ha (average of one point), Open Forest - 138 /Ha and in Scrub Forest - 53 /Ha.

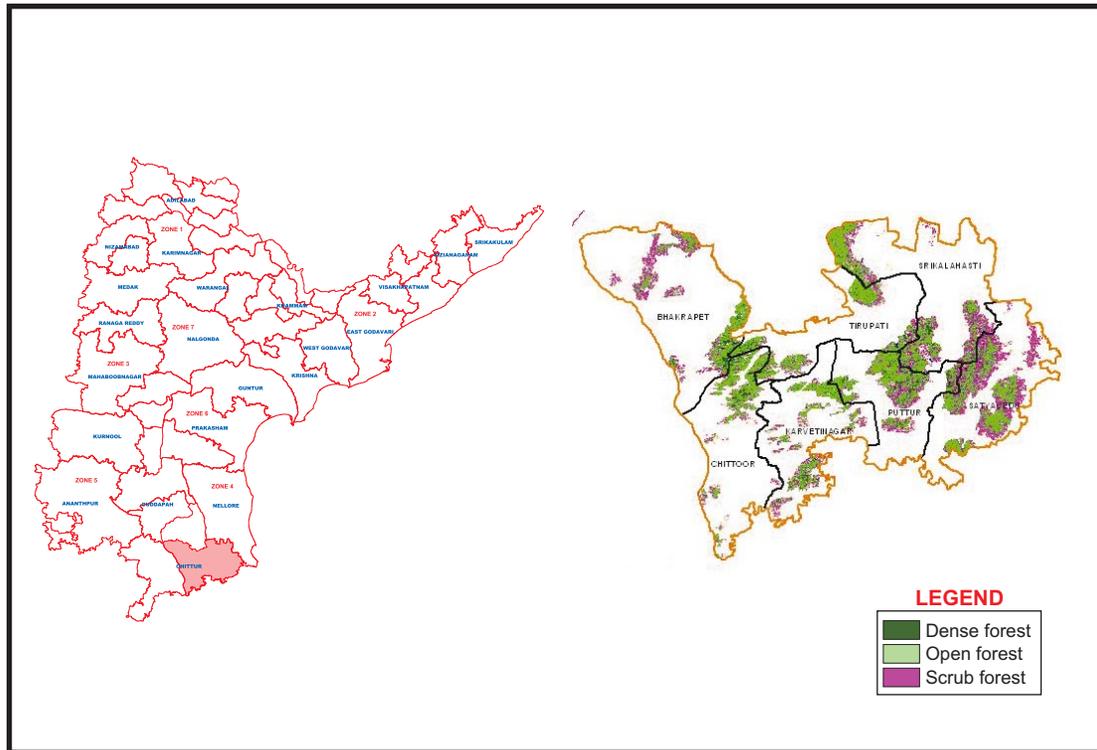
- **Top 5 prominent species in terms of number of stems** in the division are *Hardwickia binata*, *Chloroxylon swietenia*, *Albizia amara*, *Anogeissus latifolia* and *Holarrhena antidysenterica*.



Dolichandrone crisa

10. TIRUPATI CIRCLE

Chittoor East Division



- **Total growing stock** is 5.05 million M³. Of this, 3.66 million M³ is in Dense Forest, 1.29 million M³ in Open and 0.10 million M³ in the Scrub Forest. **Average growing stock** of the division is 25.67 M³/Ha. Canopy class-wise average growing stocks are 42.67 M³/Ha in Dense, 20.35 M³/Ha in Open and 8.06 M³/Ha in Scrub Forest.

- **The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.
- **The total number of stems** in the division is 49.73 million. Of these, 33.66 million fall in Dense

Species Name	Volume in Million M ³
<i>Anacardium occidentale</i>	0.21
<i>Syzygium alternifolium</i>	0.21
<i>Dalbergia paniculata</i>	0.13
<i>Wrightia tinctoria</i>	0.13
<i>Drypetes separia</i>	0.10

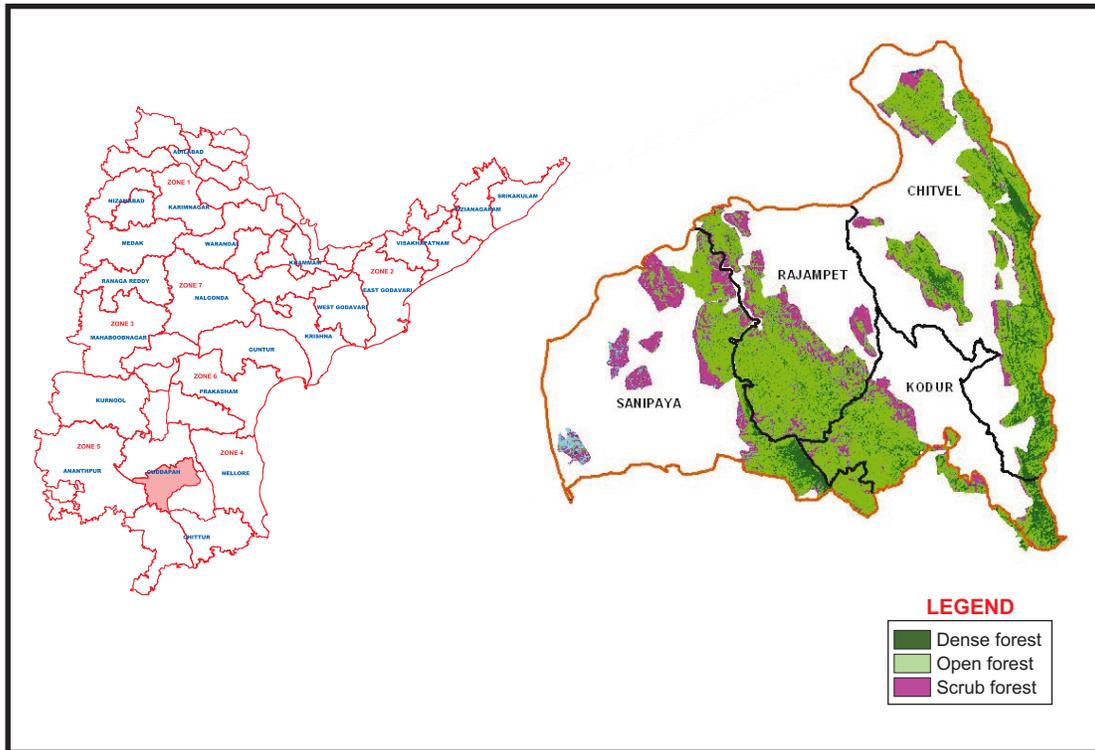
14.91 million in the Open and 1.16 million in Scrub Forest. **Average number of stems** per Ha in division is 253. They are in Dense Forest is 393 /Ha, in Open Forest - 236 /Ha and in Scrub Forest - 89 /Ha.

- **Top 5 prominent species in terms of number of stems** in the division are *Syzygium alternifolium*, *Wrightia tinctoria*, *Albizia amara*, *Anacardium occidentale* and *Lannea coromandelica*.

Rajampet Division



Pterocarpus santalinus



- **Total growing stock** is 4.08 million M³. Of this, 2.33 million M³ is in Dense Forest, 1.71 million M³ in Open and 0.04 million M³ in the Scrub Forest. **Average growing stock** of the division is 28.12 M³/Ha. Canopy class-wise average growing stocks are 39.57 M³/Ha in Dense, 23.86 M³/Ha in Open and 4.30 M³/Ha in Scrub Forest.

- **The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.

Species Name	Volume in Million M ³
<i>Pterocarpus santalinus</i>	0.78
<i>Anogeissus latifolia</i>	0.54
<i>Syzygium alternifolium</i>	0.31
<i>Hardwickia binata</i>	0.26
<i>Dalbergia paniculata</i>	0.17

- **The total number of stems** in the division is 41.88 million. Of these, 23.14 million fall in Dense,

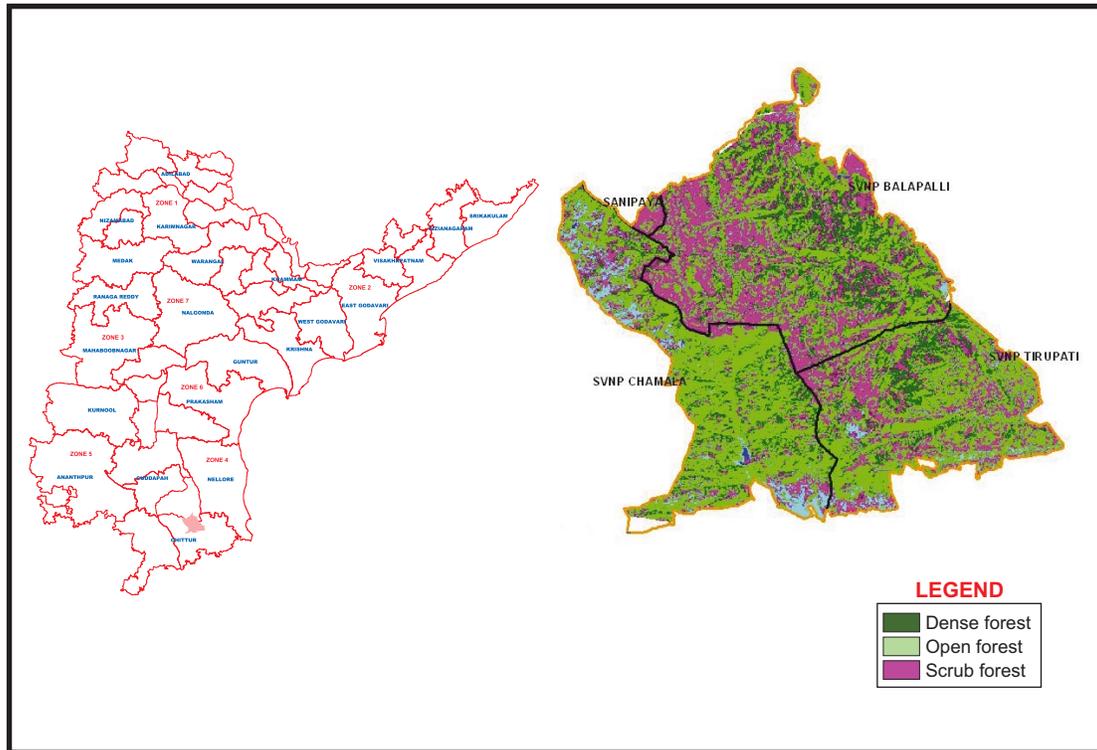
18.24 million in the Open and 0.50 million in Scrub Forest. **Average number of stems** per Ha in division is 288. They are in Dense Forest - 393 /Ha, in Open Forest - 254 /Ha and in Scrub Forest - 56 /Ha.

- **Top 5 prominent species in terms of number of stems** in the division are *Pterocarpus santalinus*, *Anogeissus latifolia*, *Syzygium alternifolium*, *Chloroxylon swietenia* and *Hardwickia binata*.



Syzygium alternifolium

Tirupati Divison



- **Total growing stock** is 2.75 million M³. Of this, 1.77 million M³ is in Dense Forest, 0.92 million M³ in Open and 0.07 million M³ in the Scrub Forest. **Average growing stock** of the division is 36.77 M³/Ha. Canopy class-wise average growing stocks are 52.60 M³/Ha in Dense, 32.17 M³/Ha in Open and 11.58 M³/Ha in Scrub Forest.

- **The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.
- **The total number of stems** in the division is 18.16 million. Of these, 9.24 million fall in Dense

Species Name	Volume in Million M ³
<i>Syzygium alternifolium</i>	0.51
<i>Terminalia chebula</i>	0.34
<i>Pterocarpus santalinus</i>	0.26
<i>Hardwickia binata</i>	0.10
<i>Anogeissus latifolia</i>	0.09

7.88 million in the Open and 1.03 million in Scrub Forest. **Average number of stems** per Ha in division is 242. They are in Dense Forest - 275 /Ha, in Open Forest - 277 /Ha and in Scrub Forest - 171 /Ha.

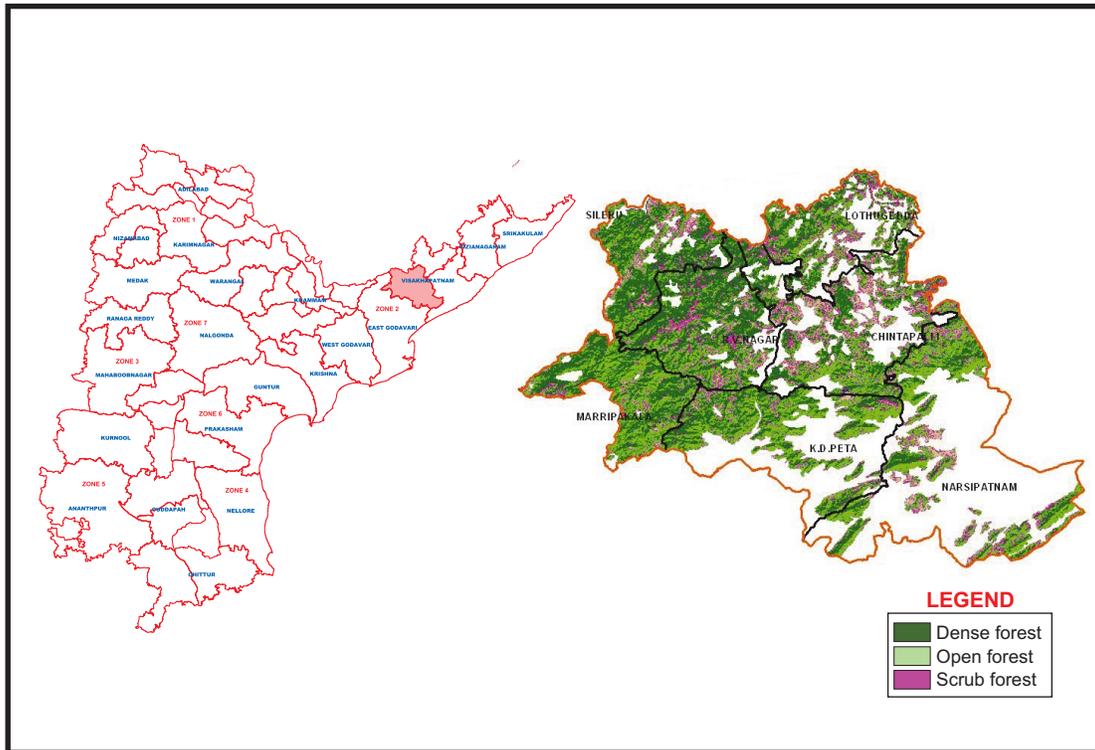
- **Top 5 prominent species in terms of number of stems** in the division are *Syzygium alternifolium*, *Terminalia chebula*, *Pterocarpus santalinus*, *Chloroxylon swietenia* and *Anogeissus latifolia*.

11. Visakhapatnam Circle

Narsipatnam Division



Saccopetalum tomentosum



- **Total growing stock** is 19.18 million M³. Of this, 17.51 million M³ is in Dense Forest, 1.46 million M³ in Open and 0.21 million M³ in the Scrub Forest. **Average growing stock** of the division is 81.50 M³/Ha. Canopy class-wise average growing stocks are 105.35 M³/Ha in Dense, 49.19 M³/Ha in Open and 24.29 M³/Ha in Scrub Forest.

- **The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.

Species Name	Volume in Million M ³
<i>Anogeissus latifolia</i>	2.00
<i>Terminalia tomentosa</i>	1.55
<i>Pterocarpus marsupium</i>	1.09
<i>Mangifera indica</i>	0.83
<i>Lannea coromandelica</i>	0.75

- **The total number of stems** in the division is 55.15 million. Of these, 48.90 million fall in Dense,

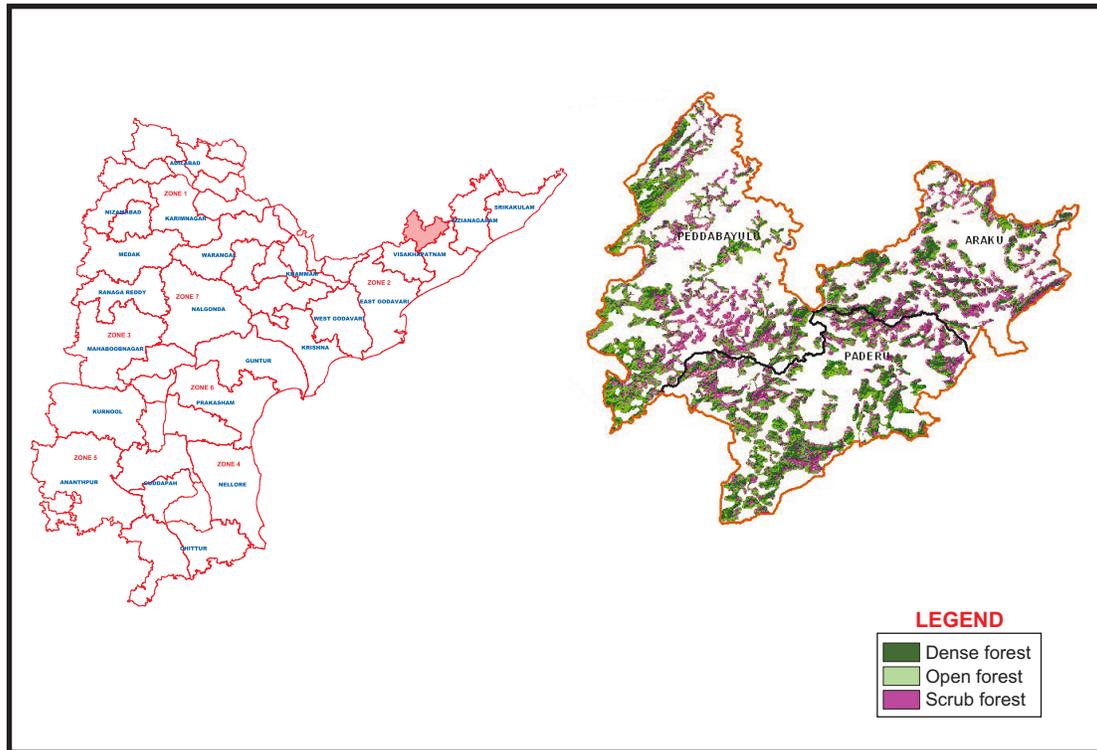
5.68 million in the Open and 0.57 million in Scrub Forest. **Average number of stems** per Ha in division is 234. They are in Dense Forest - 294 /Ha, Open Forest - 192 /Ha and in Scrub Forests - 66 /Ha.

- Top 5 prominent species in terms of number of stems in the division are *Xylia xylocarpa*, *Anogeissus latifolia*, *Terminalia tomentosa*, *Grewia tiliaefolia* and *Lannea coromandelica*.



Cedrella toona

Paderu Division



- **Total growing stock** is 2.52 million M³. Of this, 1.00 million M³ in Open and 1.51 million M³ in the Scrub Forest. **Average growing stock** of the division is 24.88 M³/Ha. Canopy class-wise average growing stocks are 50.04 M³/Ha in Open and 30.95 M³/Ha in Scrub Forest.

