GENERAL REPORT

PREINVESTMENT SURVEY OF FOREST RESOURCES

EAST GODAVARI (A.P.)

FORESTRY AND FOREST BASED INDUSTRIES DEVELOPMENT OPPORTUNITIES

सत्यमेव जयते

GOVT. OF INDIA
MINISTRY OF AGRICULTURE & IRRIGATION
DEHRA DUN
1975

Contents

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The Draft Report of East Godavari (A.P.) was prepared during January, 1973 and was submitted to the Government. The report has now been finally approved after detailed scrutiny. This authentic final report is, therefore, being issued for distribution to all concerned.

(RAMESH CHANDRA)
CHIEF COORDINATOR

Dated : 1.5.1975
DEHRA DUN, U.P.

PREFACE

This is the report of one of the first projects taken up by the Preinvestment Survey of Forest Resources on its own, the organization having initially started as a U.N.D.P. Project. The survey was designed and executed entirely under Indian expertise and new techniques were introduced to suit the prevailing conditions. This experience should go a long way in the development of survey methodology.

For a systematic and scientific expansion of wood-based industries, it is necessary as a first step to have adequate and continuing inventories of the renewable natural resources to determine their condition, productivity and potential use in relation to human needs and to support these as a guide to the proper utilization and treatment of these resources. It need not be emphasised, that, in a rapidly developing economy, an organisation must be in a condition of growth; it must recognize the necessity for constant reappraisal of its status, carry out continuous planning for future development and be aware of the possibility of acquiring or disposing of resources.

The East Godavari Catchment has large resources of miscellaneous hardwood species which remained unutilised in the past. Many important developments have since taken place in the technological field of pulping of hardwoods. This will in turn have a significant influence on the forestry practices. The possibility of using the hardwoods for pulping affords opportunities for increasing the pulp and paper production. The intensive management of the forests, as of East Godavari, will provide the much-needed raw material for the expansion of the paper mill at Rajahmundry. There is also scope for other wood-based industries like plywood, saw-milling, etc. The massive investments in creating extensive man-made forests of the desired species will provide continuous employment to the inhabitants and bring prosperity to the region. In the wake of this development, the contribution of forestry to national development will be quite significant.

This report endeavours to assess the total resources of East Godavari Catchment and the potential annual cut in order to form the basis for formulation of an action programme for the development of these resources. The main report on forestry and industrial development possibilities in East Godavari Catchment makes use of relevant survey data to present a blue-print for developing the area. It is intended for use by government, administrators, planners and industrialists. This report is supported by five technical reports dealing with the major items of the survey. These could be referred to for a complete understanding of procedures, theoretical background and analytical procedures adopted.

The report is the outcome of fruitful collaboration and active

consultation between the Preinvestment Survey of Forest Resources and the Andhra Pradesh Forest Department. The former agency designed and executed the work and each member and unit of the organisation has contributed his share towards the successful completion of the job. The Chief Conservator of Forests, Andhra Pradesh and his colleagues rendered guidance and assistance in the execution of the work. All their efforts in the making of this report are gratefully acknowledged.

New Delhi,
1st January, 1973.

Chief Coordinator
Preinvestment Survey of Forest Resources.

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SUMMARY

CHAPTER - 1.

THE BACKGROUND

The survey area, known as "East Godavari Catchment", is situated between 17° 15' N and 18° 0' N latitudes, and 18° 0' E and 82° 45' E longitudes and falls in East Godavari, Khammam, Visakhapatnam and West Godavari Districts of Andhra Pradesh. Bulk of the area (72%) lies in Kakinada and Visakhapatnam divisions.

The tract is generally hilly, elevation varying from 150 metres to 1600 metres and forms the catchment of Godavari river. Climate being tropical and humid, the summers are severe and winter frosty. Average rainfall is about 1500 mm, bulk of which is received during July - September.

Geological formations are of Archaean system and having undergone severe weathering for all these years, the soils are sandy loam, deep and rich. The area is rich in natural resources in general and forests in particular which cover 63% of the total land area. Having remained under-exploited due to lack of communication facilities, it has vast potentialities for development in future and is likely to play an important role in boosting the economy of the area.

The inhabitants of the area are of tribal origin, who practise dry farming and shifting cultivation, called "Podu" for their living. Besides farming, which hardly sustains them, they are largely dependent on forests and forestry operations for their living.

Infrastructure in the area is practically nil, which results in the area remaining cut off from civilization for almost 6 to 7 months in a year. It was in the last decade only that road development work was taken up along with other social activities.

With the improved modes of transport, the forest produce from the area is now able to reach the market places easily. Visakhapatnam, Rajahmundry, Kothagudem are the important marketing centres that are fed by this area.

CHAPTER - 2

THE RESOURCE BASE

The forests are of Southern Tropical Moist Mixed Deciduous and Southern Tropical Dry Mixed Deciduous types. There are small areas under Southern Thorn and Savanah types.

The total land area surveyed was 10,416 sq. kms. which has been divided into various land use classes. Forest covers 63% of the total land area, whereas cultivation is hardly 25%. Reserve and Protected forests account for 88% of the total forest area. Forests are further divided into high, medium and low volume strata. 50% is under high, 33% under medium and 17% under low volume strata.

The total stock on the surveyed area is 58 million cu. ms., of which 52.5 million cu. ms. is on forest land and the balance on cultivation, plantations, blanks etc. 90% of the volume is on the forest lands.

Depending upon their utility, the species have been broadly classified as big timber species, small timber species, pulpwood species and fuel and rest and volumes indicated accordingly. This classification provides ready information on the availability of raw material for different industries e.g.:

1.	Plywood timber	3.2%
2.	Saw timber	20.4%
3.	Polewood timber	14.5%
4.	Pulpwood timber	20.8%
5.	Fuel	41.1%

Bamboo occurs over an area of about 423,000 hectares, density varying from sparse to pure. Dendrocalamus strictus and Bambusa arundinacea are the two common species found, of which the latter accounts for only 10.8% of the total bamboo area.

CHAPTER - 3.

MARKET STUDY AND CONSUMPTION PATTERN

There are important timber and industrial markets at Rajahmundry, Visakhapatnam and Kothagudem. It is estimated that 149,000 cu. ms. of industrial wood reaches the various markets of Demand Zone, of which the survey area accounts for 27,000 cu. ms. Likewise, it is estimated that 3,823,500 cu. ms. of fuelwood reaches the various consumption centres but it is difficult to quantify as to how much fuelwood comes out of the surveyed area.

Detailed studies were carried out for determining the consumption pattern of the wood within the "Demand Zone", and on its basis future demand for timber and fuelwood has been worked out. The demand of timber in 1975 and 1980 is likely to be 146,000 cu. ms. and 173,000 cu. ms. respectively. In case of fuel, the demand for 1975 and 1980 is estimated to be 3,648,000 cu. ms. and 3,973,000 cu. ms.

CHAPTER - 4.

MANAGEMENT OPPORTUNITIES AND POTENTIAL ANNUAL CUT

As stated earlier, the forests within the survey area have not been fully exploited in the past. Areas near habitation and connected by roads were intensively managed and large inaccessible areas remained unworked.

Based on the survey results and other technical studies and keeping in view the present and future requirement of the people and industries, two management models are proposed :

Model No. 1:

The Model provides for sustained supply of wood in the first ten years of management and aims at bringing larger areas under management.

The systems of management proposed mostly conform to the present management practices with emphasis on clear-felling and planting of fast-growing species, bamboo and Teak.

The areas to be worked and the potential annual cut expected under different systems of management are as under:-

System	Annual area	Annual potential cut
1. Clear-felling and planting	6,000 ha.	591,600 cu. ms.
2. Selection-cum-improvement	19,675 ha.	618,500 cu. ms.
3. Coppice with reserve	2,990 ha.	108,300 cu. ms.
	Total	1,318,400 cu. ms.

The potential annual cut works out to 1.32 million cu. ms. or 2.4% of the volume standing over the forested area. The potential annual cut from Reserve and Protected forests works out to 1.2 million cu. ms.

The potential annual cut for bamboos works out to 255,000 tonnes and the figure for accessible areas of Reserve and Protected forests is 181,000 tonnes.

The future potential annual cut would, however, increase once the plantations raised during the first 10 to 15 years are ripe for harvesting and would give a boost to the economy of the area.

Model No. 2:

This model envisages more concentrated working to the extent of satisfying the present and future demand. It differs from Model No. 1, in that, here the area of working would progressively increase depending upon the corresponding increase in the demand for various types of wood products.

The demand for plywood industry is nil at present but it is likely to be 30,000 cu. ms. in 1975 and 40,000 cu. ms. in 1980. Similarly, the demand for other products like sawnwood, pulpwood and fuel is going to increase progressively in future.

With this background two systems of management are proposed:

1. Clear-felling and planting;
2. Coppice with reserves

The areas to be worked under the two systems in future years are as under:

	Clear-felling and planting	C.M.A.
1972	3000 hectares	1000 hectares
1978	5000 hectares	8000 hectares
1980	8000 hectares	8000 hectares

CHAPTER - 5.

WOOD BALANCE

On the basis of "Market and Demand Studies", the projected requirement of wood for 1975 and 1980 has been determined. Knowing the growing stock, the wood balance works out to:

1. Industrial wood:

1975 level	503,200 cu. ms.
1980 level	477,000 cu. ms.

With such huge surplus of industrial wood, the scope for establishing wood-based industries, like pulpwood and saw-milling is bright.

2. Fuelwood:

Position of fuelwood is not very promising and it may have to be met partly from the pulpwood plantations.

3. Bamboo:

The surplus works out to 91,000 tonnes and there is a good scope for expansion of paper industry.

CHAPTER - 6.

ECONOMIC AVAILABILITY AND COST OF RAW MATERIAL DELIVERY

Cost studies were carried out for determining the delivered cost of forest produce to the alternative delivery sites i.e. Rajahmundry and Bhadrachalam.

The sampling design for this study was also systematic point sampling as the one used for the ground inventory. On the basis of the cost involved on various logging operations, like felling, conversion, off-road transport, road transport, cost of loading and unloading, four cost classes with respect to product viz. timber, pulpwood,

fuelwood and bamboo have been formed.

Cost class	Per cu.m. timber	Per tonne pulpwood/ fuelwood	Per tonne bamboo
Low (A)	Upto Rs. 90	Upto Rs. 40	Upto Rs. 60
Medium (B)	Rs. 90 to 110	Rs. 40 to Rs. 50	Rs. 60 to Rs. 75
High (C)	Rs. 110 to Rs. 130	Rs. 50 to Rs. 60	Rs. 75 to Rs. 90
V. high (D)	Rs. Over Rs. 130	Over Rs. 60	Over Rs. 90

The survey area is then divided into different cost classes with respect to alternate mill sites and forest produce.

It is found that Rajahmundry is a better site than Bhadrachalam for establishment of mills as timber, pulpwood and bamboo, are available at a comparatively lower cost.

CHAPTER - 7.

DEVELOPMENT OF ROADS

The existing infrastructure in the area is poor, as would be evident from the road density, which is as low as 13 km. per 100 sq. km.

For planned develop-ment of the area, it is essential that denser network of roads and extraction routes are laid. This would help in going in for intensive management, creation of extensive man-made forests and establishment of forest-based industries in the area.

With these objectives in view, a study was carried out to determine suitable road network and estimated outlay on each category.

Upgrading of 5 existing kutcha roads, measuring 137 kms. has been proposed. The expenditure @ Rs. 30,000/- per km. would come to Rs. 4.11 million. Construction of 21 new roads measuring 510 km. in length has been proposed which @ Rs. 45,000/- per km. would cost Rs. 22.95 million. Annual maintenance works out to Rs. 1.53 million.

Apportioning the entire cost on road development to the logging expenditure alone, it works out to Rs. 4/- per cu. m., which cannot, by any means be considered heavy.

CHAPTER - 8.

SCOPE OF FOREST-BASED INDUSTRIAL DEVELOPMENT AND ASSESSMENT OF INVESTMENT REQUIREMENTS, BENEFITS AND EMPLOYMENT OPPORTUNITIES

The survey and other technical studies have shown that, though the area contains vast wood resources, it has failed to make any significant contribution to the economy of the region. There is, however, a good scope for the expansion of the existing industries and establishment of new ones.

The various industries that could be set up are as under:

1. Plywood manufacturing Unit:- Its annual intake is considered to be 30,000 cu. ms. and it could be set up either at Rajahmundry or Maredumilli.

2. Sawmill Units:- Their annual requirement is expected to be 186,000 cu. ms. The existing saw mill at Rajahmundry can also be expanded.

3. Integrated pulp and paper Unit:- The annual availability of raw material (hardwoods) is about 300,000 cu. ms. from the forest areas. The capacity of the existing pulp and paper unit at Rajahmundry could be raised to 400 tonnes per day, and also to 500 tonnes per day if bamboo supply is augmented from Kurnool Circle, as is being done at present.

4. Tannin manufacturing Unit:- A 10-tonne/day capacity mill can be easily established. Requirement of bark, would be 15,000 tonnes/year.

The return on account of the above industries would be:

1.	Plywood size timber	30,000 cu. m-s.	@ Rs. 200 per cu. m. - Rs. 6.0 mill.
2.	Sawn timber	186,000 cu. ms.	@ Rs. 100 per cu. m. - Rs. 18.6 mill.
3.	Poles	78,000 cu. ms.	@ Rs. 60 per cu. m. - Rs. 4.7 mill.
4.	Pulpwood	300,000 cu. ms.	@ Rs. 15 per cu. m. - Rs. 4.5 mill.
5.	Fuelwood	601,000 cu. ms.	@ Rs. 10 per cu. m. - Rs. 6.0 mill.
6.	Bamboo	191,000 tonnes	@ Rs. 40 per tonne - Rs. 7.6 mill.
7.	Bark for tannin	15,000 tonnes	@ Rs. 15 per tonne - Rs. 0.2 mill.
			Total: - Rs. 47.6 mill.

When the plantations of fast growing species and bamboo start yielding material, the earnings would go upto Rs. 83 million, and this could go up to Rs. 120/- million, when Teak plantations mature.

In addition to the direct returns in the shape of royalties, described above, there are many indirect returns to the exchequer, by way of excise duty, sales tax, which would be of the order of Rs. 67 million and income tax which is likely to be Rs. 43 million.

The forestry activities would also go a long way in solving the employment problem in the region and it is expected that employment would be available to about 33,000 persons which include all the technical, non-technical and labour class.

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INTRODUCTION

The Preinvestment Survey Organization was established in 1965 with the collaboration of the F.A.O. to advise and assist the Government of India in the planning and development of the country's forest resources and associated forest industries, as a part of the Third Five Year Plan. One of the aims of our Five Year Plans is to increase wood production in the country in order to fill the growing gap between domestic production and local needs, especially in the field of pulp and paper. To this end the project is oriented towards planning the expansion of existing forest industries, and planning the development of new industries based on the available forest resources, or on industrial plantations created in selected areas..

East Godavari Catchment was identified as one such area where the existing resources were not fully utilised and showed possibilities of increasing wood production. The economic development of the area was linked with the development of forests of the region. A paper mill of medium capacity was existing, but its size could be increased manifold. The resource position was not fully known and hence there was a need to estimate the resources for planning the development of industries and forests.

The new methods of survey adopted viz., the use of aerial photographs combined with ground sampling, greatly reduced the work and time required for survey and at the same time provided estimates reliable enough to meet the objectives. As these areas had poor communications, the Project helicopter came as a boon for this work. Aerial reconnaissance and land use stratification was carried out by this. The field crews were transported to inaccessible areas by helicopter, thus saving considerable time and money.

Another important aspect of the survey was the testing of the existing species for their suitability as an industrial raw material, mainly for pulp and paper. The existing forests contain mixed hardwoods. Wood samples of the frequently occurring species of the area were got tested at the Cellulose and Paper Branch of the Forest Research Institute. The results of the tests reveal that most of the hardwoods are suitable for pulping and can be used in a mixture with long-fibre material like bamboo for paper making. These open up new vistas of utilization of species which were hitherto unutilised or used only as fuelwood.

The survey as such has many facets. The inventory gives only the present stock. The demand and market studies show the present and future drain on the forests surveyed, and point out the wood balance available for future development.. The complete interpretation of the aerial photographs and transfer of the interpreted details on to the base maps gives the location of the resource for further use in management plans. Based on this data Land Use and Forest Cover Type maps have been prepared on Kodaline on a scale of 1 : 63,360 (1" = 1 mile) and ammonia prints of these will be available to the Forest Department for management plans. A Forest Resource map on a scale of 1" = 4 miles showing the same details has also been got printed which will be useful for general planning. An attempt has also been made to calculate the cost of extraction and supply of raw material at probable centres of consumption. The mere existence of a resource is not sufficient for industries. It

should also be economically available. The development of communication system is also indicated. All these are the new dimensions of integrated planning for industrial development and formulation of an industry oriented management plan. Such an integrated plan has been prepared for a small portion of the surveyed area, covered by the map 65 G/14. Similar plans have to be drawn up before the execution of development activities.

The report presents two cutting models which incorporate the findings of the survey and the possible methods of treating the forests to meet the present, and the projected demands of wood. The concluding chapter deals with the development opportunities, and the investments needed to use the resources as indicated in the models.

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CHAPTER - 1.

THE BACKGROUND

1.1. Name Of The Area:

The surveyed area i.e., "East Godavari Catchment" is so called because, most of it lies to the east of the River Godavari in the State of Andhra Pradesh.

1.2. Location:

The area is situated between 17° 15' N and 18° 0' N Latitudes and 180° 0' E and 82° 45' E longitudes, and is covered by the Survey of India map sheet Nos. 65 G and 65 K.