- **The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.

Species Name	Volume in Million M ³
<i>Xylia xylocarpa</i>	1.55
<i>Mangifera indica</i>	0.47
<i>Terminalia chebula</i>	0.22
<i>Pterocarpus marsupium</i>	0.17
<i>Garuga pinnata</i>	0.16

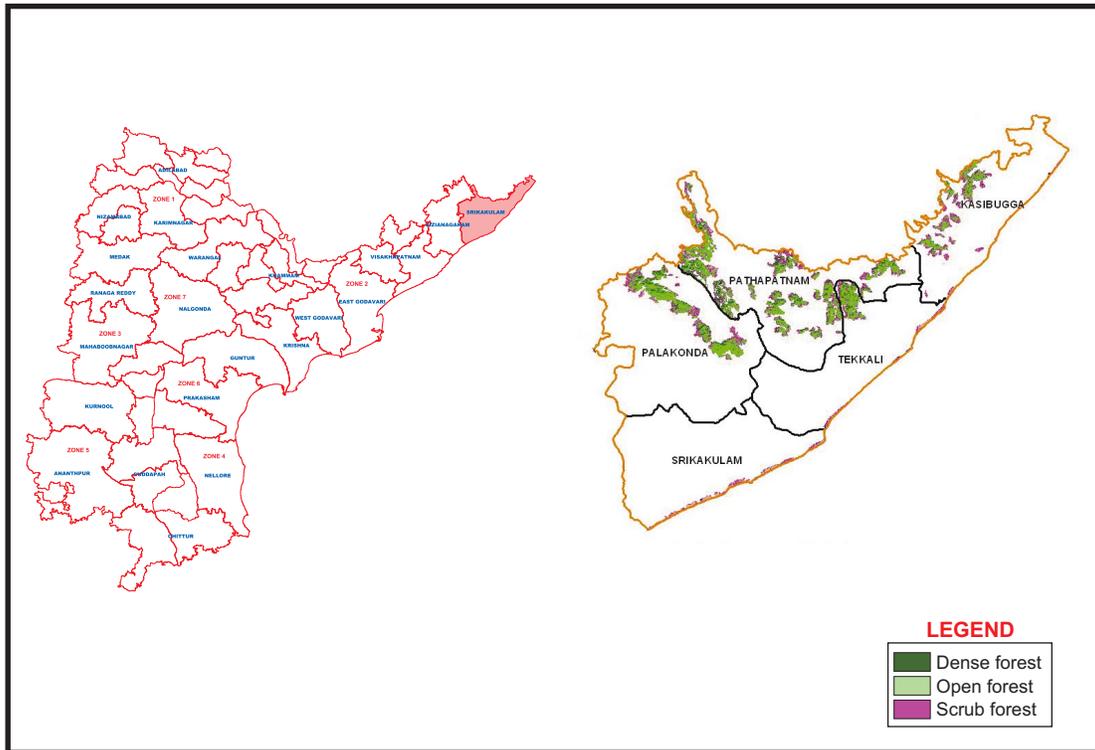
- **The total number of stems** in the division is 6.24 million. Of these, 0.21 million fall in Dense 2.67 million in the Open and 3.36 million in Scrub Forest. **Average number of stems** per Ha in division is 62. They are in Dense Forest -190 Ha, Open Forest - 134 /Ha and in Scrub Forest - 69 /Ha.

- **Top 5 prominent species in terms of number of stems** in the division are *Garuga pinnata*, *Syzygium cuminii*, *Terminalia chebula*, *Terminalia tomentosa*, *Pterocarpus marsupium*.

Srikakulam Division



Shorea robusta



- **Total growing stock** is 1.40 million M³. Of this, 1.13 million M³ is in Dense Forest, 0.25 million M³ in Open and 0.02 million M³ in the Scrub Forest. **Average growing stock** of the division is 19.38 M³/Ha. Canopy class-wise average growing stocks are 29.41 M³/Ha in Dense, 18.75 M³/Ha in Open and 6.18 M³/Ha in Scrub Forest.

- **The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.

Species Name	Volume in Million M ³
<i>Mangifera indica</i>	0.39
<i>Ficus benghalensis</i>	0.22
<i>Lannea coromandelica</i>	0.08
<i>Anacardium occidentale</i>	0.07
<i>Ficus religiosa</i>	0.05

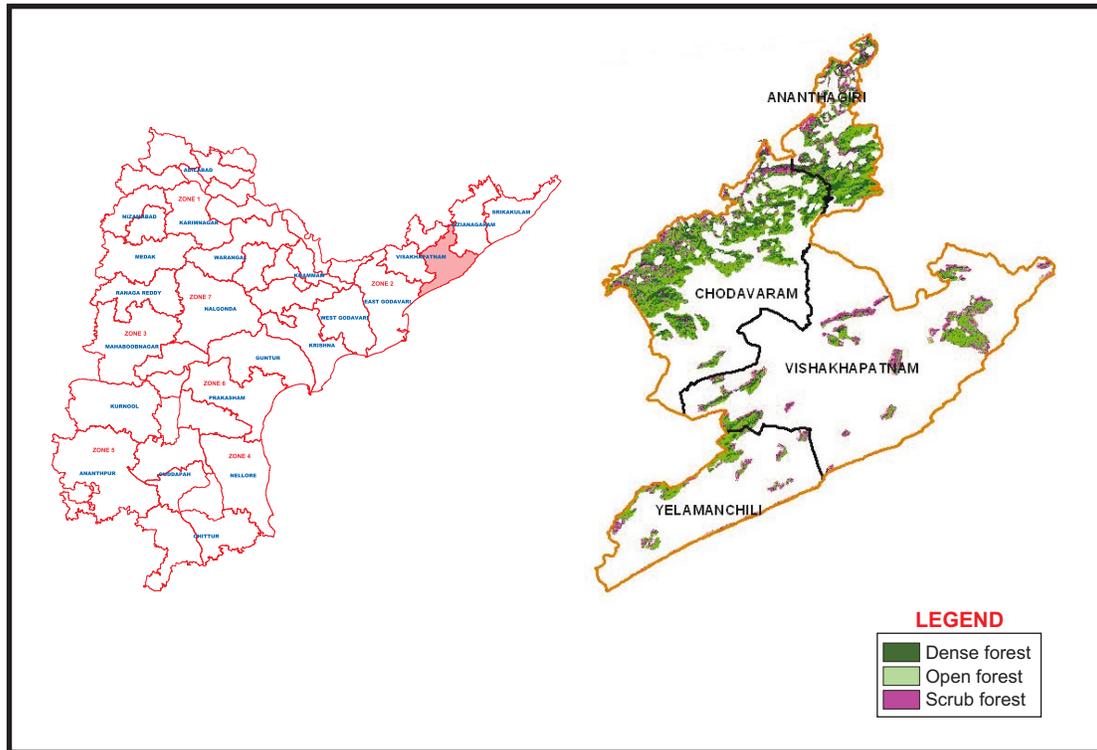
- **The total number of stems** in the division is 7.99 million. Of these, 6.74 million fall in Dense, 1.02 million in the Open and 0.23 million in Scrub Forest. **Average number of stems** per Ha in division is 111. They are in Dense Forest - 176 /Ha, Open Forest - 76 /Ha and in Scrub Forest - 60 /Ha.

- **Top 5 prominent species in terms of number of stems** in the division are *Lannea coromandelica*, *Xylia xylocarpa*, *Anacardium occidentale*, *Ficus benghalensis* and *Semicarpus anacardium*.



Mallotus philippensis

Visakhapatnam Division



- **Total growing stock** is 3.98 million M³. Of this, 2.55 million M³ is in Dense Forest, 1.18 million M³ in Open Forest, 0.24 million M³ in the Scrub Forest. **Average growing stock** of the division is 31.42 M³/Ha. Canopy class-wise average growing stocks are 50.46 M³/Ha in Dense, 37.81 M³/Ha in Open and 17.42 M³/Ha in Scrub Forest.

- **The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.
- **The total number of Stems** in the division is 19.32 million. Of these 12.53 million fall in Dense,

Species Name	Volume in Million M ³
<i>Xylia xylocarpa</i>	0.49
<i>Excoecaria agallocha</i>	0.41
<i>Anogeissus latifolia</i>	0.35
<i>Mangifera indica</i>	0.28
<i>Dalbergia paniculata</i>	0.22

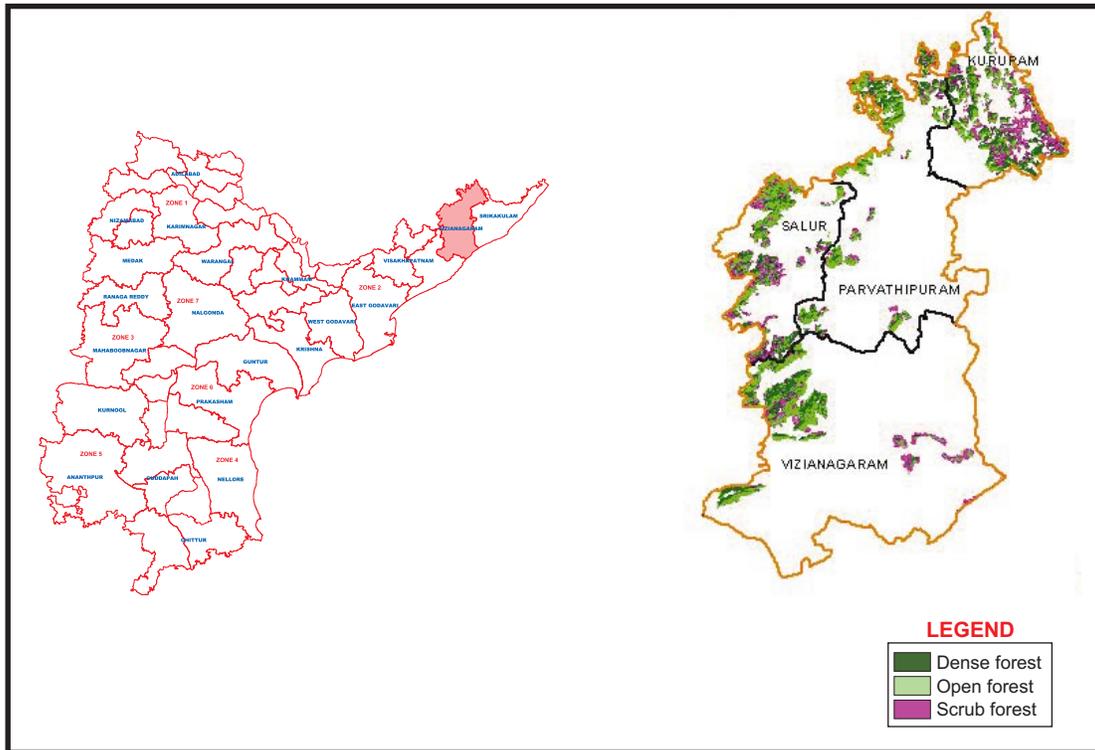
5.84 million in the Open and 0.96 million in Scrub Forest. **Average number of stems** per Ha in division is 153. They are in Dense Forest - 247 /Ha, Open Forest - 186 /Ha and in Scrub Forest - 69 /Ha.

- **Top 5 prominent species in terms of number of stems** in the division are *Xylia xylocarpa*, *Anogeissus latifolia*, *Excoecaria agallocha*, *Wrightia tinctoria* and *Lanea coromandelica*.

Vizianagaram Division



Anogeisus acuminata



- Total growing stock** is 10.94 million M³. Of this, 8.36 million M³ is in Dense Forest, 2.23 million M³ in Open and 0.35 million M³ in the Scrub Forest. **Average growing stock** of the division is 89.70 M³/Ha. Canopy class-wise average growing stocks are 108.53 M³/Ha in Dense, 90.85 M³/Ha in Open and 36.94 M³/Ha in Scrub Forest.
- The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.

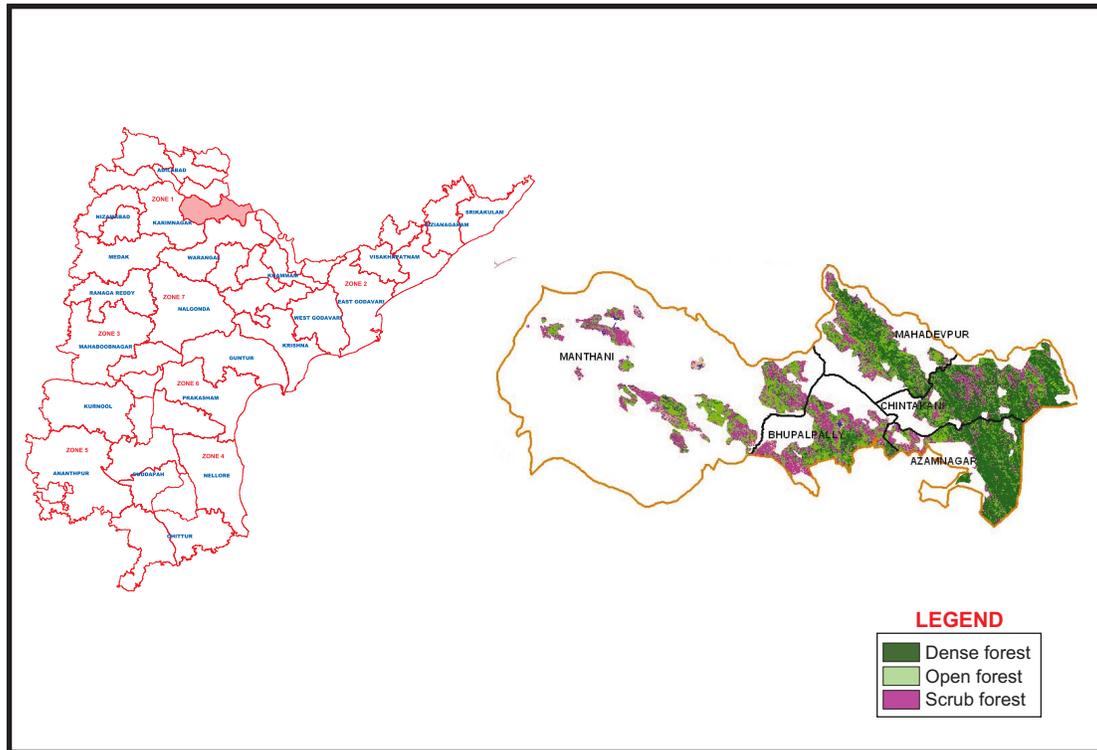
Species Name	Volume in Million M ³
<i>Mangifera indica</i>	1.94
<i>Tamarindus indica</i>	0.95
<i>Semicarpus anacardium</i>	0.79
<i>Lanea coromandelica</i>	0.59
<i>Shorea robusta</i>	0.50
- The total number of Stems** in the division is 22.47 million. Of these, 15.19 million fall in Dense 6.32 million in the Open and 0.96 million in Scrub Forest. **Average number of stems** per Ha in division is 184. They are in Dense Forest - 197 /Ha, Open Forest - 258 /Ha and in Scrub Forests - 103 /Ha.
- Top 5 prominent species in terms of number of stems** in the division are *Cleistanthus collinus*, *Xylia xylocarpa*, *Lanea coromandelica*, *Shorea robusta* and *Wrightia tinctoria*

12. Warangal Circle

Karimnagar East Division



Bridellia retusa



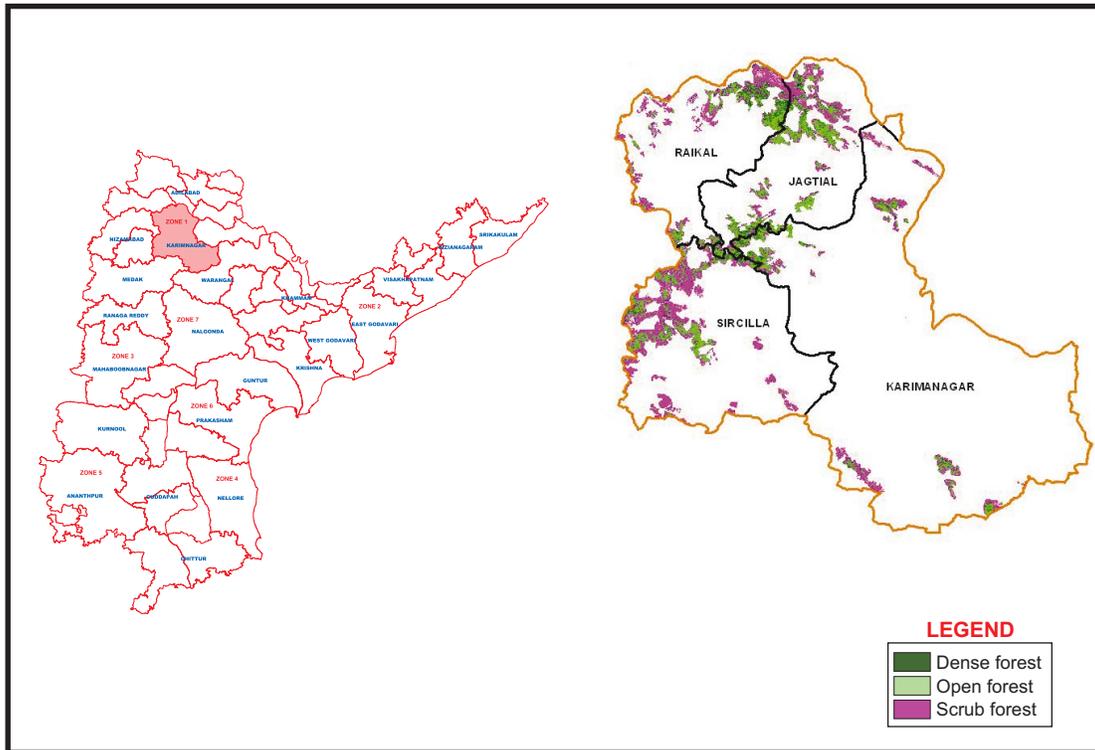
- **Total growing stock** is 4.71 million M³. Of this, 3.74 million M³ is in Dense Forest, 0.81 million M³ in Open and 0.16 million M³ in the Scrub Forest. **Average growing stock** of the division is 33.96 M³/Ha. Canopy class-wise average growing stocks are 47.37 M³/Ha in Dense, 20.66 M³/Ha in Open and 17.92 M³/Ha in Scrub Forest.
- **The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.

Species Name	Volume in Million M ³
<i>Terminalia tomentosa</i>	0.75
<i>Madhuca indica</i>	0.61
<i>Lannea coromandelica</i>	0.45
<i>Hardwickia binata</i>	0.33
<i>Anogeissus latifolia</i>	0.24
- **The total number of stems** in the division is 22.01 million. Of these, 17.16 million fall in Dense, 4.47 million in the Open and 0.38 million in Scrub Forest. **Average number of stems** per Ha in division is 159. They are in Dense Forest - 218 /Ha, Open Forest - 113 /Ha and in Scrub Forest - 44 /Ha.
- **Top 5 prominent species in terms of number of stems** in the division are *Terminalia tomentosa*, *Lannea coromandelica*, *Chloroxylon swietenia*, *Tectona grandis* and *Morinda tinctoria*

Karimnagar West Division



Butea monosperma



- **Total growing stock** is 4.22 million M³. Of this, 3.57 million M³ is in Dense Forest, 0.64 million M³ in Open and 0.01 million M³ in the Scrub Forest. **Average growing stock** of the division is 43.27 M³/Ha. Canopy class-wise average growing stocks are 62.82 M³/Ha in Dense, 23.41 M³/Ha in Open and 6.13 M³/Ha in Scrub Forest.