The area falls in the four districts of East Godavari, Khammam, Visakhapatnam and West Godavari, but almost three fourth of it lies in East Godavari and Visakhapatnam Districts. The Forest Divisions or parts of them included in this area are Bhadrachalam (S), Eluru, Kakinada, Khammam, Palvancha and Visakhapatnam. The bulk of the area i.e. 72% lies in Kakinada and Visakhapatnam divisions.

1.3. Factors of Locality:

Climate and rainfall: The climate is tropical and humid. The summers are severe with the maximum temperature reaching 46°C during the month of May. Winters are frosty and at places severe, as in the hills of Visakhapatnam. The average annual rainfall is about 1550m.m., most of which is received during July to September from the South-west monsoon. A few pre-monsoon showers are also received, and winter rains are scanty. Though the rainy season is short, moisture is available for a longer period than in similar hot areas. This is a favourable factor for the plantations.

1.4. Physical Features:

The tract is generally hilly. The southern portion is plain and gradually becomes hilly forming the Eastern Ghat range of hills. The elevation varies from 150 metres to 1800 metres. The slopes are gentle to moderate but at places are quite steep.

This area forms the catchment of the im-portant river system Godavari. Numerous small streams and nullahs drain the area. Most of the small s-treams are seasonal, and drain into the big perennial tributaries of the River Godavari. The important tributaries are Palmaleru, Sabari and Sileru. The River Godavari passes through the area near the south-western end.

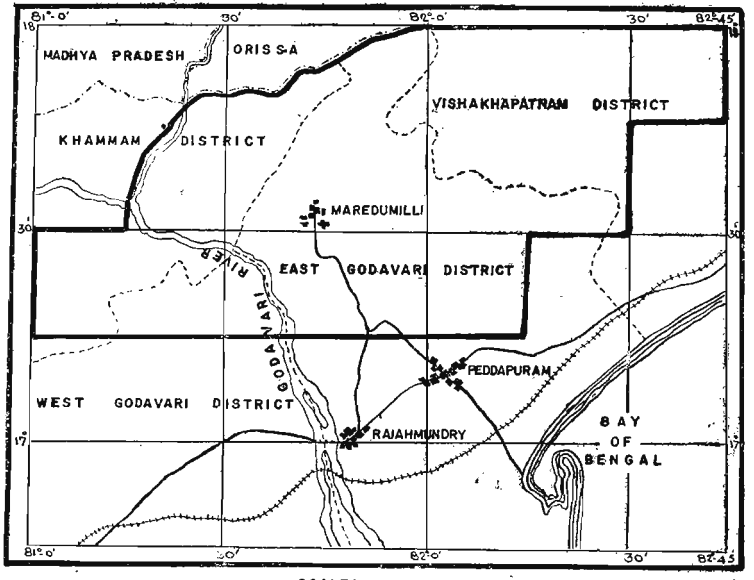
1.5. Geology, Rock And Soil:

The geological formations are very old and are of the Archaean system. The rocks are mostly metamorphic, and Granitic intrusions are quite common. The rocks having undergone long and severe weathering have resulted in soils which are sandy and loamy. The soil is deep and rich in humus as a result of thick vegetational cover.

MAP SHOWING THE SURVEYED AREA

EAST GODAVARI

(ANDHRA PRADESH)



SCALE: 1:1000 000

STATE BOUDARY

DISTRICT BOUNDARY

RAILWAYS

ROADS

RIVER

TOWN & VILLAGES

SURVEYED AREA

1.6. Natural Resources:

The area is rich in natural resources most of which have not been utilised mainly due to the poor communication system. Besides the vast and dense forests as revealed in the survey results, there are rich deposits of graphite and other minerals. The network of rivers forms the source for the major irrigation and power projects. As many as four hydro-electric projects are located on the River Sileru (Machkund, Balimela, Upper Sileru and Lower Sileru). The power generated from these projects will be of the order of 1300 megawatts.

At present intensive cultivation is practised only in the plains. The rich soils of the Godavari valley are very fertile. Tobacco and paddy are extensively grown. The land use pattern is -

Forests	-	63%
Cultivation	-	25%
Shifting Cultivation	-	6%

The soils are very rich and productive as indicated by the present luxuriant vegetation. With intensive management, the forests could contribute substantially to the economy of the State in general and the region in particular. The abundance of water, electric power, and the wood resources offer great scope for development of many wood-based industries.

1.7. The People And Their Socio-Economic Condition:

Most of the area is hilly, forested, and away from the developed towns. It remained isolated till the recent past. This resulted in the original inhabitants who are tribals, practising their ancient methods of living. They are semi-nomadic in the sense that even though they have permanent places for living, their occupation keeps them on the move. The tribes met with are "Bagatas, Samanthas, Valmikis, Kondareddis and Kapus" etc.

Their main occupation is cultivation. They practice shifting cultivation called "Podu". Their farming methods are primitive. They do not have improved implements, seeds, or fertilisers, and more often than not, the yields from lands are very poor. Their agriculture depends solely on the seasonal rain. The crops are insufficient to sustain them throughout the year, and their diet is supplemented by roots and tubers extracted from forests, hunting, and fishing.// They also collect the Minor Forest Products and sell them in the weekly markets. They also maintain cattle, which are mostly used for agricultural operations and for providing manure. They are of poor stock, and hardly provide milk.

// The only organised works they indulge in, are the forestry operations.

The tribals are generally shy by nature. They are suspicious and superstitious. They are very religious and attribute all troubles to the anger of Gods. Every village has a deity or "Konda Devta" whom they worship, and before whom they offer sacrifices. They have a well-managed society and are fond of ornaments. Though hardy, they are not work-minded, but indolent.

Malaria which used to be rampant in this area has been eradicated. Education is making inroads, and with development, they are gradually settling down to an organised way of life. They will form the main labour force for the forest development activity. The development of this region will mean the development of all these tribal inhabitants.

1.8. Infrastructure:

The lack of communications had been mainly responsible for the backwardness of the area. There were hardly any roads till the last decade. The big rivers when full were the main arteries of communication. There was hardly any contact of the tribals with civilization. Only the villages on the Godavari bank developed, while the interior areas remained as such. For virtually six months in a year, the interior villages remained isolated and inaccessible, because of the streams.

During the last ten years, the major task of road construction has been taken up. With this, the inhabitants are able to bring their products like fruits and other minor forest products to the weekly markets in the larger villages. This provides them the money needed for their requirements. The governmental and other social organisations are able to reach the interior to provide better living conditions to the people.

The timber that was removed from these forests used to be transported by carts from forests, and floated down the river Godavari and sold at Rajahmundry market. With the improved road system, there is free movement in all directions. The quick transport methods by trucks will permit higher production from the forests.

The railway runs around the area from Kothagudem and Khammam to Visakhapatnam through Eluru and Rajahmundry. The railhead nearest to the area is about 25 kms. away. The river transport system is well-developed.

1.9. Existing Industries And Markets:

The four districts which constitute the demand zone of this area have well-developed markets. Most of the products of the area are consumed by these centres. Visakhapatnam is a port town and is industrially well developed. The big industries located there are Ship-Building Yard, Oil Refinery, Port Trust, and Naval Project. A Steel Plant is in the offing.

Rajahmundry is a very important town on the river Godavari. It is the biggest timber market of the Zone. It has a paper mill which takes its raw material i.e. bamboo from the area surveyed. There is a big integrated unit of sawmill, wood workshop, wood seasoning and timber preservation plants. A barrage is to be constructed at Rajahmundry.

There are coal mines at Kothagudem. Other markets of lesser importance are Eluru, Vizianagarm, Kakinada and Khammam.

1.10. The Future Possibilities:

As has been described, the area is surrounded by many important towns and cities. With development and increasing population, the demands on the forests of the area are bound to increase. Forests which form the biggest resource will naturally attract the maximum attention. The high productive potential of the soil assures sustained supplies for future. The Government can look-forward with confidence to an economic renaissance in the region.

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CHAPTER - 2.

THE RESOURCE BASE

2.1. Forest Types:

The forests of the surveyed area are mostly of the Southern Tropical Moist Mixed Deciduous, and Southern Tropical Dry Mixed Deciduous types. Some small areas are of the Southern Thorn and Savannah type (Champion and Seth). The forests become moister towards the east and south. Teak occurs, though sparsely, in the less moist areas, viz., parts of Bhadrachelam (S), and Khammam divisions. The forests in the Rampa and Gudem agencies are luxuriant, but contain miscellaneous species. Bamboo occurs over a large part of the area.