- **The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.

Species Name	Volume in Million M ³
<i>Tectona grandis</i>	1.31
<i>Dalbergia paniculata</i>	0.78
<i>Lannea coromandelica</i>	0.48
<i>Butea monosperma</i>	0.19
<i>Boswellia serrata</i>	0.18

- **The total number of stems** in the division is 27.79 million. Of these, 22.49 million fall in Dense,

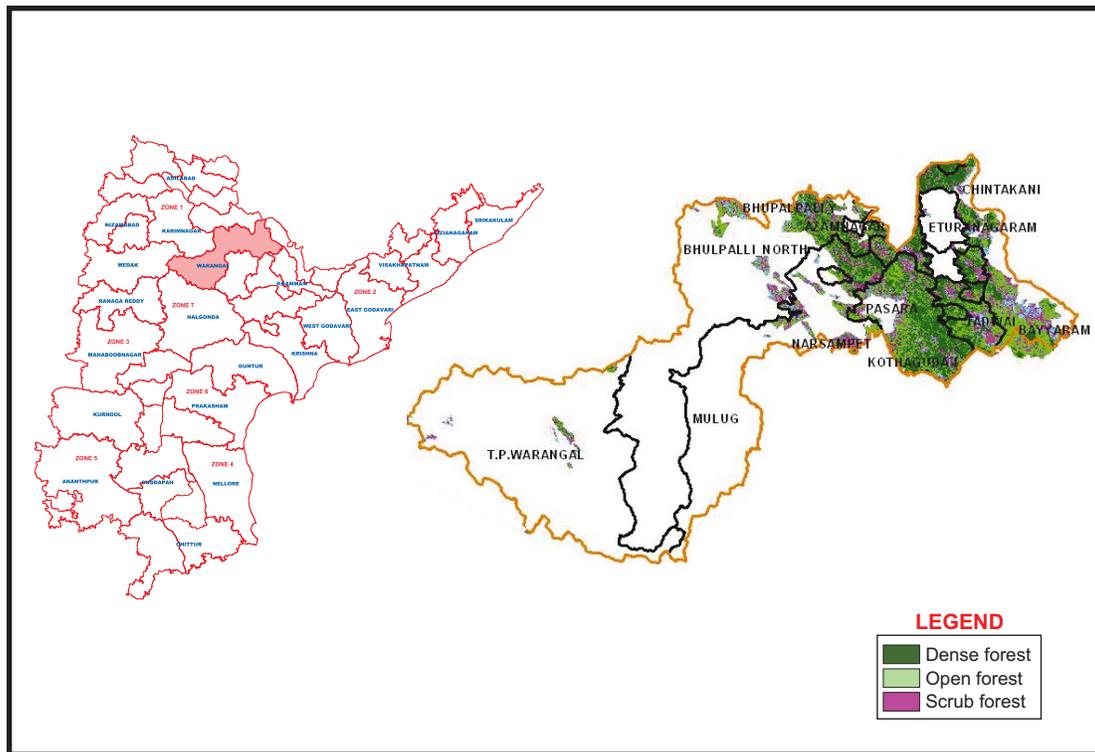
5.12 million in the Open and 0.18 million in Scrub Forest. **Average number of stems** per Ha in division is 285. They are in Dense Forest - 396 /Ha, Open Forest - 188 /Ha and in Scrub Forest - 75 /Ha.

- **Top 5 prominent species in terms of number of stems** in the division are *Tectona grandis*, *Dalbergia paniculata*, *Wrightia tinctoria*, *Trewia nudiflora* and *Cleistanthus collinus*.



Careya arborea

Warangal North Division



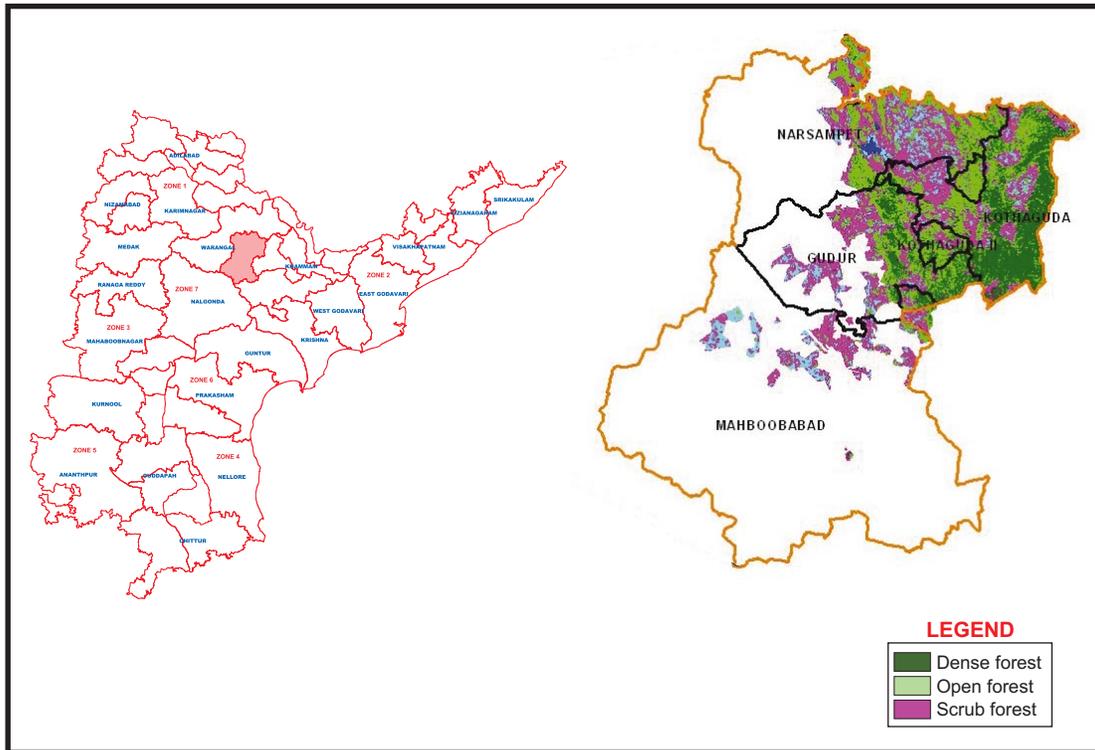
- **Total growing stock** is 12.96 million M³. Of this, 10.09 million M³ is in Dense Forest, 2.69 million M³ in Open and 0.18 million M³ in the Scrub Forest. **Average growing stock** of the division is 56.09 M³/Ha. Canopy class-wise average growing stocks are 72.69 M³/Ha in Dense, 45.80 M³/Ha in Open and 19.61 M³/Ha in Scrub Forest.
- **The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.
- **The total number of stems** in the division is 48.24 million. Of these, 36.04 million fall in Dense, 11.49 million in the Open and 0.71 million in Scrub Forest. **Average number of stems per Ha** in division is 209. They are in Dense Forest - 260 /Ha, in Open Forest - 196 /Ha and in Scrub Forest - 77 /Ha.
- **Top 5 prominent species in terms of number of stems** in the division are *Terminalia tomentosa*, *Xylia xylocarpa*, *Cleistanthus collinus*, *Anogeissus latifolia* and *Chloroxylon swietenia*.

Species Name	Volume in Million M ³
<i>Terminalia tomentosa</i>	1.80
<i>Anogeissus latifolia</i>	1.27
<i>Madhuca indica</i>	0.97
<i>Lannea coromandelica</i>	0.81
<i>Diospyros melanoxylon</i>	0.79

Warangal South Division



Sterculia urens



- **Total growing stock** is 3.63 million M³. Of this, 1.74 million M³ is in Dense Forest, 1.82 million M³ in Open and 0.08 million M³ in the Scrub Forest. **Average growing stock** of the division is 30.93 M³/Ha. Canopy class-wise average growing stocks are 62.98 M³/Ha in Dense, 34.13 M³/Ha in Open and 14.13 M³/Ha in Scrub Forest.

- **The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.

Species Name	Volume in Million M ³
<i>Terminalia arjuna</i>	0.57
<i>Lannea coromandelica</i>	0.38
<i>Xylia xylocarpa</i>	0.37
<i>Madhuca indica</i>	0.28
<i>Anogeissus latifolia</i>	0.21

- **The total number of stems** in the division is 20.91 million. Of these, 9.02 million fall in Dense,

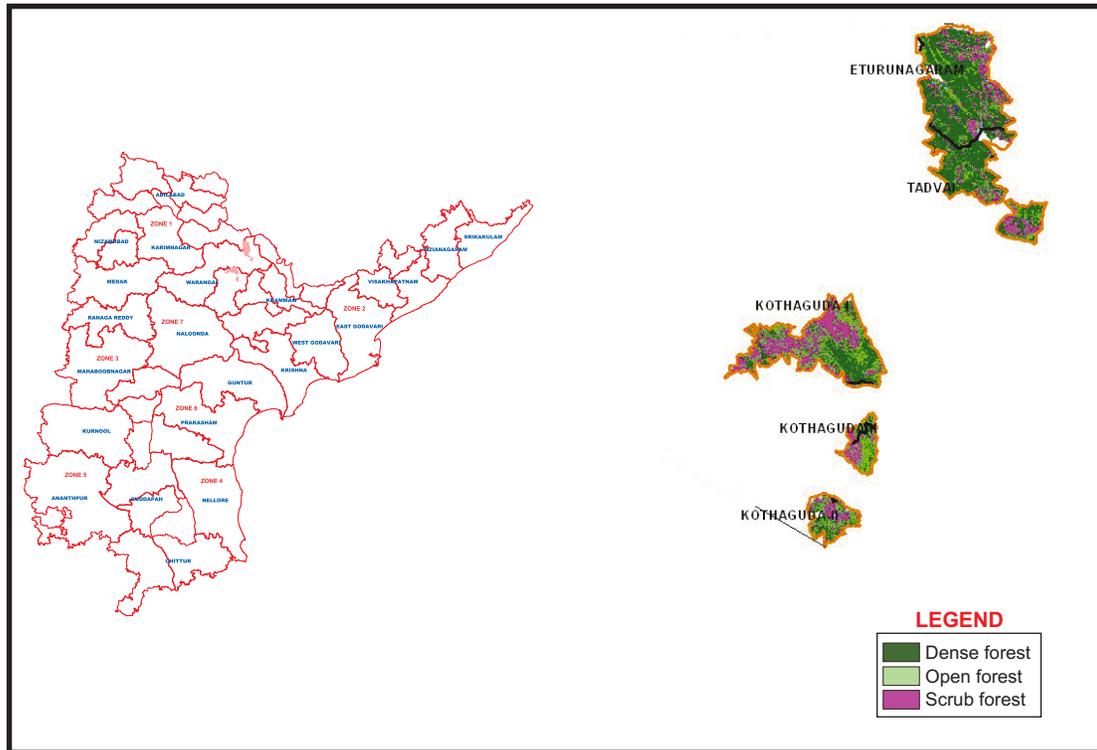
11.20 million in the Open and 0.68 million in Scrub Forest. **Average number of stems** per Ha in division is 178. They are in Dense Forest - 327 /Ha, Open Forest - 210 /Ha and in Scrub Forest - 123 /Ha.

- **Top 5 prominent species in terms of number of stems** in the division are *Xylia xylocarpa*, *Cleistanthus collinus*, *Chloroxylon swietenia*, *Lannea coromandelica* and *Terminalia arjuna*.



Barringtonia acutangula

Warangal WLM Division



- **Total growing stock** is 2.36 million M³. Of this, 1.33 million M³ is in Dense Forest, 0.99 million M³ in Open and 0.04 million M³ in Scrub Forest. **Average growing stock** of the division is 43.74 M³/Ha. Canopy class-wise average growing stocks are 68.27 M³/Ha in Dense, 33.76 M³/Ha in Open and 8.47 M³/Ha in Scrub Forest.

- **The 5 species contributing maximum to the Growing Stock** in the division and their contribution is given in the table.

Species Name	Volume in Million M ³
<i>Terminalia arjuna</i>	0.26
<i>Xylia xylocarpa</i>	0.24
<i>Anogeissus latifolia</i>	0.24
<i>Cleistanthus collinus</i>	0.17
<i>Pterocarpus marsupium</i>	0.17

- **The total number of stems** in the division is 12.76 million. Of these, 4.65 million fall in Dense,

7.93 million in the Open and 0.18 million in Scrub Forest. **Average number of stems** per Ha in division is 237. They are in Dense Forest - 239 /Ha, Open Forest - 271 /Ha and Scrub Forest - 40 /Ha.

- **Top 5 prominent species in terms of number of stems** in the division are *Xylia xylocarpa*, *Anogeissus latifolia*, *Terminalia arjuna*, *Acacia chundra* and *Cleistanthus collinus*.



7. Bamboo Resources

Bamboo Resources in AP

Bamboo, popularly known as poor man's timber, is a very important Minor Forest Produce (MFP) or Non Timber Forest Produce (NTFP) in the state. Apart from being an important raw material for paper making, it is largely used by the poorer section of the people in house making, preparation of baskets, as fencing material for agricultural gardens and houses etc. Thus a proper inventory of bamboo is essential to know its availability.

The following table gives the **Areas covered with bamboo areas in all the circles** in the state:

Circle-wise Bamboo Areas In Andhra Pradesh						
Area in Ha						
Circle	Pure Bamboo Area	Dense Bamboo Area	Medium Bamboo Area	Scattered Bamboo area	Total Bamboo Area	Bamboo Area Percentage
Adilabad	39740	36759	30798	43714	151011	21.3
Anantapur	2021	0	2021	5052	9094	2.3
Guntur	5377	6145	8450	7682	27654	4.3
Hyderabad	0	0	0	0	0	0.0
Khammam	39435	74174	49673	23473	186755	23.5
Kurnool	29715	32262	22923	14433	99333	17.9
Nizamabad	0	0	0	0	0	0.0
Rajahmundry	13260	29172	45967	47735	136134	29.3
Srisailam	39273	15526	10046	31053	95898	16.0
Tirupati	11803	10117	5058	7587	34565	8.3
Visakhapatnam	74698	35931	62406	52005	225040	34.2
Warangal	19339	11376	11376	21615	63706	10.0
Total	274661	251462	248718	254349	1029190	16.1

Pure	Above 200 clumps/ha
Dense	100 -200 clumps/ha
Medium	50 -100 clumps/ha
Scatter	Below 50 clumps/ha

Estimation of Bamboo in the State

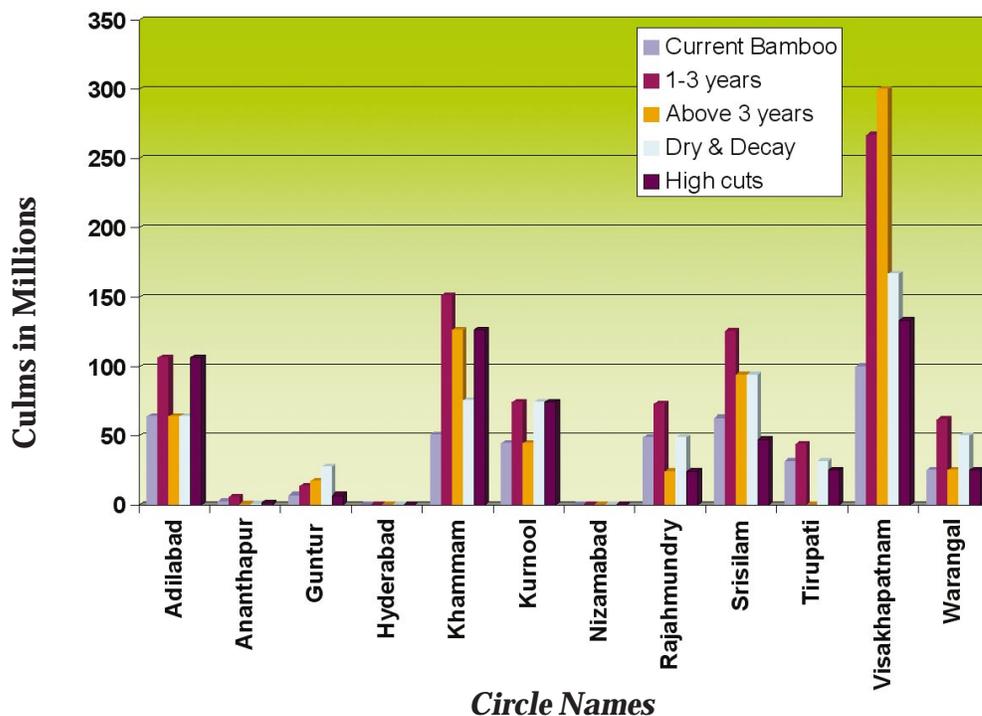
The Estimation of the bamboo in Andhra Pradesh state and its age and class-wise distribution is given below:

(Culms in Millions)

Circle	Current Bamboo	1-3 years	Above 3 years	Total	Dry & Decay	High cuts
Adilabad	63.78	106.30	63.78	233.87	63.78	106.30
Anantapur	2.24	5.98	0.34	8.57	0.75	1.50
Guntur	6.88	13.77	17.21	37.86	27.53	6.88
Hyderabad	0.00	0.00	0.00	0.00	0.00	0.00
Khammam	50.44	151.32	126.10	327.85	75.66	126.10
Kurnool	44.62	74.37	44.62	163.62	74.37	74.37
Nizamabad	0.00	0.00	0.00	0.00	0.00	0.00
Rajahmundry	48.62	72.93	24.31	145.86	48.62	24.31
Srisailam	62.66	125.31	93.98	281.95	93.98	46.99
Tirupati	31.41	43.97	0.00	75.37	31.41	25.12
Visakhapatnam	100.10	266.95	300.31	667.37	166.84	133.47
Warangal	24.80	62.00	24.80	111.60	49.60	24.80
Total	435.56	922.89	695.46	2053.91	632.54	569.85

From the table above, it is clear that current bamboo availability in the State is 435.56 millions, where as 1-3 year old bamboo culms is 922.89 million and more than 3 year old bamboo culms availability is 695.46 million. Thus the total of 2053.91 million bamboos culms are available in the state. Maximum culms are in Visakhapatnam circle, which has 667.37 million, followed by 327.85 million in Khammam circle, 281.95 million in Srisailam Circle, 233.87 million in Adilabad circle etc. There is no Bamboo available in Hyderabad and Nizamabad circles.

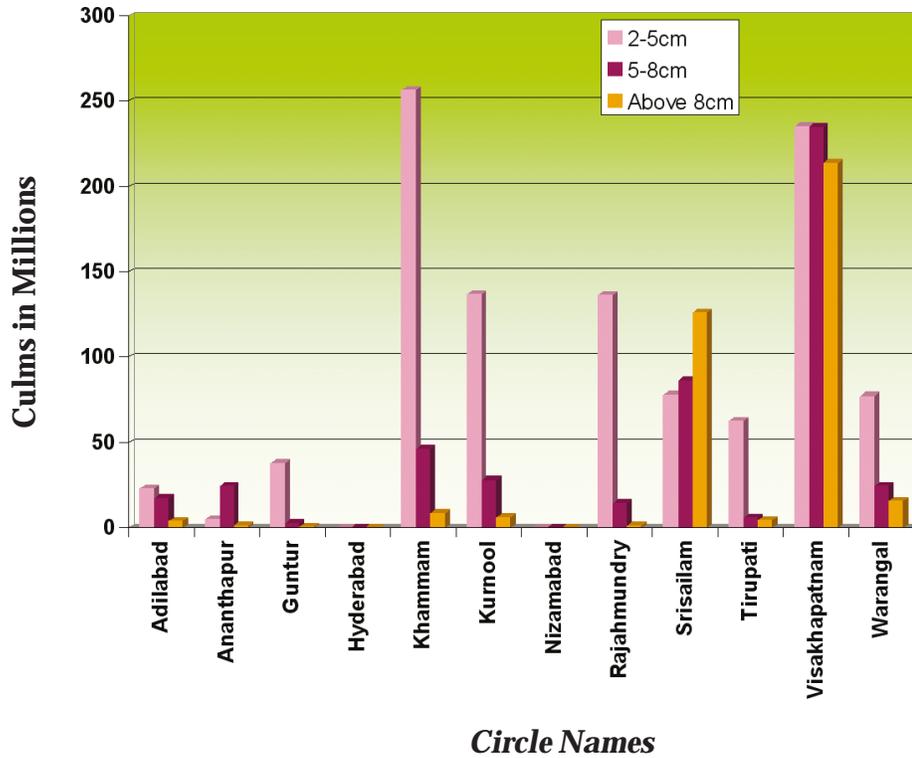
In terms high cuts of Bamboo, it is noticed that maximum high cuts of 133.47 million is found in Visakhapatnam circle, followed by 126.10 million in Khammam circle and 106.30 million in Adilabad circle.



Above bar diagram represents the Age class-wise distribution of Bamboo in the state. The Diameter class-wise bamboo availability, the circle-wise as well as the entire state is given below:

(Culms in Millions)

Circle	2-5cm	5-8cm	Above 8cm	Total
Adilabad	22.75	17.22	3.83	43.80
Ananthapur	4.56	24.23	0.90	29.70
Guntur	37.85	2.58	0.55	40.99
Hyderabad	0.00	0.00	0.00	0.00
Khammam	256.48	46.15	8.32	310.96
Kurnool	136.70	27.82	6.10	170.61
Nizamabad	0.00	0.00	0.00	0.00
Rajahmundry	136.13	14.10	0.97	151.21
Srisailam	77.69	86.15	126.25	290.09
Tirupati	62.72	5.91	4.00	72.64
Visakhapatnam	235.58	234.91	213.89	684.38
Warangal	77.13	24.18	15.38	116.68
Total	1047.59	483.25	380.19	1911.04



The table shows that the lower diameter bamboo of 2-5 cm diameter class is more than 5-8 cm diameter class and further 5-8 cm diameter class bamboo is more than above 8 cm diameter class in the entire state.



8. Analysis & Conclusion

After the Inventory process was completely over in all parts of the state of Andhra Pradesh, the findings were put together to make the Inventory Report. The following are some of the **important findings of the forest inventory in Andhra Pradesh:**

1. The forest cover with good Growing Stock is restricted to Northern Strip of Andhra Pradesh bordering Maharashtra, Chattisgarh, & Orissa. Out of the total growing stock of 232 million cubic meters in the state, Khammam circle with 12% of total forest area contributes to 19% of growing stock of the state which is the highest in the state. Similarly, Visakhapatnam circle with 10% forest area contributes to 16% of the growing stock and ranks second.
2. The average Growing Stock of the state is 36.37 cubic meters/Ha. The total Growing Stock of the state is 232 million cubic meters.
3. Visakhapatnam circle has maximum per Ha volume which is 57.84 cubic meters followed by Rajmundry circle with 56.79 cubic meters and Khammam circle with 53.60 cubic meters.
4. Hyderabad circle has the lowest Growing Stock per Ha which is 7.8 cubic meters only, the area included being Ananthapur and Chittoor West Divisions.
5. The **State Forest Growing Stock** has decreased from 291.394 million cubic meters to 232 million cubic meters now, as reported in FSI in 1995, in their publication **Extent, Composition, Density, Growing Stock and Annual increment of India's Forests in 1995**.
6. **Number of Stems per Ha:** The maximum stems are 263/Ha in Tirupati circle, followed by 244/Ha in Khammam circle. The lowest number of stems are found in Anantapur circle, which are 82/Ha and in Hyderabad circle, which are 89/Ha. The state average is 179 stems/Ha. The stems are concentrated at 10-20 cm diameter mainly.
7. **The Bamboo Bearing Forests:** Maximum **bamboo culms** are available in Visakhapatnam, which are 667.37 million, followed by 327.85 million in Khammam circle, 281.95 million in Srisailam Circle, and 233.87 million in Adilabad circle. There is no Bamboo available in Hyderabad and Nizamabad circles. Current bamboo culm availability in the state is 435.56 million, where as 1-3 years old bamboo availability is 922.89 million and more than 3 year is 695.46 million. These three together make a total of 2053.91 million bamboo culms, available in the State. In terms **high cuts of Bamboo**, it is noticed that maximum high cuts of 133.47 million is found in Visakhapatnam circle followed by 126.10 million in Khammam circle and 106.30 million in Adilabad circle. The high cuts represent the illegal and unscientific fellings in the bamboo forests (Culms in Millions). In the state, lower diameter bamboo of 2-5 cm diameter is available more in number than 5-8 cm diameter and further 5-8 cm diameter bamboo is more than above 8 cm diameter.

8. **Basal area/ha:** The state figure for Basal area is 7 sqm/Ha for Dense, 4 sqm/Ha for open & 1 sqm/Ha for Scrub forest.
9. **A Comparison with Previous Inventories done in Andhra Pradesh** is given in the following table:

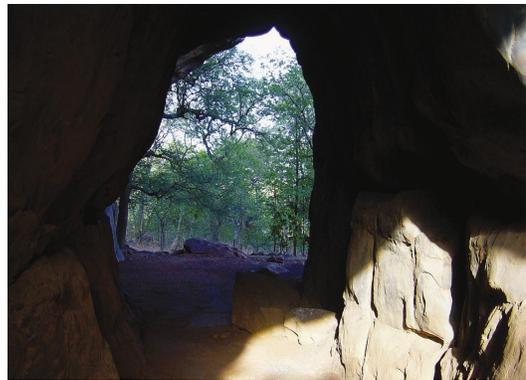
Inventory Year	Inventory Area	Volume M ³ / Hectare	
		Previous	Present
1970s	Nallamalla Catchments	20.41	30.54
Seshachalam Catchments			
1976	Nellore Division	8.55	6.37
	Rajampet Division	14.13	28.12
	Kadapa Division	8.89	18.64
	Chittoor District	13.22	21.4
	Proddatur Division	11.55	16.32
1970	Godavari Catchment (East Godavari, Khammam, Visakhapatnam, West Godavari)	55.83	56.64
1977	Adilabad Catchment	52.78	46.67
Warangal Catchments			
1970s	Warangal South Division	30.25	30.93
	Warangal North Division	36.75	56.09
Karimnagar Catchments			
	Karimnagar East Division	41.61	33.96
	Karimnagar West Division	17.29	43.27

The above table shows that there is an increase of Growing Stock in Rajampet, Cuddapah, Chittoor, Godavari catchment. Warangal North & South and Karimnagar West divisions and decline in Nellore, Adilabad catchment and Karimnagar East divisions in terms of Unit Volume/Ha. Similarly, there is a decrease in the number of stems in Adilabad catchment and Nallamalla catchment in number of Stems /Ha. The volume result is the outcome of the Volume Equations used in Forest Inventory shown in the Appendix.

10. ***Anogeissus latifolia*, *Tectona grandis* and *Xylia xylocarpa* are the three predominant species in terms of number of stems. In terms of volume, however, *Anogeissus latifolia*, *Xylia xylocarpa* and *Terminalia tomentosa* top the list in order.**
11. Seedling regeneration is inadequate in 30,440 sqkm and absent in 5650 sqkm in the state. An extent of 2110 sqkm in the state has high fire incidence, and 11,640 sqkm has medium fire incidence.







9. Appendices

1. Seven zones and divisions in each zone
2. Distribution of Canopy classes in each Division
3. Species and Volume equations used
4. Division-wise Names of Crew Leaders

Appendix-1

SEVEN ZONES AND DIVISIONS IN EACH ZONE Zone-1

District Name	S.No.	Division Name
ADILABAD	1	Adilabad
	2	Bellampally
	3	Jannaram
	4	Kagaz Nagar
	5	Mancherial
	6	Nirmal
KARIMNAGAR	7	Karimnagar East
	8	Karimnagar West
KHAMMAM	9	Bhadrachalam North
	10	Khammam
	11	Kothagudem
	12	Paloncha
	13	Paloncha WLM
NIZAMABAD	14	Kamareddy
	15	Nizamabad
WARANGAL	16	Warangal North
	17	Warangal South
	18	Warangal WLM

Zone-2

District Name	S.No.	Division Name
EAST GODAVARI	19	Kakinada
KHAMMAM	20	Bhadrachalam South
SRIKAKULAM	21	Srikakulam
VISHAKAPATNAM	22	Narsipatnam
	23	Paderu
	24	Visakhapatnam
	25	Vizianagaram
WEST GODAVARI	26	Eluru

Zone-3

District Name	Sl.No.	Division Name
MAHABUBNAGAR	27	Mahabubnagar
MEDAK	28	Medak
	29	Medak WLM
HYDERABAD	30	Hyderabad

Zone-4

District Name	S.No.	Division Name
CHITTOOR	31	Chittoor East
	32	Chittoor West
	33	Tirupati
KADAPA	34	Kadapa
	35	Proddatur
	36	Rajampet
NELLORE	37	Nellore

Zone-5

District Name	S.No.	Division Name
ANANTHAPUR	38	Anantapur
KURNOOL	39	Kurnool

Zone-6

District Name	S.No.	Division Name
KURNOOL	40	Atmakur
	41	Nandyal
MAHABUBNAGAR	42	Achampet
PRAKASAM	43	Giddalur
	44	Markapur

Zone-7

District Name	S.No.	Division Name
GUNTUR	45	Guntur
KRISHNA	46	Krishna
	47	Krishna WLM
NALGONDA	48	Nalgonda
	49	Nagarjuna Sagar



Appendix-2

DISTRIBUTION OF CANOPY CLASSES IN EACH DIVISION

Distribution of Canopy Classes in Zone - 1

(Area in Ha)

Division	Dense	Open	Scrub	Non-forest Area Incl. Water bodies	Total Area
Adilabad	110082.06	29427.88	3269.76	47118.77	189898.47
Bellampally	65014.99	51011.76	15003.46	21450.51	152480.72
Bhadrachalam North	10301.21	109192.85	16481.94	8073.80	144049.80
Jannaram	57034.15	4002.40	1000.60	2337.15	64374.30
Kagaz Nagar	16664.60	52934.61	8822.44	10898.35	89320.00
Kamareddy	4206.84	69412.92	14723.95	9785.09	98128.81
Karimnagar East	78896.18	39448.09	8766.24	11574.32	138684.84
Karimnagar West	56756.25	27195.70	2364.84	11130.88	97447.68
Khammam	46697.46	62263.28	1111.84	21368.52	131441.10
Kothagudem	121149.17	16855.54	5267.36	25298.75	168570.81
Mancherial	56612.82	37404.90	7076.60	10443.72	111538.05
Nirmal	62516.41	32103.02	844.82	7053.32	102517.57
Nizamabad	49800.61	19072.57	2119.17	7722.31	78714.67
Paloncha	59210.94	77820.09	845.87	14624.09	152501.00
Paloncha WLM	41572.98	16167.27	1154.81	9742.54	68637.60
Warangal North	138854.27	58627.36	9256.95	24285.79	231024.37
Warangal South	27570.67	53303.30	5514.13	31076.86	117464.97
Warangal WLM	19496.94	29245.40	4431.12	681.28	53854.74
Total	1022438.57	785488.96	108055.91	274666.05	2190649.50

Distribution of Canopy Classes in Zone - 2

Division	Dense	Open	Scrub	Non-forest Area Incl. Water bodies	Total Area
Bhadrachalam South	120625.98	2805.26	701.31	5201.63	129334.17
Eluru	56398.16	12640.97	1944.76	6319.29	77303.17
Kakinada	244523.46	41473.94	6912.32	30629.58	323539.30
Narsipatnam	166249.84	29594.21	8704.18	30825.92	235374.15
Paderu	1109.17	19965.00	48803.34	31274.12	101151.62
Srikakulam	38270.56	13277.54	3905.16	16718.76	72172.03
Viziaynagaram	77070.36	24522.39	9341.86	11002.60	121937.21
Visakhapatnam	50628.07	31297.35	13807.65	30875.68	126608.75
Total	754875.59	175576.66	94120.59	162847.57	1187420.41

Distribution of Canopy Classes in Zone - 3

Division	Dense	Open	Scrub	Non-forest Area Incl. Water bodies	Total Area
Mahaboobnagar	3984.21	23241.20	20585.06	14137.73	61948.20
Medak	8295.75	49774.52	12443.63	25797.25	96311.15
Hyderabad	22001.40	27281.74	12320.78	14284.36	75888.28
Total	34281.36	100297.46	45349.48	54219.34	234147.63

Distribution of Canopy Classes in Zone - 4

Division	Dense	Open	Scrub	Non-forest Area Incl. Water bodies	Total Area
Chittoor East	85722.71	63209.67	12988.29	34746.33	196667.00
Chittoor West	65803.76	55313.31	20027.23	67832.20	208976.50
Kadapa	70280.64	58705.01	4134.16	38533.53	171653.33
Nellore	54275.73	51660.03	13078.49	118986.75	238001.00
Proddatur	73988.53	46859.40	1644.19	35019.88	157512.00
Rajampet	58911.00	71823.00	8877.00	5583.00	145194.00
Tirupati	33622.94	28450.18	6034.89	6788.70	74896.71
Total	442605.31	376020.60	66784.24	307490.39	1192900.54

Distribution of Canopy Classes in Zone - 5

Division	Dense	Open	Scrub	Non-forest Area Incl. Water bodies	Total Area
Anantapur	28856.73	66263.61	37406.88	62031.77	194559.00
Kurnool	2994.18	29941.76	39922.35	47397.71	120256.00
Total	31850.91	96205.38	77329.23	109429.48	314815.00

Distribution of Canopy Classes in Zone - 6

Division	Dense	Open	Scrub	Non-forest Area Incl. Water bodies	Total Area
Achampet	62618.98	135503.36	20530.81	23682.49	242335.64
Atmakur	75420.84	37710.42	5738.54	9707.79	128577.60
Giddalur	136437.17	41832.15	9653.57	32897.58	220820.47
Markapur	124249.08	61410.46	14995.58	26631.10	227286.22
Nandyal	82453.62	15879.96	610.77	7701.14	106645.48
Total	481179.68	292336.36	51529.27	100620.10	925665.41

Distribution of Canopy Classes in Zone - 7

Division	Dense	Open	Scrub	Non-forest Area Incl. Water bodies	Total Area
Guntur	32456.59	71628.34	11191.93	32337.63	147614.49
Krishna	27656.51	6245.02	1784.29	28766.18	64452.00
Nalgonda	1508.97	15844.20	9808.31	17492.62	44654.11
Nagarjuna Sagar	2081.50	30181.79	23937.28	22911.03	79111.61
Total	63703.57	123899.35	46721.82	101507.46	335832.20

Distribution of Canopy Classes in Andhra Pradesh

State	Dense	Open	Scrub	Non-forest Area Incl. Water bodies	Total Area
Andhra Pradesh	2830935.00	1949824.76	489890.55	1110780.39	6381430.70



Appendix-3

SPECIES AND VOLUME EQUATIONS USED

Volume Equation used in AP Forest Inventory

S.No./ Species Name	Volume Equation used	Remarks
1 <i>Acacia auriculaeformis</i>	$V=0.100961+4.03861D-56.387D^2+362.638D^3-668.176D^4$	Direct Equation
2 <i>Acacia caesia</i>	$V^{1/2}= -0.00142+2.61911D-0.54703(D)^{1/2}$	VE of <i>Acacia</i> spp
3 <i>Acacia chundra</i>	Zone1: $V= 0.04235-0.74240D+7.26875D^2$ Zone2: $V=-0.02384-0.72161D+7.46888D^2$ Zone3: $V= -0.048108+5.873169D^2$ Zone4: $V=-0.048108+5.873169D^2$ Zone5: $V=-0.02471+0.16897D+1.12083D^2+2.9328D^3$ Zone6: $V=-0.048108+5.873169D^2$ Zone7: $0.02384-0.72161D+7.46888D^2$	VE of <i>A. catechu</i>
4 <i>Acacia farnesiana</i>	Zone1: $V= 0.04235-0.74240D+7.26875D^2$ Zone2: $V=-0.02384-0.72161D+7.46888D^2$ Zone3: $V=-0.048108+5.873169D^2$ Zone4: $V=-0.048108+5.873169D^2$ Zone5: $V=-0.02471+0.16897D+1.12083D^2+2.9328D^3$ Zone6: $V=-0.048108+5.873169D^2$ Zone7: $V=0.02384-0.72161D+7.46888D^2$	VE of <i>A. catechu</i>
5 <i>Acacia ferruginea</i>	$V= -0.043832+3.262852D^2$	VE of <i>Albizia procera</i>
6 <i>Acacia latronum</i>	$V^{1/2}= -0.00142+2.61911D-0.54703(D)^{1/2}$	VE of <i>Acacia</i> spp
7 <i>Acacia leucophloea</i>	$V= -0.043832+3.262852D^2$	VE of <i>Albizia procera</i>
8 <i>Acacia nilotica</i>	$V^{1/2}= -0.00142+2.61911D-0.54703(D)^{1/2}$	VE of <i>Acacia</i> spp
9 <i>Acacia planifrons</i>	$V^{1/2}= -0.00142+2.61911D-0.54703(D)^{1/2}$	VE of <i>Acacia</i> spp
10 <i>Acacia sinuata</i>	$V^{1/2}= -0.00142+2.61911D-0.54703(D)^{1/2}$	VE of <i>Acacia</i> spp
11 <i>Acacia suma</i>	$V^{1/2}= -0.00142+2.61911D-0.54703(D)^{1/2}$	VE of <i>Acacia</i> spp
12 <i>Actinodaphne maderaspatana</i>	$V/D^2=0.25564/D^2-0.030418/D+0.0012897$ (Dia in cm)	VE of <i>Beilschmiedia roxburghiana</i>
13 <i>Adina cordifolia</i>	Zone1: $V = 0.09527-1.90716 D+13.30622 D^2-7.50357D^3$ Zone2: $V^{1/2}= -0.15336+2.802965D$ Zone3: $V^{1/2}= 0.21569+4.329878D-1.504977D^{1/2}$ Zone4: $V^{1/2}= 0.21569+4.329878D-1.504977D^{1/2}$ Zone5: $V^{1/2}= 0.21569+4.329878D-1.504977D^{1/2}$ Zone6: $V/D^2=0.4472/D^2-1.3527/D+13.437$ Zone7: $V/D^2=0.4472/D^2-1.3527/D+13.437$	Direct Equation Direct Equation Direct Equation Direct Equation Direct Equation Direct Equation Direct Equation
14 <i>Agiceras corniculatum</i>	$V=-0.04262+6.09491 D^2$	VE of <i>Bauhinia</i> spp
15 <i>Aegle marmelos</i>	$V= -0.49388+7.56417D-31.45373D^2+50.93877D^3$	VE of <i>Cordia</i> spp
16 <i>Aglaiia elaeagnoidea</i>	$V^{1/2}= -0.45312-0.41426D+2.10913D^{1/2}$	VE of <i>Trewia nudiflora</i>
17 <i>Ailanthus excelsa</i>	$V= - 0.09362+9.93014D^2$	VE of <i>Ailanthus grandis</i>
18 <i>Alangium salvifolium</i>	Zone1: $V= - 0.009510+4.149345D^2$ Zone2: $V= - 0.009510+4.149345D^2$ Zone3: $V^{1/2}=0.050294+3.115497D-0.687813D^1$ Zone4: $V^{1/2}=0.050294+3.115497D-0.687813D^{1/2}$ Zone5: $V^{1/2}=0.050294+3.115497D-0.687813D^{1/2}$	VE of <i>Wrightia tinctoria</i>