2.2.1. Distribution Of Forest Resources:

The forest resources are described under the broad headings:

1. Area
2. Total volume
3. Stand and stock
4. Bamboo

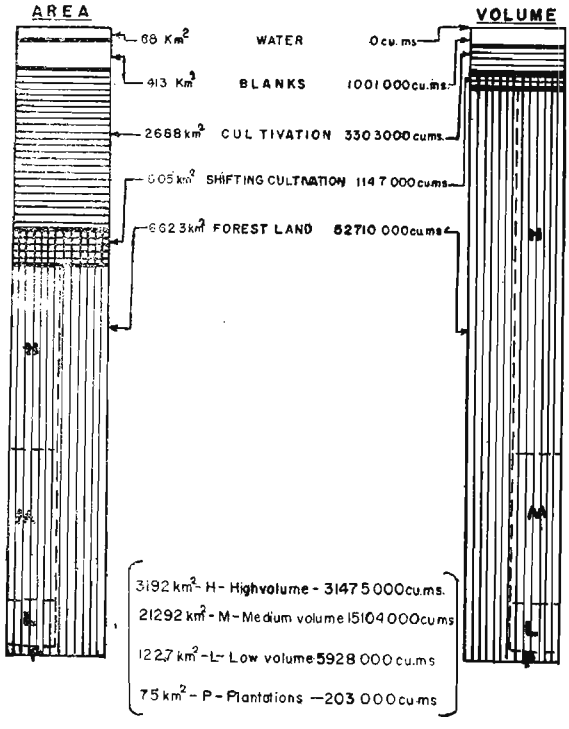
2.2.2. Area:

The total land area surveyed is 10,416 km^2. The following table shows the land use pattern and the extent of each category:

Land Use Class	Area '00 hs.	% of total area
Forest land	6548	62.9
1. High volume stratum	3192	
2. Medium volume stratum	2129	
3. Low volume stratum	1227	
2. Plantations	75	0.7
Total forest i.e. (1 & 2)	6623	63.6
3. Shifting cultivation	605	5.8
4. Cultivation	2688	25.8
5. Blank	413	4.0
6. Water	88	0.8
Total others i.e. (3, 4, 5 & 6)	3794	36.4
Grand Total	10416	100.0

The results indicate that 63.6% of the total land area is covered by natural or man-made forests which emphasise the need for developi

DIAGRAM SHOWING CONTRIBUTION OF DIFFERENT LAND CLASSES TO AREA AND TOTAL VOLUME IN THE SURVEYED AREA.



economy of the region on forest-based industries. Only about one fourth of the area is under cultivation. These facts point to the conclusion that there could be a substantial wood surplus after meeting the local needs.

About half of the forested area has high volume density of about 99 cu. ms. per hectare. The conditions are thus ideal for the growth of good forests, which could be further accelerated by intensive and improved management practices. Area classification has also been done by revenue districts, forest divisions, legal status, forest types, terrain and slope. Raw full tables have been presented in the Technical Report No. 3(2) "Inventory Results".

It is seen that 86.1 per cent of the forested area is Reserve or Protected forests and is under the control of the Forest Department. This will facilitate management and concentrated working. The other forests, like classified forests, etc. constitute a very small percentage and can conveniently be left to meet the requirements of the local population. These will mostly be the fringe forests near habitations.

The forests are mostly of miscellaneous species, and there is very little teak in the natural forest. This is perhaps the main reason why this resource remained unused. But this could now serve as a useful raw material for the new industries. Successful Teak plantations raised in the past are indicators of the possibilities of intensive management and large scale plantation activity to use the full soil potential. An attempt has also been made to classify the land for plantation purposes by studies on aerial photographs. This is the composite effect of soil, terrain and existing vegetation. The existing crops have been taken as indicators of the soil conditions. Accordingly, 812,000 ha. or more than 90% of the forest area is suitable for plantations. This indicates that the present low increment producing natural and mixed forests can be replaced by the faster growing species most needed for the industries.

The forest area is generally hilly with only about 3.6% in flat region. It is as expected, that bulk of the flat area should be under cultivation or non-forest use, and forests confined to the hilly terrain. However, the slopes are not very steep. 304,000 ha. or 42.5% of the forests are on slopes upto 30% and 633,400 ha. or 87.8% of the forests are on slopes upto 100%. Similar analysis shows that 326,500 ha. or 45.6% of the forest area is in plains or lower one third portion of the hills, and 468,900 ha. or 65.8% of the area upto middle portion of the hills. Only about 25 per cent of the area is on hill tops and upper one third portions of hills.

2.2.3. Volume Of Growing Stock:

The total growing stock in the entire surveyed area inclusive of non-forest lands is of the order of 58 million cubic metres. Of this, the forest lands alone (excluding the plantations) contribute 52.6 million cu. ms. and the shifting cultivation lands about 1.1 million cubic metres.

The total volume (under bark including branchwood) in the different strata is:

		Total volume 1000 cu. ms.	% of total volume
1.	Forest land	52,507	90.3
	1. High volume stratum	31,475	54.1
	2. Medium volume stratum	15,104	25.9
	3. Low volume stratum	5,928	10.2
2.	Plantations	203	0.3
3.	Shifting cultivation	1,147	2.0
4.	Cultivation	3,303	5.7
5.	Blanks	1,001	1.7
6.	Water	-	-
	Total	58,162	100.0

It is apparent that 90% of the volume is on the forest lands. Out of this 45,525,000 cu. ms. or 86.6% is in the Reserve and Protected forests. Similarly 618,000 cu. ms. or 53.9% of the volume from shifting cultivation is also in the Reserve and Protected forests. In all over 46 million cu. ms. (46.143 million cu. ms.) or 86% of the wood growing in the forest and shifting cultivation lands is from the Reserve and Protected forests. Areas have been classified into volume density classes by p-hoto studies. High volume areas have nearly 100 cu. ms. per hectare. Medium volume areas have 50 to 100 cu. ms. per hectare, and low volume areas have 15 to 50 cu. ms. per hectare. It is gratifying to know that more than half the area is having high volume density.

Detailed cull studies were made to assess the volume not available because of defects like rot, hollowness etc. They reveal that cull is negligible and hence no cull factor has been applied.

2.2.4. Stand And Stock Tables:

These have been prepared for each stratum on the Present Utilization Pattern, and break-ups have been given for groups of species according to the classification given below. This grouping is based on local studies on utilization pattern:

Big Timber Species
Small Timber Species
Pulpwood Species
Fuel and rest

PRE-INVESTMENT SURVEY OF FOREST RESOURCES

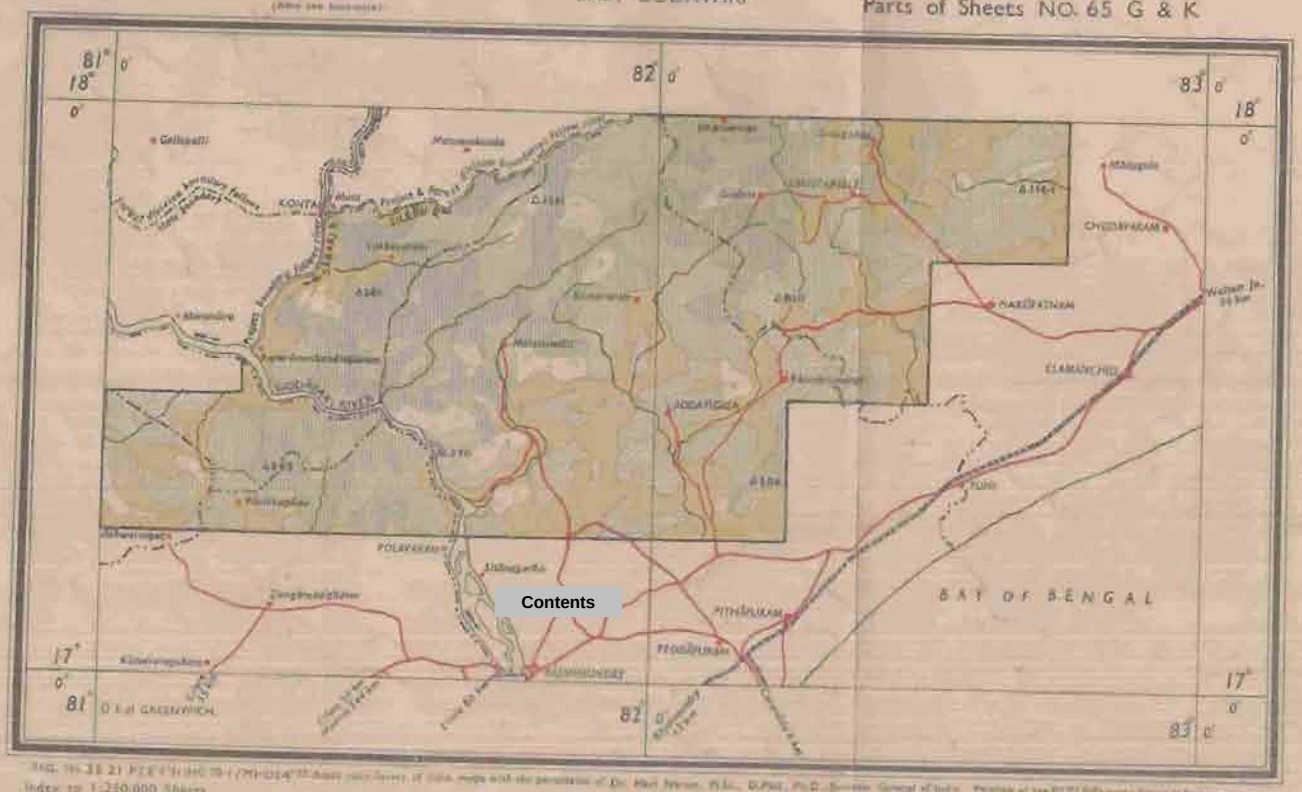
LOCATION MAP

CENTRAL ZONE

EAST GODĀVARI

Season 1970.
(Area see Inset map)

Parts of Sheets NO. 65 G & K



Contents

Index to 1:250,000 Sheets

1972.