S.No./ Species Name	Volume Equation used	Remarks
	Zone6: $V^{1/2} = 0.050294 + 3.115497D - 0.687813D^{1/2}$	
	Zone7: $V = -0.009510 + 4.149345D^2$	
19 <i>Albizia amara</i>	$V^{1/2} = -0.00142 + 2.61911D - 0.54703(D)^{1/2}$	VE of <i>Acacia spp</i>
20 <i>Albizia lebbeck</i>	$V = 0.270 - 2.953 D + 12.336 D^2$	Direct Equation
21 <i>Albizia odoratissima</i>	$V = 0.270 - 2.953 D + 12.336 D^2$	VE of <i>Albizia lebbeck</i>
22 <i>Albizia procera</i>	$V = -0.043832 + 3.262852D^2$	Direct Equation
23 <i>Albizia stipulata</i>	$V^{1/2} = -0.25706 + 3.16251 D$	Direct Equation
24 <i>Alphonsea lutea</i>	$V = -0.03001 + 5.75523D^2$	VE of <i>Olea dioica</i>
25 <i>Alphonsea sclerocarpa</i>	$V = -0.03001 + 5.75523D^2$	VE of <i>Olea dioica</i>
26 <i>Alstonia scholaris</i>	$V^{1/2} = 0.13548 + 4.20022 D - 1.17365D^{1/2}$	VE of <i>Diospyros malabarica</i>
27 <i>Anacardium occidentale</i>	$V = -0.04262 + 6.09491 D^2$	VE of <i>Bauhinia spp</i>
28 <i>Anona squamosa</i>	$V = 0.17994 - 2.78776 D + 14.44961 D^2$ <i>antidysenterica</i>	VE of <i>Hollarhena</i>
29 <i>Anogeissus latifolia</i>	Zone1: $V = 0.034725 - 0.78412 D + 7.1873 D^2 + 6.9495 D^3$	Direct Equation
	Zone2: $V = 0.345341 - 4.684510D + 22.3767D^2 - 19.1675D^3$	Direct Equation
	Zone3: $V = 0.055883 + 5.603009 D^3$	Direct Equation
	Zone4: $V = 0.055883 + 5.603009 D^3$	Direct Equation
	Zone5: $V = 0.055883 + 5.603009 D^3$	Direct Equation
	Zone6: $V = 0.055883 + 5.603009 D^3$	Direct Equation
	Zone7: $V = 0.055883 + 5.603009 D^3$	Direct Equation
30 <i>Anogeissus acuminata</i>	$V^{1/2} = -0.07109 + 2.99732 D - 0.26953 D^{1/2}$	VE of <i>Albizia spp</i>
31 <i>Anthocephalus kadamba</i>	$V = -0.0189 + 0.0008073 D^2$	
32 <i>Antidesma bunius</i>	$V = 0.076 - 1.319 D + 11.370 D^2$	VE of <i>Artocarpus hirsuta</i>
33 <i>Antidesma</i>		VE of <i>Artocarpus</i>
<i>ghaesebilla</i>	$V = 0.076 - 1.319 D + 11.370 D^2$	<i>hirsuta</i>
34 <i>Antidesma menasu</i>	$V = 0.076 - 1.319 D + 11.370 D^2$	VE of <i>Artocarpus hirsuta</i>
35 <i>Artocarpus</i>		VE of <i>Artocarpus</i>
<i>heterophyllus</i>	$V = 0.076 - 1.319 D + 11.370 D^2$	<i>hirsuta</i>
36 <i>Artocarpus hirsuta</i>	$V = 0.076 - 1.319 D + 11.370 D^2$	Direct Equation
37 <i>Artocarpus lakoocha</i>	$V^{1/2} = -0.066962 + 2.61991 D$	Direct Equation
38 <i>Atlantia monophylla</i>	$V = -0.03510 + 5.32981D^2$	VE of <i>Mellia azedarch</i>
39 <i>Avicenia marina</i>	$V = -0.04262 + 6.09491 D^2$	VE of <i>Bauhinia spp</i>
40 <i>Avicenia officinalis</i>	$V = -0.04262 + 6.09491 D^2$	VE of <i>Bauhinia spp</i>
41 <i>Azadirachta indica</i>	$V = 0.270 - 2.953 D + 12.336 D^2$	VE of <i>Albizia lebbeck</i>
42 <i>Balanites roxburghii</i>	$V = 0.011617 - 0.309699 D + 4.629527 D^2$	VE of <i>Cleistanthus collinus</i>
43 <i>Baliospermum montanum</i>	$V = 0.17994 - 2.78776 D + 14.44961 D^2$	VE of <i>Holarrhena antidysenterica</i>
44 <i>Barringtonia acutangula</i>	$V = 0.011617 - 0.309699 D + 4.629527 D^2$	VE of <i>Cleistanthus collinus</i>
45 <i>Bauhinia malabarica</i>	$V = -0.04262 + 6.09491 D^2$	VE of <i>Bauhinia spp</i>
46 <i>Bauhinia purpurea</i>	$V = -0.04262 + 6.09491 D^2$	VE of <i>Bauhinia spp</i>
47 <i>Bauhinia racemosa</i>	$V = -0.04262 + 6.09491 D^2$	VE of <i>Bauhinia spp</i>
48 <i>Bauhinia retusa</i>	$V = -0.04262 + 6.09491 D^2$	VE of <i>Bauhinia spp</i>
49 <i>Bauhinia variegata</i>	$V = -0.04262 + 6.09491 D^2$	VE of <i>Bauhinia spp</i>

S.No./ Species Name	Volume Equation used	Remarks
50 <i>Beilschmiedia roxburghiana</i>	$V/D^2=0.25564/D^2-0.030418/D+0.0012897$ (Dia in cm)	Direct Equation
51 <i>Bischofia javanica</i>	$V = 0.25771-2.33118D+11.12071D^2$	Direct Equation
52 <i>Bombax ceiba</i>	Zone1: $V/D^2= 0.18573/D^2-2.85418/D+15.03576$	Direct Equation
	Zone2: $V/D^2 =0.136196/D^2-2.07674/D+10.1566$	Direct Equation
	Zone3: $V/D^2= 0.18573/D^2-2.85418/D+15.03576$	Direct Equation
	Zone4: $V/D^2= 0.18573/D^2-2.85418/D+15.03576$	Direct Equation
	Zone5: $V/D^2= 0.18573/D^2-2.85418/D+15.03576$	Direct Equation
	Zone6: $V/D^2= 0.18573/D^2-2.85418/D+15.03576$	Direct Equation
	Zone7: $V/D^2= 0.18573/D^2-2.85418/D+15.03576$	Direct Equation
53 <i>Cochlospermum religiosum</i>	$V = 0.028917+7.77704D^3$	Direct Equation
54 <i>Boswellia serrata</i>	Zone1: $V/D = -0.76369/D+0.710215+0.4976D+11.0387D^2$	Direct Equation
	Zone2: $V = 0.36432-1.32768(D)^{1/2}+9.48471D^2$	
	Zone3: $V = 0.028917+7.77704D^3$	
	Zone4: $V = 0.028917+7.77704D^3$	
	Zone5: $V = 0.028917+7.77704D^3$	
	Zone6: $V = 0.028917+7.77704D^3$	
	Zone7: $V = 0.028917+7.77704D^3$	
55 <i>Boswellia ovalifoliolata</i>	Zone1: $V/D = -0.76369/D+0.710215+0.4976D+11.0387D^2$	VE of <i>Boswellia serrata</i>
	Zone2: $V = 0.36432-1.32768(D)^{1/2}+9.48471D^2$	
	Zone3: $V = 0.028917+7.77704D^3$	
	Zone4: $V = 0.028917+7.77704D^3$	
	Zone5: $V = 0.028917+7.77704D^3$	
	Zone6: $V = 0.028917+7.77704D^3$	
	Zone7: $V = 0.028917+7.77704D^3$	
56 <i>Boswellia serrata</i>	Zone1: $V/D = -0.76369/D+0.710215+0.4976D+11.0387D^2$	Direct Equation
	Zone2: $V = 0.36432-1.32768(D)^{1/2}+9.48471D^2$	Direct Equation
	Zone3: $V = 0.028917+7.77704D^3$	Direct Equation
	Zone4: $V = 0.028917+7.77704D^3$	Direct Equation
	Zone5: $V = 0.028917+7.77704D^3$	Direct Equation
	Zone6: $V = 0.028917+7.77704D^3$	Direct Equation
	Zone7: $V = 0.028917+7.77704D^3$	Direct Equation
57 <i>Breynia vitis-idaea</i>	$V =0.17994-2.78776D+14.44961D^2$	VE of <i>Holarrhena antidysenterica</i>
58 <i>Bridelia cinerascens</i>	$V = 0.027354+4.663714D^2$	VE of <i>Ziziphus xylopyrus</i>
59 <i>Bridelia hamiltoniana</i> <i>B. montana</i>	$V = 0.027354+4.663714D^2$	VE of <i>Ziziphus xylopyrus</i>
60 <i>Bridelia retusa</i>	$V/D = 0.035142/D-0.839708+8.157614D$	
61 <i>Broussonetia papyrifera</i>	$V^{1/2} = -0.10185087+3.0746775D$	
62 <i>Bruguiera cylindrica</i>	$V= -0.009510+4.149345D^2$	VE of <i>Wrightia tinctoria</i>
63 <i>Bruguiera gymnorrhiza</i>	$V= -0.009510+4.149345D^2$	VE of <i>Wrightia tinctoria</i>
64 <i>Buchanania axillaris</i>	$V= -0.309862+5.7058D-31.819D^2+72.355D^3$	Direct Equation
65 <i>Buchanania lanceolata</i>	$V= -0.309862+5.7058D-31.819D^2+72.355D^3$	VE of <i>Buchanania angustifolia</i>
66 <i>Buchanania lanzan</i>	Zone1: $V=0.019341-0.262689D+4.293135D^2$	Direct Equation
	Zone2: $V = V=0.031-0.64087D+6.04066D^2$	Direct Equation

S.No./ Species Name	Volume Equation used	Remarks
	Zone3: $V=0.019341-0.262689D+4.293135D^2$	Direct Equation
	Zone4: $V = 0.019341-0.262689D+4.293135D^2$	Direct Equation
	Zone5: $V = 0.019341-0.262689D+4.293135D^2$	Direct Equation
	Zone6: $V = 0.019341-0.262689D+4.293135D^2$	Direct Equation
	Zone7: $V =0.019341-0.262689D+4.293135D^2$	Direct Equation
67 <i>Buddleia asiatica</i>	$V=0.17994-2.78776D+14.44961D^2$	VE of <i>Holarrhena antidysenterica</i>
68 <i>Bursera serrata</i>	$V= 0.051812-1.076790D+7.991280D^2$	VE of <i>Terminalia tomentosa</i>
69 <i>Butea monospema</i>	$V=-0.49388+7.56417D-31.45373D^2+50.93877D^3$	VE of <i>Cordia spp</i>
70 <i>Callicarpa arborea</i>	$V^{1/2}= -0.04506+2.33446D$	VE of <i>Callicarpa spp</i>
71 <i>Calophyllum inophyllum</i>	$V=0.14429-1.75632D+10.61539D^2$	Direct Equation
72 <i>Canthium dicoccum</i>	$V= 0.011617-0.309699D+4.629527D^2$	VE of <i>Cleistanthus collinus</i>
73 <i>Canthium parviflorum</i>	$V=0.17994-2.78776D+14.44961D^2$	VE of <i>Holarrhena antidysenterica</i>
74 <i>Casearia elliptica</i>	$V=0.14031-2.06478D+11.25750D^2$	VE of <i>Casearia spp</i>
75 <i>Casearia esculenta</i>	$V=0.14031-2.06478D+11.25750D^2$	VE of <i>Casearia spp</i>
76 <i>Cassia fistula</i>	$V = 0.14451-0.0313827D+0.0010286D^2$	Direct Equation
77 <i>Cassia siamea</i>	$V = 0.05159-0.53331D+3.46016D^2+10.18473D^3$	Direct Equation
78 <i>Cassine glauca</i>	$V^{1/2}= -0.45312-0.41426D+2.10913D^{1/2}$	VE of <i>Trewia nudiflora</i>
79 <i>Ceiba pentandra</i>	$V/D^2= 0. 18573/D^2-2.85418/D+15.03576$	VE of <i>Bombax ceiba</i>
80 <i>Chloroxylon swietenia</i>	$V= -0.003156+2.043969D^2$	Direct Equation
81 <i>Cochlospermum religiosum</i>	$V = 0.028917+7.77704D^3$	VE of <i>cochlospermum gosshipium</i>
82 <i>Chukrasia tabularis</i>	$V= -0.07559+9.23051D^2$	Direct Equation
83 <i>Cinnamomum zeylanicum</i>	$V = 0.089-1.242D+9.732D^2$	Direct Equation
84 <i>Cleistanthus collinus</i>	Zone1: $V = 0.011617 - 0.309699 D + 4.629527 D^2$	Direct Equation
	Zone2: $V = 0.030925-0.567037D+5.709471D^2$	Direct Equation
	Zone3: $V = 0.011617 - 0.309699 D + 4.629527 D^2$	Direct Equation
	Zone4: $V = 0.011617 - 0.309699 D + 4.629527 D^2$	Direct Equation
	Zone5: $V = 0.011617 - 0.309699 D + 4.629527 D^2$	Direct Equation
	Zone6: $V = 0.011617 - 0.309699 D + 4.629527 D^2$	Direct Equation
	Zone7: $V = 0.011617 - 0.309699 D + 4.629527 D^2$	Direct Equation
85 <i>Clerodendrum phlomidis</i>	$V=0.17994-2.78776D+14.44961D^2$	VE of <i>Holarrhena antidysenterica</i>
86 <i>Cordia dichotoma</i>	$V= -0.49388+7.56417D-31.45373D^2+50.93877D^3$	Direct Equation
87 <i>Cordia macleodii</i>	$V= -0.49388+7.56417D-31.45373D^2+50.93877D^3$	VE of <i>Cordia spp</i>
88 <i>Cordia walichii</i>	$V= -0.49388+7.56417D-31.45373D^2+50.93877D^3$	VE of <i>Cordia spp</i>
89 <i>Crataeva religiona</i> (<i>Crataeva religiosa</i>)	Zone1: $V= -0.009510+4.149345D^2$	VE of <i>Wrightia tinctoria</i>
	Zone2: $V^{1/2} = 0.050294+3.115497D-0.687813D^{1/2}$	Direct Equation
	Zone3: $V^{1/2} = 0.050294+3.115497D-0.687813D^{1/2}$	Direct Equation
	Zone4: $V^{1/2} = 0.050294+3.115497D-0.687813D^{1/2}$	Direct Equation
	Zone5: $V^{1/2} = 0.050294+3.115497D-0.687813D^{1/2}$	Direct Equation
	Zone6: $V^{1/2} = 0.050294+3.115497D-0.687813D^{1/2}$	Direct Equation
	Zone7: $V^{1/2} = 0.050294+3.115497D-0.687813D^{1/2}$	Direct Equation
90 <i>Dalbergia lanceolaria</i>	$V=0.265-3.135D+12.771D^2$	VE of <i>Dalbergia latifolia</i>