1:1,000,000

Kilometres 0 5 10 20 30 40 50 60 70 80 90 100 Kilometres

The limits of forest cover types were compiled from 1 inch to a mile Survey maps & Land use maps, which in turn were based on interpretation of 40,000 scale aerial photographs taken in Jan. Feb. 1968.

The limits of forest cover types were generalised on 1 inch to a mile base maps & areas less than 400 hectares were either omitted or merged with the adjoining type for mapping the map.

The alignment of Forest Division boundaries has been adopted from demarcation reserved maps. Pre-investment Survey of Forest Resources Organisation.

The back ground details have been compiled from existing 1/4 inch sheets Nos 65 G 2nd edition 1958 and 65 K 2nd edition 1951.

Heights shown are in metres.

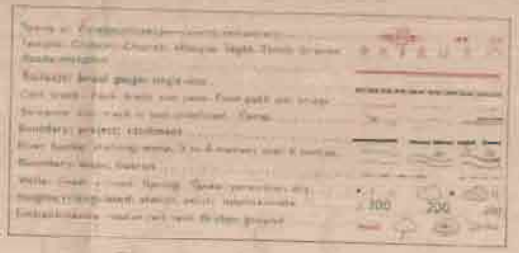
Administrative Index

1 MADHYA PRADESH.
2 ORISSA.

Forest Type Symbols

Index to Forest Divisions

1 SOUTH EASTAR.
2 JEYPORE.
3 VISHĀKHAPATTANAM.
4 SOUTH BHADRĀCHALAM.
5 PĀLONCHA.
6 KHAMMAM.



The first category includes all species which are used as large size timber for construction, furniture and such other purposes. The big timber species also include species suitable for plywood. The second category includes species used as small timber, poles etc. The third category includes species which have been tested and found to be suitable for pulping. The last category comprises other species which can be used for fuel. This classification provides ready information on the availability of raw material for different types of industries. If for instance, a plywood factory is to be established, the quantity of wood of the plywood species above the minimum diameter requirement will be needed. For a pulpwood factory, the quantity of pulpable species is needed.

The tables below show that big timber species constitute about 60% of the total volume, and pulp-able species about 19%.

Volume (UB) - in '000 cu. ms.

Strata	Big timber spp.	Small timber spp.	Pulpable spp.	Fuel and rest spp.	Total
Shifting cultivation	522	210	160	255	1,147
Low volume	2,880	505	1,785	752	5,928
Medium volume	8,384	1,859	3,186	1,675	15,104
High volume	19,110	3,722	6,029	2,614	31,475
Total	30,904	6,296	11,158	5,296	53,654

For a detailed break-up by species in each stratum in all the above four utility classes, please see Technical Report 5(2).

For the proposed utilization pattern, the following broad classification of volumes has been adopted:

1.	Plywood	Over 40 cms. diameter dbh of plywood. Species; according to ISI specification.
2.	Timber	Over 30 cms. diameter dbh of timber species big and small timber.
3.	Polewood	20 to 30 cms. dbh of all timber spp.
4.	Pulpwood	Total volume of species according to the list of pulpable species.
5.	Fuelwood	All sizes of species excluding (1) to (4) and volume below 20 cms. of timber species and branch wood of plywood, timber and polewood.

For calculating the volumes of each category, the following methods based on local studies have been employed:

1) Plywood: The gross volume of plywood species above 40 cms. dbh was reduced by 25% (for branchwood) to arrive at the volume of main stem and leading branch only. This was further reduced by 66.6% to give the volume of plywood material.

2) Timber: The volume of all timber species above 30 cms. dbh was reduced by 25% (branchwood) to arrive at the volume of main stem and leading branch. This was further reduced by 25% to get the timber volume. 53.3% of the plywood species volume was added, as this volume will be available as timber, after removing the plywood logs.

3) Polewood: The total volume of timber species in dbh class 20 - 30 cms. was reduced by 18% as allowance for branchwood.

4) Pulpwood: Total volume including branchwood of the pulpable species has been treated as pulpwood volume.

5) Fuelwood: The balance material after deducting plywood, timber, polewood, and pulpwood material from the growing stock has been taken as fuelwood. The total net volume in different utility classes is as shown below with their percentage:

	Total Vol. '000 cu. ms.	Percentage
1. Plywood material	1,706	3.2
2. Saw timber	10,950	20.4
3. Polewood	7,779	14.5
4. Pulpwood	11,158	20.8
5. Fuel	22,061	41.1
Total	53,654	100.0

The above table shows at a glance, the possibilities of setting up different types of industries like plywood, sawmilling, pulp and paper etc., based on the resources of this region. The resources are adequate to support more than one industry like plywood, sawmilling, and pulp. If on the other hand, only one type of industry is established, the resources may increase slightly by diverting them from other classes. For instance, if pulp is the only industry, then some of the material included in timber and pole species will also be available. If sawmilling is the only industry, then all the plywood species will also be available. A balanced distribution to different industries is possible. The future management will naturally be designed to meet the requirements of the industry that come up and, hence future resources are bound to increase.

2.2.5. Bamboo

Bamboo occurs extensively and it is estimated that about 423,200 ha. are covered by it. The density of occurrence varies from scattered to pure. Two species viz: Dendrocalamus strictus and Bambusa arundinacea are found, but the area under Bambusa arundinacea is only about 10.8% of the total bamboo area. Hence in this report, the two species have been treated as one for resource assessment. Two site qualities have been recognised. The occurrence of bamboo is as follows.

Bamboo Occurrence

Area in '00 ha.

Quality	Occurrence Class			Total	Row total as % of total area
	Scattered	Dense	Pure		
I	498	804	773	2075	49.0
II	1292	468	397	2157	51.0
Total	1790	1272	1170	4232	100.0

179,000 ha. or 42.3% of the bamboo area has only scattered bamboo i.e. there are less than 50 clumps per hectare, while 127,200 ha. or 30.1% of the area has dense bamboo i.e. 50 to 100 clumps per hectare, and 127,000 ha. or 27.6% of the area has pure bamboo, i.e. more than 100 clumps per hectare. The total bamboo stock from the area is:

Stratum	Area '00 ha.	Total bamboo stock in '000 tonnes		
		Sound	Damaged	Total
Scattered bamboo	1790	141	38	179
Dense bamboo	1272	394	95	489
Pure bamboo	1170	670	162	832
Total	4232	1205	295	1500

For the purpose of this calculation, the weight of the damaged culms found in a clump is taken as half of that of the sound mature culm. The dry rotten culms have been considered as contributing no stock. The average number of 1 season old, 2 season old and three and more seasons old culms per clump are:

Quality	Clump size Classes											
	I				II				III			
	1-S	2-S	3+S	All	1-S	2-S	3+S	All	1-S	2-S	3+S	All
I	0.9	1.0	6.0	8.7	1.8	2.3	16.4	20.5	3.3	3.9	29.8	37.0
II	1.1	1.4	5.8	8.3	2.6	2.5	14.9	20.0	5.2	5.0	29.7	39.9

Clump size classes are:

I	- Clump diameter less than 1 metre.
II	- Clump diameter 1- 2 metres.
III	- Clump diameter more than 2 metres.
S	- Season old.

The table shows the number of culms in the clump and the recruitment position of new culms.

It is apparent that there is an accumulation of mature, stock, and possibility because of this, and half cut culms, the recruitment is rather poor. The bamboo stock from this area can be increased by cleaning the culmps, which may induce more new culms to come. This not only provides higher initial yield, but ensures its continuity. Another factor is the preponderance of culmps which have culms less than the minimum number prescribed to be retained under the bamboo felling rules of the department.

CHAPTER - 3.

MARKET STUDY AND CONSUMPTION PATTERN

3.1. The Demand Zone:

The four districts whose portions constitute the surveyed area form the demand zone. It implies that the produce from the demand zone is primarily disposed of in that region. Most of it may be consumed and part of it may be exported. The Zone has an important timber market at Rajahmundry and important industries at Visakhapatnam and Kothagudem. All these are areas with increasing demand for wood products. The variety of species, numerous sizes, different grades of wood being demanded at different price levels, however, make the demand picture rather complex. All the supply and consumption figures pertain to the year 1968 when the study was undertaken.

3.2. The Supply:

The markets of the zone are fed from the following sources of wood:-

1) Imports of wood which are mostly from Bastar (M.P.), Orissa and Maharashtra;
2) Production form the forests of the zone, of which the present surveyed area is a part;
3) Production from non-forest lands.

The wood is either in the form of industrial wood or fuelwood. Industrial wood includes the wood supplies to saw-mills and which after conversion may be used for construction, etc.

It has been estimated that about 149,000 cu. ms. of industrial wood (r) reaches the market. This includes about 27,500 cu. ms. of industrial wood which is re-exported out of the zone. The supplies from the three sources listed above are:

1.	Imports.	- 60,000 cu. ms. (r)
2.	Production from the forests of the zone (recorded 52,000 and un-recorded 3,000).	- 57,000 cu. ms. (r)
3.	Production from non-forest land	- 31,500 cu. ms. (r)
	Total	- 149,000 cu. ms. (r)

It is also estimated that of this, only about 22,000 cu. ms. of wood is from the surveyed area, while the balance comes from the other forest areas within the demand zone.

Fuelwood constitutes the main drain from the wood reserves. The large population depends for its daily requirement of fuelwood from the area. The industries also require considerable quantities of fuelwood.

The annual consumption has been estimated as 3,628,500 cu. ms. (r). The supplies come from forests, private lands, private plantations of Casuarina, saw mill wastes, etc. It is difficult to quantify exactly the supplies from different small unrecorded sources. The supplies from the various sources are as follows:

Supply of fuelwood from forests 900,000 cu. ms. to plains, 36,500 cu. ms. to the agency areas mostly as free grants.	936,500 cu. ms. (r)
Supply from private farm lands of Casuarina	100,000 cu. ms. (r)
Supply from saw-mill wastes	36,500 cu. ms. (r)
Supply from unrecorded sources	2,553,500 cu. ms. (r)
Total	3,628,500 cu. ms. (r)

3.3. Consumption Pattern:

Analysis of the results of the consumption and market studies in the zone reveals that:

1. The level of total consumption of wood is of the order of 3,748,000 cu.ms. (r) of which 121,500 cu. ms. (r) is of industrial wood.

2. The consumption of saw logs in the round by the saw-milling industry is by far the most significant part of the industrial wood. In terms of roundwood equivalent, it is 72,000 cu. ms. and represents 59% of total industrial wood consumption. There are 207 saw mills at 74 centres — their dispersal being far and wide in the districts of East Godavari and West Godavari and not so spread out in the other two districts.

The Government integrated saw mill, seasoning kiln and treatment plant at Rajahmundry is the only major mill in the region with an input of saw logs between 9,000 to 10,000 cu. ms. (r) per annum. The estimated consumption of logs for hand sawing is 4000 cu. ms.(r) which works out to be about 3% of the total consumption.

3. There are no plywood, particle board or hardboard units in the Zone. Other industries like ship-building, boat building and vehicle body-building account for a modest 2,700 cu. ms.(r) per annum which is just 2% of the total consumption. This also includes requirement of poles for electric transmission.

4. Requirement of timber for mining is to the extent of 8,000 cu. ms.(r) (6.5 % of total consumption) per year. This is the consumption of Collieries at Singereni, in Khammam District, which produce 1.5 million tonnes of coal per year.

5. The requirement of poles for constructional purposes is estimates at 29,800 cu. ms. (r) which is 24.5% of total consumption.

6. Wood used for agricultural implements accounts for about 4% of total consumption. It is 5,000 cu. ms. (r).

7. There is sizable export amounting to 27,500 cu. ms. of timber to other districts. This includes exports of the timber imported into the Zone.

8. Use of wood for fuel far surpasses all other uses put together. It is estimated to be more than 3.6 million cu. ms. (r) annually of which 90,000 cu. ms. (r) is industrial firewood.

9. The only major forest-based industry is the Andhra Pradesh Paper Mills at Rajahmundry. It consumes 100,000 tonnes of air-dry bamboo per annum, of which 74,000 tonnes are derived from the forests of the Zone.

10. There is a consumption of 50,000 tonnes of air-dry bamboos for non-industrial uses in the zone entirely derived from forests of the zone.

3.4. Future Demand Trend:

The demand for industrial wood is likely to increase substantially with the coming up of the new industries and expansion of the existing ones. The requirements of different categories of industrial wood are:

Projected demand of wood in the Zone -Timber

S.No.	Item	In Cubic Metres 1968	1975	1980
1.	Sawnwood used for ship-building, boat-building, sawmills, hand-sawing.	78,500	94,000	110,000
2.	Wood for agricultural implements.	5,000	6,000	7,000
3.	Wood for mining.	8,000	10,000	12,500
4.	Wood for transmission poles	300	400	800
5.	Wood for construction.	29,800	36,000	42,300
	Total	121,500	146,000	173,000

There may be a slight drop in fuelwood demand in the immediate future and thereafter, a small increase. This is because of the substitution of wood by alternative energy sources. The total estimated demands in 1975 and 1980 are likely to be 3,648,000 cu. ms. and 3,973,000 cu. ms. respectively.

But according to the estimates made in the National Council of

Applied Economic Research, the fuelwood demand is expected to increase by 14% during 1968-75 period and by 30% during 1968-80 period. For purposes of wood balances, the higher figures of N.C.A.E.R. have been adopted. The future demand of bamboo is estimated as:

Year	Industrial requirement '000 tonnes	Other requirement '000 tonnes	Total '000 tonnes
1975	160	50	210
1980	270	60	330

/-----/

CHAPTER - 4.

MANAGEMENT OPPORTUNITIES AND POTENTIAL ANNUAL CUT

4.1. Management Opportunities:

It has been shown in the previous chapters that the forests of the East Godavari Catchment, even though they contain a rich growing stock of miscellaneous species, have not yet played any significant role in the development of the backward region. This could be attributed to the lack of demand for the existing produce, and to the high cost of extraction for the otherwise utilizable species. The forests have virtually remained inaccessible.

The recent technological advances in the pulping of hardwoods will help a great deal in increasing the value of the forest crops and there would be a great scope for intensifying forest management, and augmenting the cut from the forests. The intensive forest management, and industrial development in the region, which, in its wake will improve the communication system, will lead to the socio-economic development of this backward tribal area in particular and contribute to the national economy. The region is on the threshold of industrial development, and a nucleus of forest based industries already exists in it. There would be ample scope for expanding the existing industries and setting up new ones for ensuring full integration and utilization of the cut from the forests.

This situation will provide an opportunity for increasing the returns from the forests. This will involve sizable investments on infrastructural and industrial development, intensifying and modernising forest management, and the raising of plantations of commercial or pulpwood species. It has been ascertained that there are adequate areas which could be considered as suitable for the raising of man-made forests. The soil and climatic factors are known to be favourable for this activity.

4.2. Present Management Activities:

The present management activities followed in the region are geared to a low key of utilization. A large proportion of the area has not been worked in the past. The areas nearer the habitations and connected by roads are managed intensively by adopting the clear-felling and planting, and coppice with reserves systems. The remote areas are worked under the selection-cum-improvement system.

The Forest Department has, however, in recent years, extended plantation activities in a fairly big way and sizable targets of Teak, Bamboo and Eucalyptus planting have been achieved. Trials have also been conducted on introducing tropical pines in the region. The results are encouraging and they hold a promise for the future. Natural regeneration of the important species has also been good. The most abundant species Xylia xylocarpa for instance, has profuse natural regeneration and this phenomenon has been made use of in the selection and coppice forests.

4.3. Guide Lines For The Proposed Management Model:

The main objectives for the proposed management are:-

1. To satisfy the present and future requirements of wood of the existing industries, and the local people.

2. To provide additional raw material for the following planned industries:-

   i) Plywood factory with an additional intake of 30,000 cu. ms. of plywood material;

   ii) Supply sufficient wood and bamboo for the expansion of the Andhra Pradesh Paper Mills at Rajahmundry for which the expansion programme indicated is:

Present (1972)	-	150 tonnes per day.
1975	-	300 tonnes per day.
1980	-	500 tonnes per day.

3. To increase the productivity and economic value per unit area of the forest by concentrated planting of more valuable species and tending of other forests.

   To provide recreative functions and protective influences of the forest to the catchment area in checking soil erosion, regulation of water supply etc.

Consistent with these objectives, and keeping in view the constraints of the department, two models have been prepared. While suggesting the methods of working, full recourse has been taken to the existing practices to smoothen the process of intensification. The allocation of areas to different systems of management has been made after considering the important factors of silviculture, topography, location with reference to industrial sites, centres of demand etc.

The important features of the proposed management models are:

1. Creation of pulpwood and bamboo plantations to provide raw material for the paper mill on a sustained basis and at low cost. Since the cost at which raw material should be made available for paper making has its limitations, the inputs in planting and consequently production can be increased by reducing the transport cost. It is therefore necessary to locate the pulpwood and bamboo plantations as near to the mill site as possible to make them sound financial investment propositions.