S.No./ Species Name	Volume Equation used	Remarks
91 <i>Dalbergia latifolia</i>	$V=0.265-3.135D+12.771D^2$	
92 <i>Dalbergia paniculata</i>	$V=0.265-3.135D+12.771D^2$	VE of <i>Dalbergia latifolia</i>
93 <i>Dalbergia sissoo</i>	$V^{1/2} = -0.3238+3.0077D$	Direct Equation
94 <i>Delonix regia</i>	$V = 0.05159-0.53331D+3.46016D^2+10.18473D^3$	VE of <i>Cassia siamea</i>
95 <i>Desmodium oojainensis</i>	Zone1: $V=0.025941-0.832619D+8.285841D^2$	Direct Equation
	Zone2: $V^{1/2}=0.03456+3.8192D-0.080884D^{1/2}$	Direct Equation
	Zone3: $V^{1/2}= -0.469152+1.403410D+1.42555D^{1/2}$	Direct Equation
	Zone4: $V^{1/2}= -0.469152+1.403410D+1.42555D^{1/2}$	Direct Equation
	Zone5: $V^{1/2}= -0.469152+1.403410D+1.42555D^{1/2}$	Direct Equation
	Zone6: $V^{1/2}= -0.469152+1.403410D+1.42555D^{1/2}$	Direct Equation
	Zone 7: $V^{1/2}= -0.469152+1.403410D+1.42555D^{1/2}$	Direct Equation
96 <i>Dillenia bracteata</i>	$V^{1/2}=0.05376+3.73731D-0.79622D^{1/2}$	VE of <i>Dillenia indica</i>
97 <i>Dillenia indica</i>	$V^{1/2}=0.05376+3.73731D-0.79622D^{1/2}$	Direct Equation
98 <i>Dillenia pentagyna</i>	$V = 0.070-1.295D +9.429 D^2$	Direct Equation
99 <i>Diospyros Candolleana</i>	Zone1: $V= -0.03915+0.16295D+4.09182D^2$	VE of <i>Cleistanthus collinus</i>
	Zone2: $V= -0.019404+3.802027D^2$	Direct Equation
	Zone3: $V = 0.011617 - 0.309699 D + 4.629527 D^2$	Direct Equation
	Zone4: $V = 0.011617 - 0.309699 D + 4.629527 D^2$	Direct Equation
	Zone5: $V = 0.011617 - 0.309699 D + 4.629527 D^2$	Direct Equation
	Zone6: $V = 0.011617 - 0.309699 D + 4.629527 D^2$	Direct Equation
	Zone7: $V = 0.011617 - 0.309699 D + 4.629527 D^2$	Direct Equation
100 <i>Diospyros chloroxylon</i>	Zone1: $V= -0.03915+0.16295D+4.09182D^2$	VE of <i>Cleistanthus collinus</i>
	Zone2: $V= -0.019404+3.802027D^2$	Direct Equation
	Zone3: $V = 0.011617 - 0.309699 D + 4.629527 D^2$	Direct Equation
	Zone4: $V = 0.011617 - 0.309699 D + 4.629527 D^2$	Direct Equation
	Zone5: $V = 0.011617 - 0.309699 D + 4.629527 D^2$	Direct Equation
	Zone6: $V = 0.011617 - 0.309699 D + 4.629527 D^2$	Direct Equation
	Zone7: $V = 0.011617 - 0.309699 D + 4.629527 D^2$	Direct Equation
101 <i>Diospyros cordifolia</i>	$V= -0.03915+0.16295D+4.09182D^2$	VE of <i>Cleistanthus collinus</i>
102 <i>Diospyros ebenum</i>	$V^{1/2}= 0.92625+7.86461D-4.67222(D)^{1/2}$	VE of <i>Diospyros spp</i>
103 <i>Diospyros melanoxyton</i>	$V = 0.024814-0.578532D+6.11017D^2$	Direct Equation
104 <i>Diospyros montana</i>	Zone1: $V= -0.03915+0.16295D+4.09182D^2$	VE of <i>Cleistanthus collinus</i>
	Zone2: $V= -0.019404+3.802027D^2$	Direct Equation
	Zone3: $V = 0.011617 - 0.309699 D + 4.629527 D^2$	Direct Equation
	Zone4: $V = 0.011617 - 0.309699 D + 4.629527 D^2$	Direct Equation
	Zone5: $V = 0.011617 - 0.309699 D + 4.629527 D^2$	Direct Equation
	Zone6: $V = 0.011617 - 0.309699 D + 4.629527 D^2$	Direct Equation
	Zone7: $V = 0.011617 - 0.309699 D + 4.629527 D^2$	Direct Equation
105 <i>Diospyros ovalifolia</i>	Zone1: $V= -0.03915+0.16295D+4.09182D^2$	VE of <i>Cleistanthus collinus</i>
	Zone2: $V= -0.019404+3.802027D^2$	Direct Equation
	Zone3: $V = 0.011617 - 0.309699 D + 4.629527 D^2$	Direct Equation
	Zone4: $V = 0.011617 - 0.309699 D + 4.629527 D^2$	Direct Equation
	Zone5: $V = 0.011617 - 0.309699 D + 4.629527 D^2$	Direct Equation
	Zone6: $V = 0.011617 - 0.309699 D + 4.629527 D^2$	Direct Equation

S.No./ Species Name	Volume Equation used	Remarks
	Zone7: $V = 0.011617 - 0.309699 D + 4.629527 D^2$	Direct Equation
106 <i>Diospyros peregrina</i>	$V = 0.024814 - 0.578532D + 6.11017D^2$	VE of <i>Diospyros melanoxylon</i>
107 <i>Diospyros sylvatica</i>	$V = 0.024814 - 0.578532D + 6.11017D^2$	VE of <i>Diospyros melanoxylon</i>
108 <i>Diospyros tomentosa</i>	$V = 0.024814 - 0.578532D + 6.11017D^2$	VE of <i>Diospyros melanoxylon</i>
109 <i>Dolichandrone crispata</i>	$V = 0.019341 - 0.262689D + 4.293135D^2$	VE of <i>Buchanania latifolia</i>
110 <i>Dolichandrone falcata</i>	$V = -0.04262 + 6.09491D^2$	VE of <i>Bauhinia spp</i>
111 <i>Derris indica</i>	$V = 0.091153 - 1.66153D + 10.24624D^2$	VE of <i>Pongamia pinnata</i>
112 <i>Ehretia acuminata</i> var. <i>serrata</i>	$V = -0.03844 + 0.946490D - 5.40987D^2 + 33.17338D^3$	VE of <i>Ehretia laevis</i>
113 <i>Ehretia laevis</i>	$V = -0.03844 + 0.946490D - 5.40987D^2 + 33.17338D^3$	Direct Equation
114 <i>Elaeocarpus lucidus</i>	$V^{1/2} = -0.00273 + 2.56199D$	VE of <i>Bischofia javanica</i>
115 <i>Eriolaena hookeriana</i>	$V = 0.018620 + 13.916741D^3$	VE of <i>Grewia tiliaefolia</i>
116 <i>Erythroxylum monogynum</i>	$V = 0.17994 - 2.78776 D + 14.44961 D^2$	VE of <i>Holarrhena antidysenterica</i>
117 <i>Erythrina variegata</i>	$V = -0.07803 + 1.70258D - 9.16180D^2 + 33.91455D^3$	VE of <i>Erythrina spp</i>
118 <i>Erythrina indica</i>	$V = -0.07803 + 1.70258D - 9.16180D^2 + 33.91455D^3$	VE of <i>Erythrina spp</i>
119 <i>Erythrina suberosa</i>	$V = -0.07803 + 1.70258D - 9.16180D^2 + 33.91455D^3$	VE of <i>Erythrina spp</i>
120 <i>Eucalyptus camaldulensis</i>	$V = 0.02894 - 0.89284D + 8.72416D^2$	VE of <i>Eucalyptus spp</i>
121 <i>Eucalyptus tereticornis</i>	$V = 0.02894 - 0.89284D + 8.72416D^2$	VE of <i>Eucalyptus spp</i>
122 <i>Eugenia caryophyllata</i>	$V = -0.02792 + 0.92933D - 5.56465D^2 + 25.77488D^3$	VE of <i>Eugenia spp</i>
123 <i>Excoecaria agallocha</i>	$V^{1/2} = 0.03629 + 3.95389D - 0.84421(D)^{1/2}$	VE of <i>Ficus spp</i>
124 <i>Ficus tsjela</i>	$V^{1/2} = 0.03629 + 3.95389D - 0.84421(D)^{1/2}$	VE of <i>Ficus spp</i>
125 <i>Ficus arnottiana</i>	$V^{1/2} = 0.03629 + 3.95389D - 0.84421(D)^{1/2}$	VE of <i>Ficus spp</i>
126 <i>Ficus benghalensis</i>	$V^{1/2} = 0.03629 + 3.95389D - 0.84421(D)^{1/2}$	VE of <i>Ficus spp</i>
127 <i>Ficus benjamina</i>	$V^{1/2} = 0.03629 + 3.95389D - 0.84421(D)^{1/2}$	VE of <i>Ficus spp</i>
128 <i>Ficus carica</i>	$V^{1/2} = 0.03629 + 3.95389D - 0.84421(D)^{1/2}$	VE of <i>Ficus spp</i>
129 <i>Ficus heterophylla</i>	$V^{1/2} = 0.03629 + 3.95389D - 0.84421(D)^{1/2}$	VE of <i>Ficus spp</i>
130 <i>Ficus hispida</i>	$V^{1/2} = 0.03629 + 3.95389D - 0.84421(D)^{1/2}$	VE of <i>Ficus spp</i>
131 <i>Ficus infectoria</i>	$V^{1/2} = 0.03629 + 3.95389D - 0.84421(D)^{1/2}$	VE of <i>Ficus spp</i>
132 <i>Ficus krishnae</i>	$V^{1/2} = 0.03629 + 3.95389D - 0.84421(D)^{1/2}$	VE of <i>Ficus spp</i>
133 <i>Ficus lucenses</i>	$V^{1/2} = 0.03629 + 3.95389D - 0.84421(D)^{1/2}$	VE of <i>Ficus spp</i>
134 <i>Ficus microcarpa</i> / <i>F. retusa</i>)	$V^{1/2} = 0.03629 + 3.95389D - 0.84421(D)^{1/2}$	VE of <i>Ficus spp</i>
135 <i>Ficus mollis</i>	$V^{1/2} = 0.03629 + 3.95389D - 0.84421(D)^{1/2}$	VE of <i>Ficus spp</i>
136 <i>Ficus mysorensis</i>	$V^{1/2} = 0.03629 + 3.95389D - 0.84421(D)^{1/2}$	VE of <i>Ficus spp</i>
137 <i>Ficus racemosa</i>	$V^{1/2} = 0.03629 + 3.95389D - 0.84421(D)^{1/2}$	VE of <i>Ficus spp</i>
138 <i>Ficus religiosa</i>	$V^{1/2} = 0.03629 + 3.95389D - 0.84421(D)^{1/2}$	VE of <i>Ficus spp</i>
139 <i>Ficus tinctoria</i>	$V^{1/2} = 0.03629 + 3.95389D - 0.84421(D)^{1/2}$	VE of <i>Ficus spp</i>
140 <i>Firmiana colorata</i>	$V^{1/2} = -0.08150 + 2.48467D$	VE of <i>Pterospermum spp</i>
141 <i>Garcinia spicata</i>	$V^{1/2} = -0.08150 + 2.48467D$	VE of <i>Pterospermum spp</i>
142 <i>Garcinia xanthochymus</i>	$V^{1/2} = 0.13548 + 4.20022D - 1.17365(D)^{1/2}$	VE of <i>Diospyros malabarica</i>
143 <i>Gardenia latifolia</i>	Zone1: $V = -0.009510 + 4.149345D^2$	VE of <i>Wrightia tinctoria</i>

S.No./ Species Name	Volume Equation used	Remarks
	Zone2: $V = -0.009510 + 4.149345D^2$	Direct Equation
	Zone3: $V^{1/2} = 0.050294 + 3.115497D - 0.687813(D)^{1/2}$	Direct Equation
	Zone4: $V^{1/2} = 0.050294 + 3.115497D - 0.687813(D)^{1/2}$	Direct Equation
	Zone5: $V^{1/2} = 0.050294 + 3.115497D - 0.687813(D)^{1/2}$	Direct Equation
	Zone6: $V^{1/2} = 0.050294 + 3.115497D - 0.687813(D)^{1/2}$	Direct Equation
	Zone7: $V^{1/2} = 0.050294 + 3.115497D - 0.687813(D)^{1/2}$	Direct Equation
144 <i>Gardenia turgida</i>	Zone1: $V = -0.009510 + 4.149345D^2$	VE of <i>Wrightia tinctoria</i>
	Zone2: $V = -0.009510 + 4.149345D^2$	Direct Equation
	Zone3: $V^{1/2} = 0.050294 + 3.115497D - 0.687813(D)^{1/2}$	Direct Equation
	Zone4: $V^{1/2} = 0.050294 + 3.115497D - 0.687813(D)^{1/2}$	Direct Equation
	Zone5: $V^{1/2} = 0.050294 + 3.115497D - 0.687813(D)^{1/2}$	Direct Equation
	Zone6: $V^{1/2} = 0.050294 + 3.115497D - 0.687813(D)^{1/2}$	Direct Equation
	Zone7: $V^{1/2} = 0.050294 + 3.115497D - 0.687813(D)^{1/2}$	Direct Equation
145 <i>Garuga pinnata</i>	$V = 0.034 - 0.901D + 6.898D^2$	Direct Equation
146 <i>Givotia rottleriformis</i>	$V = 0.034 - 0.901D + 6.898D^2$	VE of <i>Garuga pinnata</i>
147 <i>Gliricidia maculata</i>	$V = 0.05159 - 0.53331D + 3.46016D^2 + 10.18473D^3$	VE of <i>Cassia siamea</i>
148 <i>Glochidion zeylanicum</i>	$V^{1/2} = 0.13548 + 4.20022D - 1.17365(D)^{1/2}$	VE of <i>Diospyros malabarica</i>
149 <i>Glochidion velutinum</i>	$V^{1/2} = 0.13548 + 4.20022D - 1.17365(D)^{1/2}$	VE of <i>Diospyros malabarica</i>
150 <i>Glycosmis pentaphylla</i>	$V = 0.17994 - 2.78776 D + 14.44961 D^2$	VE of <i>Holarrhena antidysenterica</i>
151 <i>Gmelina arborea</i>	$V = 0.25058 - 3.55124D + 16.41720D^2 - 8.32129D^3$	Direct Equation
152 <i>Grevillea robusta</i>	$V = 0.02834 + 4.68381D^2$	VE of <i>Bombax ceiba</i>
153 <i>Grewia tiliaefolia</i>	$V = 0.018620 + 13.916741D^3$	
154 <i>Guazuma ulmifolia</i>	$V = 0.018620 + 13.916741D^3$	VE of <i>Grewia tiliaefolia</i>
155 <i>Gymnosporia spinosa</i>	$V = 0.17994 - 2.78776 D + 14.44961 D^2$	VE of <i>Holarrhena antidysenterica</i>
156 <i>Gyrocarpus americanus</i>	$V = 0.034 - 0.901D + 6.898D^2$	VE of <i>Garuga pinnata</i>
157 <i>Hardwickia binata</i>	$V = 0.046883 - 0.894379D + 7.220441D^2$	VE of <i>Madhuca latifolia</i>
158 <i>Heterophragma quadriloculare</i>	$V = 1.38791 - 12.52739D + 30.51466D^2 - 9.65242D^3$	VE of <i>Sterospermum personatum</i>
159 <i>Hibiscus tiliaceus</i>	$V = 0.0589 + 0.000956D^2$	VE of <i>Hibiscus macrophyllus</i>
160 <i>Hibiscus platanifolius</i>	$V = 0.0589 + 0.000956D^2$	VE of <i>Hibiscus macrophyllus</i>
161 <i>Hildegardia populifolia</i>	$V = 0.034 - 0.901D + 6.898D^2$	VE of <i>Garuga pinnata</i>
162 <i>Holarrhena pubescens /antidysenterica</i>	$V = 0.17994 - 2.78776 D + 14.44961 D^2$	VE of <i>Holarrhena antidysenterica</i>
163 <i>Holoptelea integrifolia</i>	$V = 1.38791 - 12.52739D + 30.51466D^2 - 9.65242D^3$	VE of <i>Sterospermum personatum</i>
164 <i>Homalium nepalense</i>	$V = 1.38791 - 12.52739D + 30.51466D^2 - 9.65242D^3$	VE of <i>Sterospermum personatum</i>
165 <i>Hymenictryn excelsum / H. orixense</i>	$V/D^2 = 0.15698/D^2 - 2.75681/D + 14.19521$	Direct Equation
166 <i>Ixora arborea // . parviflora / I .arborea</i>	Zone1: $V = 0.011617 - 0.309699D + 4.629527D^2$	VE of <i>Cleistanthus collinus</i>
	Zone2: $V = 0.030925 - 0.567037D + 5.709471D^2$	Direct Equation
	Zone3: $V = 0.011617 - 0.309699D + 4.629527D^2$	Direct Equation
	Zone4: $V = 0.011617 - 0.309699D + 4.629527D^2$	Direct Equation
	Zone5: $V = 0.011617 - 0.309699D + 4.629527D^2$	Direct Equation

S.No./ Species Name	Volume Equation used	Remarks
	Zone6: $V=0.011617-0.309699D+4.629527D^2$	Direct Equation
	Zone7: $V=0.011617-0.309699D+4.629527D^2$	Direct Equation
167 <i>Ixora pavetta</i>	Zone1: $V=0.011617-0.309699D+4.629527D^2$	VE of <i>Cleistanthus collinus</i>
	Zone2: $V = 0.030925-0.567037D+5.709471D^2$	Direct Equation
	Zone3: $V=0.011617-0.309699D+4.629527D^2$	Direct Equation
	Zone4: $V=0.011617-0.309699D+4.629527D^2$	Direct Equation
	Zone5: $V=0.011617-0.309699D+4.629527D^2$	Direct Equation
	Zone6: $V=0.011617-0.309699D+4.629527D^2$	Direct Equation
	Zone7: $V=0.011617-0.309699D+4.629527D^2$	Direct Equation
168 <i>Kydia calycina</i>	$V = 0.72892+0.0015117D^2-0.25727(D)^{1/2}(\text{Dia in cm})$	Direct Equation
169 <i>Lagerstroemia parviflora</i>	$V = 0.066188-1.334512D+9.403257D^2$	Direct Equation
170 <i>Lannea coromandelica</i>	$V = 0.091153-1.66153D+10.24624D^2$	Direct Equation
171 <i>Litsea decanensis</i>	$V=0.12652-0.018037D+0.000956D^2$	VE of <i>Lisea spp</i>
172 <i>Litsea glutinosa</i>	$V=0.12652-0.018037D+0.000956D^2$	VE of <i>Lisea spp</i>
173 <i>Litsea monopetala</i>	$V=0.12652-0.018037D+0.000956D^2$	VE of <i>Lisea spp</i>
174 <i>Macaranga peltata</i>	$V = 0.13333-2.18825D+13.12678D^2$	Direct Equation
175 <i>Madhuca indica</i>	Zone1: $V/D^2=0.025091/D^2-0.185618/D+3.561089+10.801390D$	Direct Equation
	Zone2: $V = -0.00092-0.55547D+7.34460D^2$	Direct Equation
	Zone3: $V= 0.00092-0.55547D+7.34460D^2$	Direct Equation
	Zone4: $V =0.00092-0.55547D+7.34460D^2$	Direct Equation
	Zone5: $V = 0.00092-0.55547D+7.34460D^2$	Direct Equation
	Zone6: $V = 0.00092-0.55547D+7.34460D^2$	Direct Equation
	Zone7 $V =:0.00092-0.55547D+7.34460D^2$	Direct Equation
176 <i>Madhuca longifolia</i>	Zone1: $V/D^2=0.025091/D^2-0.185618/D+3.561089+10.801390D$	VE of <i>Madhuca latifolia</i>
	Zone2: $V = -0.00092-0.55547D+7.34460D^2$	Direct Equation
	Zone3: $V= 0.00092-0.55547D+7.34460D^2$	Direct Equation
	Zone4: $V =0.00092-0.55547D+7.34460D^2$	Direct Equation
	Zone5: $V = 0.00092-0.55547D+7.34460D^2$	Direct Equation
	Zone6: $V = 0.00092-0.55547D+7.34460D^2$	Direct Equation
	Zone7 $V =:0.00092-0.55547D+7.34460D^2$	Direct Equation
177 <i>Mallotus philippensis</i>	$V = 0.14749-2.87503D+19.61977D^2-19.11630D^3$	Direct Equation
178 <i>Mangifera indica</i>	$V=0.288-2.913D+13.869D^2$	Direct Equation
179 <i>Manilkara hexandra</i>	Zone1: $V=0.011617-0.309699D+4.629527D^2$	VE of <i>Cleistanthus collinus</i>
	Zone2: $V = 0.030925-0.567037D+5.709471D^2$	Direct Equation
	Zone3: $V=0.011617-0.309699D+4.629527D^2$	Direct Equation
	Zone4: $V=0.011617-0.309699D+4.629527D^2$	Direct Equation
	Zone5: $V=0.011617-0.309699D+4.629527D^2$	Direct Equation
	Zone6: $V=0.011617-0.309699D+4.629527D^2$	Direct Equation
	Zone7: $V=0.011617-0.309699D+4.629527D^2$	Direct Equation
180 <i>Melia azedarach</i>	$V= - 0.03510+5.32981D^2$	Direct Equation
181 <i>Mesua ferrea</i>	$V=0.09252-1.95124D+13.51055D^2$	Direct Equation
182 <i>Michelia champaca</i>	$V^{1/2}=0.37142+5.64184D-2.27448(D)^{1/2}$	VE of <i>Michelia spp</i>
183 <i>Miliusa tomentosa</i>	$V^{1/2} = 0.66382+7.03093D-3.68133(D)^{1/2}$	VE of <i>Miliusa spp</i>
184 <i>Miliusa velutina</i>	$V^{1/2} = 0.66382+7.03093D-3.68133(D)^{1/2}$	VE of <i>Miliusa spp</i>
185 <i>Mitragyna parvifolia</i>	Zone1: $V=0.048795-1.241364D+9.496613D^2$	Direct Equation

S.No./ Species Name	Volume Equation used	Remarks
	Zone2: $V=0.08444-1.26801D+8.75274D^2$	Direct Equation
	Zone3: $V/D^2=0.099768/D^2-1.744274/D+10.086934$	Direct Equation
	Zone4: $V/D^2=0.099768/D^2-1.744274/D+10.086934$	Direct Equation
	Zone5: $V/D^2=0.099768/D^2-1.744274/D+10.086934$	Direct Equation
	Zone6: $V/D^2=0.099768/D^2-1.744274/D+10.086934$	Direct Equation
	Zone7: $V/D^2=0.099768/D^2-1.744274/D+10.086934$	Direct Equation
186 <i>Morinda citrifolia</i>	$V= -0.49388+7.56417D-31.45373D^2+50.93877D^3$	VE of <i>cordia species</i>
187 <i>Morinda tinctoria</i>	$V= -0.49388+7.56417D-31.45373D^2+50.93877D^3$	Direct Equation
188 <i>Mundulea sericea</i>	$V = 0.027354+4.663714D^2$	VE of <i>Ziziphus xylopyros</i>
189 <i>Mundulea suberosa</i>	$V = 0.027354+4.663714D^2$	VE of <i>Ziziphus xylopyros</i>
190 <i>Naringi crenulata</i> <i>/Limonia acidissima</i>	$V= -0.49388+7.56417D-31.45373D^2+50.93877D^3$	VE of <i>Cordia species</i>
191 <i>Nauclea orientalis</i>	Zone1: $V= 0.048795-1.241364D+9.496613D^2$	VE of <i>Mitragyna parvifolia</i>
	Zone2: $V= 0.048795-1.241364D+9.496613D^2$	Direct Equation
	Zone3: $V/D^2= 0.099768/D^2-1.744274/D+10.086934$	Direct Equation
	Zone4: $V/D^2=0.099768/D^2-1.744274/D+10.086934$	Direct Equation
	Zone5: $V/D^2=0.099768/D^2-1.744274/D+10.086934$	Direct Equation
	Zone6: $V/D^2=0.099768/D^2-1.744274/D+10.086934$	Direct Equation
	Zone7: $V/D^2=0.099768/D^2-1.744274/D+10.086934$	Direct Equation
192 <i>Neolitsea foliolosa</i>	$V= 0.12652-0.018037D+0.000956D^2$	VE of <i>Litsea spp</i>
193 <i>Nyctanthes arbor-tristis</i>	$V= 0.12652-0.018037D+0.000956D^2$	VE of <i>Lisea spp</i>
194 <i>Ochna jabotapita</i>	$V = 0.011617 - 0.309699 D + 4.629527 D^2$	VE of <i>Cleistanthus collinus</i>
195 <i>Ochna obtusata</i>	$V = 0.011617 - 0.309699 D + 4.629527 D^2$	VE of <i>Cleistanthus collinus</i>
196 <i>Ochna squarrosa</i>	$V = 0.011617 - 0.309699 D + 4.629527 D^2$	VE of <i>Cleistanthus collinus</i>
197 <i>Olea dioica</i>	$V = - 0.03001+5.75523D^2$	Direct Equation
198 <i>Oroxylum indicum</i>	Zone1: $V= -0.009510+4.149345D^2$	VE of <i>Wrightia tinctoria</i>
	Zone2: $V= -0.009510+4.149345D^2$	Direct Equation
	Zone3: $V^{1/2} = 0.050294+3.115497D-0.687813(D)^{1/2}$	Direct Equation
	Zone4: $V^{1/2} = 0.050294+3.115497D-0.687813(D)^{1/2}$	Direct Equation
	Zone5: $V^{1/2}= 0.050294+3.115497D-0.687813(D)^{1/2}$	Direct Equation
	Zone6: $V^{1/2}= 0.050294+3.115497D-0.687813(D)^{1/2}$	Direct Equation
	Zone7 : $V^{1/2}= 0.050294+3.115497D-0.687813(D)^{1/2}$	Direct Equation
199 <i>Palaquium ellipticum</i>	Zone1: $V=0.011617-0.309699D+4.629527D^2$	VE of <i>Cleistanthus collinus</i>
	Zone2: $V = 0.030925-0.567037D+5.709471D^2$	Direct Equation
	Zone3: $V=0.011617-0.309699D+4.629527D^2$	Direct Equation
	Zone4: $V=0.011617-0.309699D+4.629527D^2$	Direct Equation
	Zone5: $V=0.011617-0.309699D+4.629527D^2$	Direct Equation
	Zone6: $V=0.011617-0.309699D+4.629527D^2$	Direct Equation
	Zone7: $V=0.011617-0.309699D+4.629527D^2$	Direct Equation
200 <i>Pambarus missionis</i>	Zone1: $V=0.011617-0.309699D+4.629527D^2$	VE of <i>Cleistanthus collinus</i>
	Zone2: $V = 0.030925-0.567037D+5.709471D^2$	Direct Equation

S.No./ Species Name	Volume Equation used	Remarks
	Zone3: $V=0.011617-0.309699D+4.629527D^2$	Direct Equation
	Zone4: $V=0.011617-0.309699D+4.629527D^2$	Direct Equation
	Zone5: $V=0.011617-0.309699D+4.629527D^2$	Direct Equation
	Zone6: $V=0.011617-0.309699D+4.629527D^2$	Direct Equation
	Zone7: $V=0.011617-0.309699D+4.629527D^2$	Direct Equation
201 <i>Pavetta indica</i>	$V = 0.17994-2.78776 D+14.44961 D^2$	VE of <i>Holarrhena antidysenterica</i>
202 <i>Peltophorum pterocarpum</i>	$V = -0.09362+9.93014D^2$	VE of <i>Ailanthus grandis</i>
203 <i>Persea macrantha</i>	$V = -0.5193+0.0252D$ (Dia in cm)	VE of <i>Phoebe spp</i>
204 <i>Phoebe paniculata</i>	$V=0.12652-0.018037D+0.000956D^2$	VE of <i>Phoebe lanceolata</i>
205 <i>Phyllanthus emblica</i>	$V = -0.022635+4.889163D^2$	VE of <i>emblica officinalis</i>
206 <i>Pithecelobium dulce</i>	Zone1: $V= -0.009510+4.149345D^2$	VE of <i>Wrightia tinctoria</i>
	Zone2: $V= -0.009510+4.149345D^2$	Direct Equation
	Zone3: $V^{1/2}= 0.050294+3.115497D-0.687813(D)^{1/2}$	Direct Equation
	Zone4: $V^{1/2}= 0.050294+3.115497D-0.687813(D)^{1/2}$	Direct Equation
	Zone5: $V^{1/2}= 0.050294+3.115497D-0.687813(D)^{1/2}$	Direct Equation
	Zone6: $V^{1/2}= 0.050294+3.115497D-0.687813(D)^{1/2}$	Direct Equation
	Zone7: $V^{1/2}= 0.050294+3.115497D-0.687813(D)^{1/2}$	Direct Equation
207 <i>Pittosporum floribundum</i>	Zone1: $V= -0.009510+4.149345D^2$	VE of <i>Wrightia tinctoria</i>
	Zone2: $V= -0.009510+4.149345D^2$	Direct Equation
	Zone3: $V^{1/2}= 0.050294+3.115497D-0.687813(D)^{1/2}$	Direct Equation
	Zone4: $V^{1/2}= 0.050294+3.115497D-0.687813(D)^{1/2}$	Direct Equation
	Zone5: $V^{1/2}= 0.050294+3.115497D-0.687813(D)^{1/2}$	Direct Equation
	Zone6: $V^{1/2}= 0.050294+3.115497D-0.687813(D)^{1/2}$	Direct Equation
	Zone7: $V^{1/2}= 0.050294+3.115497D-0.687813(D)^{1/2}$	Direct Equation
208 <i>Pleiospermum alatum</i>	$V = 0.027354+4.663714D^2$	VE of <i>Zizyphus xylopyra</i>
209 <i>Pleurostyliya opposita</i>	$V = -0.03001+5.75523D^2$	VE of <i>Olea dioica</i>
210 <i>Polyalthia cerassoides</i>	Zone1: $V= -0.009510+4.149345D^2$	VE of <i>Wrightia tinctoria</i>
	Zone2: $V= -0.009510+4.149345D^2$	Direct Equation
	Zone3: $V^{1/2}= 0.050294+3.115497D-0.687813(D)^{1/2}$	Direct Equation
	Zone4: $V^{1/2}= 0.050294+3.115497D-0.687813(D)^{1/2}$	Direct Equation
	Zone5: $V^{1/2}= 0.050294+3.115497D-0.687813(D)^{1/2}$	Direct Equation
	Zone6: $V^{1/2}= 0.050294+3.115497D-0.687813(D)^{1/2}$	Direct Equation
	Zone7: $V^{1/2}= 0.050294+3.115497D-0.687813(D)^{1/2}$	Direct Equation
211 <i>Polyalthia suberosa</i>	$V = 0.17994-2.78776 D+14.44961 D^2$	VE of <i>Holarrhena antidysenterica</i>
212 <i>Pongamia pinnata</i>	$V = 0.091153-1.66153D+10.24624D^2$	VE of <i>Lannea coromandilica</i>
213 <i>Premna latifolia</i>	$V^{1/2} = -0.59983+0.72994D+2.12551(D)^{1/2}$	VE of <i>Premna species</i>
214 <i>Premna tomentosa</i>	$V^{1/2} = -0.59983+0.72994D+2.12551(D)^{1/2}$	VE of <i>Premna species</i>
215 <i>Prosopis juliflora</i>	$V^{1/2}= -0.00142+2.61911D-0.54703(D)^{1/2}$	VE of <i>Acacia spp</i>
216 <i>Prosopis spicigera</i>	$V^{1/2}= -0.00142+2.61911D-0.54703(D)^{1/2}$	VE of <i>Acacia spp</i>
217 <i>Protium serratum</i>	$V^{1/2}=0.05376+3.73731D-0.79622D^{1/2}$	VE of <i>Dillenia indica</i>
218 <i>Pterocarpus marsupium</i>	$V= 0.477930-5.9792D+24.5798D^2-16.7699D^3$	Direct Equation
219 <i>Pterocarpus santalinus</i>	$V^{1/2} = -0.144504+2.943115D$	VE of <i>Dalbergia latifolia</i>
220 <i>Pterospermum suberifolium</i>	$V^{1/2} = -0.08150+2.48467D$	VE of <i>Pterospermum species</i>

S.No./ Species Name	Volume Equation used	Remarks
221 <i>Pterospermum xylocarpum</i>	$V^{1/2} = -0.08150+2.48467D$	VE of <i>Pterospermum species</i>
222 <i>Putranjiva roxburghii</i>	$V^{1/2} = -0.08150+2.48467D$	VE of <i>Pterospermum species</i>
223 <i>Radermachera xylocarpa</i>	$V = 0.066188-1.334512D+9.403257D^2$	VE of <i>Lagerstroemia parviflora</i>
224 <i>Randia uliginosa</i>	Zone1: $V=0.011617-0.309699D+4.629527D^2$ Zone2: $V = 0.030925-0.567037D+5.709471D^2$ Zone3: $V=0.011617-0.309699D+4.629527D^2$ Zone4: $V=0.011617-0.309699D+4.629527D^2$ Zone5: $V=0.011617-0.309699D+4.629527D^2$ Zone6: $V=0.011617-0.309699D+4.629527D^2$ Zone7: $V=0.011617-0.309699D+4.629527D^2$	VE of <i>Cleistanthus collinus</i> Direct Equation Direct Equation Direct Equation Direct Equation Direct Equation Direct Equation
225 <i>Rhizophora apiculata</i>	$V= 0.0245-0.00497D+0.000719D^2$ (Dia in Cm)	VE of <i>Manilkara littoralis</i>
226 <i>Rhizophora mucronata</i>	$V= 0.0245-0.00497D+0.000719D^2$ (Dia in Cm)	VE of <i>Manilkara littoralis</i>
227 <i>Salix tetrasperma</i>	$V = 0.14749-2.87503D+19.61977D^2-19.11630D^3$	VE of <i>Mallotus philippensis</i>
228 <i>Salvadora persica</i>	$V = 0.17994-2.78776 D+14.44961 D^2$	VE of <i>Holarrhena antidysenterica</i>
229 <i>Samanea saman</i>	$V = -0.09362+9.93014D^2$	VE of <i>Ailanthus grandis</i>
230 <i>Santalum album</i>	$V = 0.17994-2.78776 D+14.44961 D^2$	VE of <i>Holarrhena antidysenterica</i>
231 <i>Sapindus emarginatus</i>	$V = 0.14749-2.87503D+19.61977D^2-19.11630D^3$	VE of <i>Mallotus philippinensis</i>
232 <i>Sapium insigne</i>	$V = -0.06440+0.48094D+4.61818D^2$	VE of <i>Sapium eugenifolium</i>
233 <i>Saraca asoka</i>	$V = -0.03001+5.75523D^2$	VE of <i>Olea dioica</i>
234 <i>Schfflera roxburghii</i>	$V = 0.17994-2.78776 D+14.44961 D^2$	VE of <i>Holarrhena antidysenterica</i>
235 <i>Schleichera oleosa</i>	$V = 0.024814-0.578532D+6.11017D^2$	VE of <i>Diospyros melanoxylon</i>
236 <i>Schrebera swietenoides</i>	$V= 0.270-2.953 D+12.336 D^2$	VE of <i>Albizia lebbek</i>
237 <i>Scolopia crenulata</i>	Zone1: $V=0.011617-0.309699D+4.629527D^2$ Zone2: $V = 0.030925-0.567037D+5.709471D^2$ Zone3: $V=0.011617-0.309699D+4.629527D^2$ Zone4: $V=0.011617-0.309699D+4.629527D^2$ Zone5: $V=0.011617-0.309699D+4.629527D^2$ Zone6: $V=0.011617-0.309699D+4.629527D^2$ Zone7: $V=0.011617-0.309699D+4.629527D^2$	VE of <i>Cleistanthus collinus</i> Direct Equation Direct Equation Direct Equation Direct Equation Direct Equation Direct Equation
238 <i>Semicarpus anacardium</i>	$V^{1/2} = 1.67477+14.83747D-9.43386D^{1/2}$	Direct Equation
239 <i>Sesbania grandiflora</i>	$V = 0.17994-2.78776 D+14.44961 D^2$	VE of <i>Holarrhena antidysenterica</i>
240 <i>Shorea robusta</i>	$V = 0.148-1.025D+8.380D^2$	
241 <i>Shorea roxburghii</i>	$V = 0.148-1.025D+8.380D^2$	VE of <i>Shorea robusta</i>
242 <i>Shorea tumbuggaia</i>	$V/D = 0.109884/D-1.804754+10.297714D$	VE of <i>Shorea robusta</i>
243 <i>Sonneretia apetala</i>	$V^{1/2} = 0.050294+3.115497D-0.687813(D)^{1/2}$	VE of <i>Wrightia tinctoria</i>
244 <i>Sonneretia caseolaris</i>	$V^{1/2} = 0.050294+3.115497D-0.687813(D)^{1/2}$	VE of <i>Wrightia tinctoria</i>
245 <i>Spondias pinnata</i>	$V^{1/2} = 0.49487+6.18662D-2.95076(D)^{1/2}$	Direct Equation
246 <i>Sterculia foetida</i>	$V = 0.091153-1.66153D+10.24624D^2$	VE of <i>Bombax ceiba</i>
247 <i>Sterculia urens</i>	$V = 0.27909-3.26515D+13.46829D^2$	VE of <i>Lannea coromandilica</i>
248 <i>Sterculia villosa</i>	$V = 0.27909-3.26515D+13.46829D^2$	Direct Equation