2. Conversion of mixed forests to plantations of Teak which has and will continue to have high market value. These will also provide wood for the plywood industry. Maximum production will give the highest return from the investment, and hence all high volume areas which have the greatest productivity potential are taken up for plantations.

3. Manage the other forests to meet the requirements of industrial wood and fuelwood, mainly depending on natural regeneration by seed or coppice.

The first model provides for a constant supply of wood in the first 10 years of management, and aims at bringing a larger area under management. The second model presents a more concentrated system of working only to the extent of satisfying the present and future demands. In both the models, areas with slopes more than 100% have been excluded from working for soil conservation needs. The classification of areas by slope classes is given in the inventory results and the present calculations are confined to the forested area excluding the plantations.

No management is prescribed for the shifting cultivation areas either, but these will form the buffer for the fuelwood needs which are likely to be enormous.

4.4. Description of Models:

Slope and stocking are main criteria for allocation of areas to different management systems in the two models. Tabular statement in this respect is:

Stratum	Area with slopes upto 30% in ha.	Area with slope from 30% upto 100% in ha.	Area with slope over 100% in ha.	Total ar. area in ha.
High volume	141,100	169,500	8,600	319,200
Medium volume	93,700	109,200	10,000	212,900
Low volume	66,600	53,000	3,100	122,700
Total	301,400	331,700	21,700	654,800

Note: The above distribution is based on Table No. 8 of the Technical Report 3(2). The unspecified areas therein have been allotted proportionately to the respective slope classes.

4.4.1. Model I:

The systems of management proposed are:-

1. Clear-felling and planting;

2. Selection-cum-improvement system;

3. Coppice with reserves system;

4. Working of the over lapping bamboo area.

1. Clear felling and planting: The following annual targets of plantations of different species are proposed:

i) Teak plantations on a 80 year rotation over 1000 hectares annually;

ii) Fast growing species (Eucalyptus) plantations on a 10 year rotation over 3000 hectares annually;

iii) Bamboo plantations on a 40 year rotation over 2000 hectares annually. Planting to be done for 15 years. The plantations will be ready for harvest in the ninth year. The felling cycle will be 3 years.

Thus the total area required for the plantations is:

i)	Teak	60,000 ha.
ii)	Fast growing species	30,000 ha.
iii)	Bamboo	30,000 ha.
	Total	120,000 ha.

The annual target of 3,000 ha. of fast growing species plantations has been adopted keeping in mind the projected requirement of the pulp and paper mill at Rajahmundry, the production capacity of which could be raised substantially in the years to come. This aspect has been dealt within a later part of this report.

Bamboo plantations are at present considered financially un-economic. But bamboo forms an important component of raw material for paper and will be required in larger quantities for industrial expansion. By concentrating the availability, increasing the yield and locating them nearer the mills, it is expected that bamboo plantations would become financially viable.

Before passing on to the other items pertaining to the management model, it would be worthwhile to stress that it would only be valid for a definite set of prescriptions and area allocation. Should the objectives and allotment of areas (or, as for that, plantation targets) change at any time, it would be quite easy to recast the model and work out afresh the potential annual cut.

2. Area to be allotted to Selection-cum-improvement Felling: The remaining area of the high volume stratum (after deducting the area put under protection and that set apart for plantations) along with the entire area of the medium volume stratum (excluding the area put under protection) will be put under Selection-cum-Improvement felling. The break up of area by volume strata would be:-

(i)	High volume stratum	- 190,600 ha.
(ii)	Medium volume stratum	- 202,900 ha.
	Total	- 393,500 ha.

The forests under this treatment class will be worked on a felling cycle of 20 years for selection removal of trees above a stipulated diameter class and for carrying out improvement felling and thinning in the entire crop. The selection size diameter that has been adopted is 40 cms. and over. A provision has been made in the prescriptions (for the sake of safety) for the removal of 50% of selection size trees under each annual cut. The other treatment to be given to the crop will be improvement felling combined with a light thinning, whereby dead, dying and diseased trees will be removed and thinning will be done to give adequate growing space to trees. Under this treatment it has been determined that the cut would amount to 35% of the crop after excluding trees over 40 cms. diameter. The main cut i.e. trees over 40 cms. diameter and the thinning yield will both come from the same areas.

3. Area to be worked under Coppice with Reserves: The area under the low volume stratum (excluding the portion to be put under protection will be worked under the Coppice with Reserves System. This will provide for a fairly elastic management pattern to suit the different crop conditions. The area that would fall under this treatment class would be 119,600 ha.

A cutting cycle of 40 years has been adopted for this model, and it has been stipulated that ¼ of the growing stock will be retained in the form of reserves.

4. Working of the overlapping bamboo area: The overlapping area under bamboo is 423,000 ha. For the harvesting of bamboo the same management model has been adopted as was in vogue in the Forest Department. The bamboo cutting rules used for the model are given in Appendix II.

5. Calculation of the Potential Annual Cut: Having laid down the prescriptions and done the allotment of areas to the different treatment classes, it could now be possible to calculate the potential annual cut on the basis of inventory results pertaining to volume and stand distribution under the different forest strata.

Since there is to be no felling of trees in the protection areas, there will be no yield from them. The potential annual cut from the other three treatment classes is calculated below:

5(i). Potential annual cut from clear-felling areas: The annual planting area (for Teak, fast-growing species, and bamboo) is 6,000 hectares. The average volume per hectare is 98.6 cu. ms. Since the entire growing stock is to be clear-felled, the potential annual yield from such areas would be 591,600 cu. ms.

5(ii). Potential annual cut from Selection-cum-improvement Felling Areas:

The annual area of working would be 393,500 ha. = 19,675 ha. The distribution of this area, on the basis of 20 years proportionate distribution could be taken as 9,530 ha. under high volume stratum and 10,145 under the medium volume stratum. The standing volume over the area of annual working would be :

(i)	9,530 ha. x 98.6 cu. ms.	= 939,600 cu. ms.
(ii)	10,145 ha. x 70.9 cu. ms.	= 719,200 cu. ms.
	Total	1,658,800 cu. ms.

The above volume would be made up as shown below:

Stratum	Component of vol. of trees over 40 cms. dia.	Component of vol. of trees upto 40 cms. dia.
High volume stratum	164,400 (17.5%) cu. ms.	775,200 cu. ms.
Medium volume stratum	89,900 (12.5%) cu. ms.	629,300 cu. ms.
Total	254,300 cu. ms. 50% of above	1,404,500 cu. ms. 35% of above.
The potential annual cut would therefore be:	127,100 cu. ms.	491,400 cu. ms.

5(iii). Potential annual cut from Compiea with Reserve areas:- The area of annual working would be 119.600 ha. = 2990 ha. The standing volume over this area would be 2990x48.3/40 years $\surd$ cu. ms. = 144,400 cu. ms. Granting that $\frac{1}{4}$ of this volume is to be retained as reserves, the potential annual cut comes to 108,300 cu. ms.

5(iv). Total potential annual cut:- Adding up the potential annual cut from the different treatment classes, the total potential annual cut comes to:

(i)	From plantation areas	591,600 cu. ms.
(ii)	From selection-cum-improvement felling areas	618,500 cu. ms.
(iii)	From C.W.R. areas	108,300 cu. ms.
		1,318,400 cu. ms.

which could be taken as 1.32 million cu. ms. This works out to 2.4% of the volume standing over forested areas.

5(v). Break-up of potential annual cut into utility assortments: The break-up of the potential annual cut from the different classes would be as shown below:

Treatment Class	Utility assortment					Total cu. ms.
	Plywood material in cu. ms.	Saw timber in cu. ms.	Poles in cu.ms.	Pulp wood in cu.ms.	Fuel-wood in cu. ms.	
Plantation area	18,900 (3.2%)	120,700 (20.4%)	85,800 (14.5%)	123,000 (20.8%)	243,200 (41.1%)	591,600
Selection-cum-improvement felling						
(i) Selection size removal	15,400 (12%)	86,400 (68%)	-	-	25,300 (20%)	127,100
(ii) Improvement felling and thinning	-	-	-	163,800 (1 part)	327,600 (2 parts)	491,400
C.W.R. Area		-	-	36,100 (1 part)	72,200 (2 parts)	108,300
Total	34,300	207,100	85,800	322,900	668,300	1,318,400
Rounded off to thousand cu.ms.	34,000	207,000	86,000	323,000	668,000	1,318,00

5(vi). Potential Annual Cut from Reserve and Protected Forests:- The Reserve and Protected Forests constitute 86% of the total forested area. In apportioning the potential annual cut to this segment, the above figure will have to be modified. The plantation areas (which constitute 18% of the forest area) would invariably be located within the Reserve and Protected forests. Thus, when applying the percentage distribution of area for apportioning the potential annual cut to these areas, there would be justification for taking the figure as slightly higher than 86%. For this report, therefore, the proportion of area and potential annual out for Reserve and Protected forests has been taken as 90% and on this basis the prediction of the cut from these forests after rounding off would be:

Plywood material	- 30,600 cu. ms.
Saw timber	- 186,300 cu. ms.
Poles	- 77,500 cu. ms.
Pulpwood	- 290,700 cu. ms.
Fuelwood	- 601,200 cu. ms.
Total	-1,186,300 cu. ms. or say 1.2 million cu. ms.