S.No./ Species Name	Volume Equation used	Remarks
249 <i>Stereospermum personatum</i>	$V = 1.38791 - 12.52739D + 30.51466D^2 - 9.65242D^3$	Direct Equation
250 <i>Stereospermum suaveolens</i>	$V^{1/2} = 0.49746 + 5.98454D - 2.84986D^{1/2}$	Direct Equation
251 <i>Strebulus asper</i>	$V = 0.011617 - 0.309699 D + 4.629527 D^2$	VE of <i>Cleistanthus collinus</i>
252 <i>Strychnos nux-vomica</i>	$V = 0.011617 - 0.309699 D + 4.629527 D^2$	VE of <i>Cleistanthus collinus</i>
253 <i>Strychnos patatorum</i>	$V = 0.011617 - 0.309699 D + 4.629527 D^2$	VE of <i>Cleistanthus collinus</i>
254 <i>Suregada multiflorum</i>	$V = 0.011617 - 0.309699 D + 4.629527 D^2$	VE of <i>Cleistanthus collinus</i>
255 <i>Syzygium alternifolium</i>	$V^{1/2} = 0.30706 + 5.12731D - 2.09870(D^{1/2})$	VE of <i>Syzygium cuminii</i>
256 <i>Syzygium cuminii</i>	$V^{1/2} = 0.30706 + 5.12731D - 2.09870(D^{1/2})$	Direct Equation
257 <i>Syzygium jambos</i>	$V = -0.13284 + 1.88944D - 4.96385D^2 + 21.41051D^3$	VE of <i>Syzygium species</i>
258 <i>Tamarindus indica</i>	$V = 0.046883 - 0.894379D + 7.220441D^2$	VE of <i>Madhuca latifolia</i>
259 <i>Tectona grandis</i>	$V = 0.023613 - 0.531006D + 6.731036D^2$	
260 <i>Terminalia alata</i>	$V = 0.051812 - 1.076790D + 7.991280D^2$	VE of <i>Terminalia tomentosa</i>
261 <i>Terminalia paniculata</i>	$V = 0.13100 - 1.87132D + 9.47861D^2$	Direct Equation
262 <i>Tarennia astatica</i>	$V = 0.17994 - 2.78776 D + 14.44961 D^2$	VE of <i>Holarrhena antidysenterica</i>
263 <i>Terminalia arjuna</i>	$V = 0.50603 - 6.64203D + 25.23882D^2 - 9.19797D^3$	VE of <i>Terminalia spp</i>
264 <i>Terminalia bellirica</i>	$V = -0.14823 + 2.44138D - 6.86434D^2 + 18.05444D^3$	Direct Equation
265 <i>Terminalia catappa</i>	$V = 0.50603 - 6.64203D + 25.23882D^2 - 9.19797D^3$	VE of <i>Terminalia spp</i>
266 <i>Terminalia chebula</i>	$V = -0.05004 - 0.03440D + 6.35715D^2$	Direct Equation
267 <i>Terminalia pallida</i>	$V = 0.13100 - 1.87132D + 9.47861D^2$	VE of <i>Terminalia paniculata</i>
268 <i>Tetrameles nudiflora</i>	$V/D^2 = 0.12914/D^2 - 2.50478/D + 15.25108$	
269 <i>Thespesia populnea</i>	$V = 0.018620 + 13.916741D^3$	VE of <i>Grewia tiliaefolia</i>
270 <i>Toona ciliata</i>	$V = 1.10314 - 3.52579D^{1/2} + 15.50182D^2$	Direct Equation
271 <i>Trema orientalis</i>	$V^{1/2} = 0.050294 + 3.115497D - 0.687813(D)^{1/2}$	VE of <i>Wrightia tinctoria</i>
272 <i>Trewia nudiflora</i>	$V^{1/2} = -0.45312 - 0.41426D + 2.10913D^{1/2}$	Direct Equation
273 <i>Vitex altissima</i>	$V = -0.16386 + 2.23116D - 7.00969D^2 + 22.13099D^3$	VE of <i>Vitex peduncularis</i>
274 <i>Vitex leucoxydon</i>	$V = -0.16386 + 2.23116D - 7.00969D^2 + 22.13099D^3$	VE of <i>Vitex peduncularis</i>
275 <i>Vitex peduncularis</i>	$V = -0.16386 + 2.23116D - 7.00969D^2 + 22.13099D^3$	VE of <i>Vitex peduncularis</i>
276 <i>Vitex pinnata</i>	$V = -0.16386 + 2.23116D - 7.00969D^2 + 22.13099D^3$	VE of <i>Vitex peduncularis</i>
277 <i>Vitex pubescens</i>	$V = -0.16386 + 2.23116D - 7.00969D^2 + 22.13099D^3$	VE of <i>Vitex peduncularis</i>
278 <i>Vitex sp</i>	$V = -0.16386 + 2.23116D - 7.00969D^2 + 22.13099D^3$	VE of <i>Vitex peduncularis</i>
279 <i>Wendlandia corymbosa</i>	$V = -0.009510 + 4.149345D^2$	VE of <i>Wrightia tinctoria</i>
280 <i>Wrightia arobrea</i>	$V = -0.009510 + 4.149345D^2$	VE of <i>Wrightia tinctoria</i>
281 <i>Wrightia tomentosa</i>	$V = -0.009510 + 4.149345D^2$	Direct Equation
282 <i>Xantolis tomentosa</i>	$V^{1/2} = 0.13548 + 4.20022D - 1.17365D^{1/2}$	VE of <i>Diospyros malabarica</i>
283 <i>Xylia xylocarpa</i>	$V = -0.000039 + 3.34636D^2 + 3.18889D^3$	Direct Equation
284 <i>Zanthoxylum rhetsa</i>	$V = -0.04521 + 0.45290D + 5.18275D^2$	Direct Equation
285 <i>Zanthoxylum armatum</i>	$V = -0.04521 + 0.45290D + 5.18275D^2$	VE of <i>Zanthoxylum rhetsa</i>
286 <i>Zizyphus mauritiana</i>	$V = 0.027354 + 4.663714D^2$	VE of <i>Zizyphus xylopyrus</i>
287 <i>Others/Rest of species</i>	Zone1: $V = 0.088183 - 1.490948D + 8.984266D^2$ Zone2: $V = 0.184105 - 3.07474D + 16.448494D^2 - 12.38362D^3$ Zone3: $V = 0.058237 + 4.597986D^3$ Zone4: $V = 0.058237 + 4.597986D^3$ Zone5: $V = 0.058237 + 4.597986D^3$ Zone6: $V = 0.058237 + 4.597986D^3$ Zone7: $V = 0.058237 + 4.597986D^3$	

Species for which 'Others Equation' used

1	<i>Aphanamixis polystachya</i>	22	<i>Dendrocalamas strictus</i>	40.	<i>Linociera malabarica</i>
2	<i>Borassus flabellifer</i>	23	<i>Drypetes separia</i>		
3	<i>Capparis grandis</i>	24	<i>Erianthus arundinaceus</i>	41.	<i>Linociera ramiflora</i>
4	<i>Capparis divaricata</i>	25	<i>Erioglossum rubiginosum</i>	42.	<i>Linociera zeylanica</i>
5	<i>Carallia brachiata</i>	26	<i>Glycosmis pentaphylla</i>	43.	<i>Lumintzera racemosa</i>
6	<i>Careya arborea</i>	27	<i>Grewia hirsuta</i>	44.	<i>Maba buxifolia</i>
7	<i>Caryota urens</i>	28	<i>Grewia aspera</i>	45.	<i>Meliosma pinnata</i>
8	<i>Casuarina equisetifolia</i>	29	<i>Grewia bicolor</i>	46.	<i>Memocylon umbellatum</i>
9	<i>Catunaregam spinosa</i>	30.	<i>Grewia damina</i>	47.	<i>Millingtonia hortensis</i>
10	<i>Celtis timorensis</i>	31.	<i>Grewia flavescens</i>	48.	<i>Mimusops elengi</i>
11	<i>Celtis tetrandra</i>	32.	<i>Guettarda speciosa</i>	49.	<i>Moringa oleifera</i>
12	<i>Ceriops decandra</i>	33.	<i>Heyna trijuga</i>	50.	<i>Moringa concanensis</i>
13	<i>Tarenna asiatica</i>	34.	<i>Isonandra candolleana</i>	51.	<i>Phoenix loureirii</i>
14	<i>Citrus limon</i>	35.	<i>Jatropha gossypifolia</i>	52.	<i>Phoenix sylvestris</i>
15	<i>Citrus pseudolimon</i>	36.	<i>Lepisanthes tetraphylla</i>	53.	<i>Scurrula cordifolia</i>
16	<i>Calycopteris floribunda</i>	37.	<i>Leucaena leucocephala</i>	54.	<i>Scutia myrtina</i>
17	<i>Commiphora berryi</i>	38.	<i>Limonia acidissima /</i>	55.	<i>Secuinega leucopyrus</i>
18	<i>Commiphora caudata</i>		<i>Limonoa crenulata)</i>	56.	<i>Soymida febrifuga</i>
19	<i>Cycas sphaericus</i>	39.	<i>Limonia elephantum /</i>	57.	<i>Tamarix dioica</i>
20	<i>Cycas beddomei</i>		<i>Feronia elephantum</i>	58.	<i>Walsura trifoliata</i>
21	<i>Cycas circinalis</i>				



Appendix-4

NAMES OF THE FIELD INVENTORY TEAM MEMBERS

S.NO CIRCLE	S.NO	DIVISION	NAMES
1. Adilabad	1	Adilabad	I.Nicolos Xavier
	2	Bellampally	J.Thirupathi
	3	Jannaram	MD.Hafeezuddin
	4	Kagaznagar	MD.Hafeezuddin
	5	Mancherial	R.Ravi
	6	Nirmal	Z.KingFisher
2. Anantapur	7	Anantapur	B.Sreepathi Naidu,A.Ganganna, D.L.Viswamurthy,S.MalliKharjuna, T.V.Muralidher
	8	Chittoor West	N.Venkatramana, D.Parthasarathynaidu, G.Sivanna, M.Sudhaker.
3. Guntur	9	Giddalur	A. Srinivasa Rao, C. Madhava Rao, S.K Nazeer Ahmed,
	10	Guntur	A.Vikramark,S.Vijaya Laxmi
	11	Nellore	G.Prasad,B.Rajendra Prasad
4.Hyderabad	12	Hyderabad	R. Ravikumar
	13	Mahabubnagar	B.Narsimhulu
	14	Nalgonda	MD.HafeezKhan
5. Khammam	15	Bhadrachalam North	CH.SrinivasaRao, V.V.V.Ramamurthy Raju, V.Raju,M.Murali,N.KiranKumar
	16	Bhadrachalam South	K.NarsimhaRao,CH.Srinivas
	17	Khammam	CH.SrinivasRao
	18	Kothagudem	B.SrinivasReddy, D.Shameen
	19	Paloncha	M.Murali
	20	Paloncha WLM	M.AnilKumar
6. Kurnool	21	Kadapa	B.C.Reddaiah,S.Karimulla
	22	Kurnool	Ramesh Babu, G.Narayana Swamy
	23	Nandyal	P.Kathal,B.Srinivasulu
	24	Proddatur	M.V.Subba Reddy, E.Srinivasa Murthy
7. Nizamabad	25	Medak	J.Vasantha,T.Srinias, J.VishnuVardhan
	26	Nizamabad	B.Amber Singh
	27	Kamareddy	Y. Subashchandra Yadav

8. Rajahmundry	28	Eluru	N.Chandra Shekher, K.H.N.Malleshwar Rao
	29	Krishna	M.Kalyani
	30	Krishna WLM	M.Kalyani
9. Srisailam	31	Achampet	Bal Raj, M.Anjaneyulu, Syed Magqum Hussaini
	32	Atmakur	G.Prasad,B.Parasu Ramudu, B .Victor Emmannuel
	33	Markapur	P.V.NarsimhaRao, G.Venkateshwarlu, B.G.V.Srinivasulu
	34	Nagarjuna Sagar	M.Gopal A.Vikramark
10. Tirupati	35	Tirupati	P.RamaKoti, K.Venkatasubbaiah, N.R.Sridher
	36	Chittoor East	M.Paramesulu, N.LakshmiPathi
	37	Rajampet	R. Ramakrishna, E. Srinivasulu
11. Visakhapatnam	38	Narsipatnam	K.B.Bhoga Lingeswar Rao, K.Jagdeeshwar Rao, S.Kalyana Muni,T.Venkata Samy
	39	Paderu	K.Krishna Rao
	40	Srikakulam	A.Krishna Murthy
	41	Visakhapatnam	T.V.B. Varma, MD. Shafi, K. Shivaprasad
	42	Vizianagaram	CH.Vijaya Kumar, B.Venkati, K.RamaRao, P.V.Ramana Raju, P.Simhadri Raju
12. Warangal	43	Karimnagar East	G.RaviKiran, G.Rajeshwar Rao, K.Vijaya Rao
	44	Karimnagar West	Aiesha Quddoosiya, S.Anjali, N.Mohanlal
	45	Warangal WLM	K.Venugopal& V.Laxminarsu
	46	Warangal North	B.Anandam Nagaraju, P.Ramudu, K.VijayKumar, M.Pricilla
	47	Warangal South	G.Ashok

Glossary

Allowable Error: A systemic error that is 'acceptable', both statistically and analytically. The amount of error that can be tolerated without invalidating the usefulness of the analytic result.

Basal Area : The area of the cross section of a stem at Breast-Height is called the Basal area of the tree.

Confidence Interval : In statistics, a confidence interval (CI) is a particular kind of interval estimate of a population parameter. Instead of estimating the parameter by a single value, an interval likely to include the parameter is given. Thus, confidence intervals are used to indicate the reliability of an estimate. How likely the interval is to contain the parameter, is determined by the confidence level or confidence coefficient. Increasing the desired confidence level will widen the confidence interval, however the estimated value will be away from the absolute value.

Coefficient of Variation : In probability theory and statistics, the coefficient of variation (CV) is a normalised measure of dispersion of a probability distribution. It is defined as the ratio of the standard deviation to the mean.

Dense Forest : All lands with forest cover having a canopy density between 40 to 100 percent.

Forest Blank : A patch within a forest which bears few or no trees.

Forest Inventory : The measurement of certain parameters of forests to assess the growing stock and other characteristics of forests.

Forest Type : Forest type is defined as a unit of vegetation which possess broad characteristics in physiognomy and structure sufficiently pronounced to permit of its differentiation from other such units (Champion and Seth 1968)

Geographic Information System (GIS) : A computer based system for capturing, storing, manipulating, analyzing and displaying data, which are spatially referenced to the earth.

Global Positioning System : The Global Positioning System (GPS) is a space-based global navigation satellite system. It provides reliable positioning, navigation, and timing services to worldwide users on a continuous basis in all weather, day and night, anywhere on or near the Earth which has an unobstructed view of four or more GPS satellites.

Growing Stock : Volume of all living trees in a given area of forest or wooded land that have more than a certain diameter at breast height. It is usually measured in solid cubic metres (m³).

It includes the stem from ground level or stump height up to a given top diameter, and may also include branches above a certain diameter.

General Volume Equation : General Volume equations are based on only Diameter at Breast Height and height (DBH)

Local Volume Equation : Local Volume equations are based on only Diameter at Breast Height. (DBH)

Mangroves : Salt tolerant ever green forest ecosystem found mainly in tropical and sub – tropical coastal and / or inter tidal regions.

NDVI : The Normalized Difference Vegetation Index (NDVI) is a simple numerical indicator that can be used to analyse remote sensing measurements, typically but not necessarily from a space platform, and assess whether the target being observed contains live green vegetation or not. It is defined as the ratio of the difference in the NIR & Red radiance values to the sum of the NIR & Red radiance values.

Open Forest : Lands with forest cover having a canopy density between 10 to 40 percent.

Protected Forest (PF) : An area notified under the provisions of the Indian Forest Act or other State Forest Acts, having limited degree of protection. In protected forest all activities are permitted unless prohibited.

Reserved Forests (RF) : An area so constituted under the provisions of the Indian Forest Act or other State Forest Acts, having full degree of protection. In Reserved forests all activities are prohibited unless permitted.

Scrub : Degraded forest lands having canopy density less than 10 percent.

Standard Deviation and Variance : In probability theory and statistics, the variance of a random variable or distribution is the expected, or mean, value of the square of the deviation of that variable from its expected value or mean. Thus, the variance is a measure of the amount of variation within the values of that variable, taking account of all possible values and their probabilities or weightings (not just the extremes which give the range).

The standard deviation of a statistical population, a data set, or a probability distribution is the square root of its variance. Standard deviation is a widely used measure of the variability or dispersion.

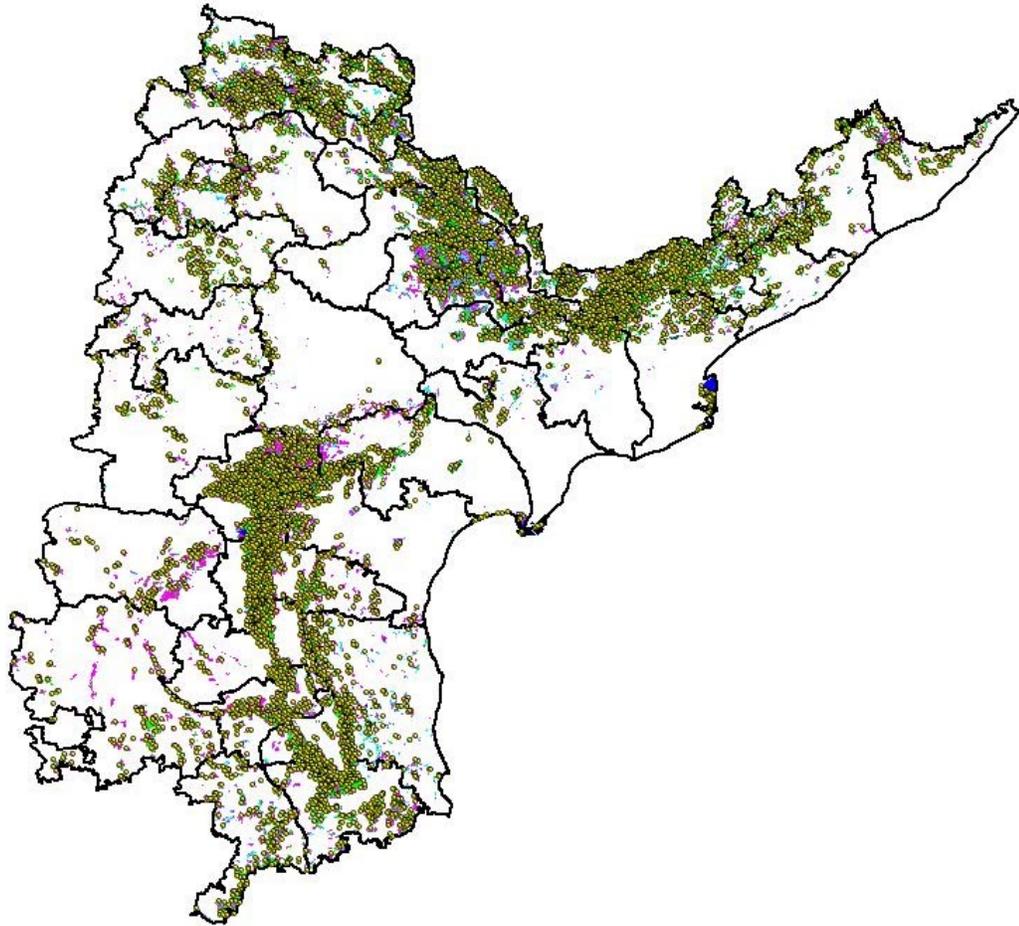
Tree : A large woody perennial plant having a single well defined stem (bole or trunk) and more or less definite crown. It also includes bamboos, palms, fruit trees, etc and excludes non-perennial non-woody species like banana and tall shrubs or climbers.

For the purpose of assessing growing stock and tree cover, only those trees having diameter at breast height (dbh) of 10 cm or more are measured.





Distribution of Inventory points in Andhra Pradesh



● Inventory Point
□ District boundary

About the Book....

As the great scientist Kelvin stated, our knowledge is limited, if we can not express anything in numbers. Inventory of the forests of the Andhra Pradesh is an attempt in that direction.

Assessment of growing stock is essential for management of forests on sustainable basis. For this purpose, information on growing stock - the sum by numbers or volume of all the trees growing in a specified area - and various parameters indicating the health of forest is essential.

Forest Department of Andhra Pradesh has undertaken inventory of forests of the entire state using modern tools in one go. Efforts put in were difficult, spread over a period of 4 years and everybody from the forest department of the state contributed in the exercise in some way or other. As the result, a consolidated Report on forests, basal area, volume of timber, species composition, regeneration status, soil characteristics, forest health, availability of Bamboo is in your hands, in the form of a publication, which gives information on all these topics in a comprehensive manner.

This book will be highly useful to practicing foresters, scientists, policy makers and communities in general.