5(vii). Potential Annual Out of Bamboo: The model for calculation of the potential annual cut of bamboo is based on a 3 year cutting cycle. The detailed prescriptions followed by the Forest Department are given in Appendix II.

The inventory data collected for bamboo has been used for determining the potential annual cut using simulation techniques. The steps involved are detailed below:

1. Total area of sample plots for bamboo is 10.4 ha.
2. Total number of bamboo clumps in sample plots is 1,151.
3. Number of bamboo clumps which satisfy the minimum stocking for exploitation is 430 which works out to 40% of the total number of clumps.
4. In the clumps under item 1, the number of culms is:

   (a) Broken culms - 4,600
   (b) Sound culms - 4,000

Two broken culms are assumed to be equal to one sound culm.

5. The number of culms per hectare of sampled area comes to:

   (a) Broken culms $\frac{4600}{10.4}$ = 442 or 221 sound culms equivalent
   (b) Sound culms $\frac{4000}{10.4}$ = 385.

6. The weight of an individual culm has been determined to be 3 kg.

7. The weight of culms per ha. as shown under item 5 comes to:

   a. Sound culms - 1.15 tonnes
   b. Broken culms - 0.66 tonnes

   Total - 1.81 tonnes

8. Total bamboo area is 423,000 ha.

9. Total cut in a cutting cycle of three years on entire bamboo area would be:

   a. Sound culms - 486,000 tonnes
   b. Broken culms - 279,000 tonnes

   Total - 765,000 tonnes

10. Total annual cut would be:

   a. Sound culms - 162,000 tonnes
   b. Broken culms - 93,000 tonnes

   Total - 255,000 tonnes

This yield projection also fits in fairly satisfactorily with the annual recruitment of new culms which has been worked out as being equivalent to 220,000 tonnes. This affords a good check on the calculated potential annual cut.

It is emphasised that about 60% of the culms do not have sufficient number of culms to afford cutting at present. In due course they will grow and provide considerable yield when the broken culms will not be available.

5(viii). Potential Annual Cut of Bamboo from Reserve and Protected Forests

The extent of Reserve and Protected Forest area is 86% of the total forested area. To make the estimation of cut realistic, allowance will have to be made for inaccessible and difficult areas and, therefore, on both these counts, a deduction of 25% could be made from the total potential annual cut. On this basis, a potential annual cut of 191,000 tonnes of bamboo from the accessible Reserve and Protected forests could be taken in the management model.

In the first cycle of bamboo cutting nearly half the yield would come from broken culms. In the subsequent cycles, it would be reasonable to expect this gap to be made up from the other bamboo clumps which have been left out from the present calculation for not satisfying the minimum stocking. Better management of the bamboo areas would also make for an increase in subsequent yields.

5(ix). Estimation of future potential Annual Cut based on the Management:

Model:- Any discussion of the potential annual cut would not be complete until a projection is made into the future on the basis of the model that has been adopted. This will also help in bringing into focus the impact of the model and the scope of industrial develop-ment.

The first major aspect of the new management model would be in the direction of laying a sound base for rich earnings in future from the disposal of Teak timber of plantation origin. The economic effects will be examined in a subsequent chapter, but it may be pointed out here that on the basis of present values, the harvesting of Teak Plantations alone will yield an annual revenue of more than Rs. 60 million.

The plantations of fast growing species would provide sustained supplies of almost uniform sized and homogenous raw material for the pulp and paper industry. It would be possible to integrate these plantations with the industry and to plan for capacities taking into consideration the yields from these plantations and also from the bamboo areas and plantations.

The Teak plantations would be expected to yield the following material per hectare in the years shown against each from the year of formation:

10th year	15-20 cu. ms.	-	15,000 cu. ms. - 20,000 cu. ms.
20th year	50-60 cu. ms.	-	50,000 cu. ms. - 60,000 cu. ms.
40th year	50-60 cu. ms.	-	50,000 cu. ms. - 60,000 cu. ms.
60th year	120-140 cu. ms.	-	120,000 cu. ms. -140,000 cu. ms.

These latter figures are for total annual availability.

As for the fast growing plantations, they could be expected to provide 300,000 cu. ms. annually at the rate of 100 cu. ms. per ha. from the 11th year of formation.

The bamboo plantations would provide an escalating yield from the first cutting cycle after the clumps become exploitable (this could be taken as the 9th year after planting) and the potential cut per year from the bamboo plantations would be:

9th to 11th year	- 12,000 tonnes
12th to 14th year	- 24,000 tonnes
15th to 17th year	- 36,000 tonnes
18th to 20th year	- 48,000 tonnes
21st to 40th year	- 60,000 tonnes

The potential annual cut from the Selection-cum-Improvement felling areas will be constant and sustained. There would, however, be a drop in the annual availability of plywood material and saw timber from the 16th year onwards when the plantation targets of fast-growing species and bamboo are completed.

5(x). Further steps required to be taken to Formulate concrete Management Plans for the next fifteen or twenty years.

The management model presented in the preceding parts of this Chapter has been based on a broad study of a large area and at best, it could be considered as helpful in indicating broadly the delineation of treatment classes and the expectation of the potential annual cut in order to plan effectively for industrial development, capacities, and allocation of raw material resources. The same model could be made more effective if the treatment classes are actually superimposed on the forest types and volume strata distribution maps which have been prepared by the organization.

For the management to be meaningful, it would be necessary to select compact areas of treatment for a block of fifteen or twenty years and then to carry out micro-planning for it. This would necessitate a more detailed study of the areas and also perhaps a more intensive inventory sampling to improve the precision of data pertaining to the specific micro-areas. It would suffice here to leave the matter at this stage by pointing out that there would be no difficulty in doing so, and that, by way of demonstration, the Preinvestment Survey of Forest Resources Organisation has actually done a study of this type for the forests of 1"=1 mile map sheet 65 G/14 falling within the present reporting area. A report on this study will be brought out separately.

MODEL - II

4.4.2. Introduction:

There are two salient features of this model. Firstly, it provides for progressive increase in the intensity of forest management to match the progressive increase in future demand for forest produce. Secondly, it aims at a concentrated system of forest management to keep the cost of logging and transport to the minimum in view of undeveloped nature of terrain. For a successful implementation of the model, however, it is necessary to assess the present and future demand. This is needed not only for achieving maximum revenue but also for optimum planning of logging and planting operations. Various steps involved are described below:

1) Determination of aggregate present and future demands:- The demands of the plywood industry at present are nil. They are likely to be of the order of 30,000 cu. ms. of plywood material by 1975 and 40,000 cu. m-s. by 1980.

The sawnwood requirement is likely to increase from 121,000 cu. ms. in 1968 to 146,000 cu. ms. in 1975 and to 175,000 cu. ms. in 1980.

The paper mill at Rajahmundry has a production capacity of 150 tonnes per day at present and this is estimated to increase to 300 tonnes per day by 1975, and 500 tonnes per day by 1980. The mill is using only bamboo as raw material, but in future it is likely to use hardwoods and bamboo in the ration of 40 to 60.

The fuelwood demand is considerable and the drain on the surveyed a-rea on this count was 675,000 cu. ms. in 1968. Based on the estimates of the National Council of Applied Economic Research the fuelwood requirement is likely to increase by 14% by 1975 and by 30% in 1980*.

The consolidated demand position is as follows (in cu. ms.)

Year	Plywood	Roundwood	Hardwood for pulp	Fuelwood	Total
1968	-	121,500	-	675,000	788,500 or 796,000
1975	30,000	146,800	162,000	769,000	1107,800 or 1108,000
1980	40,000	173,000	270,000	882,700	1365,700 or 1366,000

* These figures differ from the ones quoted in market study report and are based on latest study of N.C.A.E.R.

If 1,000 cu. ms. is considered as 1 unit of wood, the demand of various categories of wood will be:

Year	Plywood	Industrial wood	Fuelwood/ pulpwood	Total
Present	-	121	675	796
1975	30	147	932	1109
1980	40	173	1153	1366

2. The systems of management: Only two systems of management are suggested:-

(1) Clear-felling and planting: For increasing the production capacity per unit of area, clear felling followed by plantation is perhaps the best system. However, availability of funds and trained personnel will be a limiting factor. For purposes of the present model following targets for plantation are assumed.

Year	Species planted in '000 ha.			
	Teak	Bamboo	Eucalyptus	Total
1972	1	1	1	3
1975	1	2	2	5
1980	2	3	3	8

The plantation areas as discussed earlier will be selected in the high volume strata where the average volume per hectare is 98.6 cu. ms. From the inventory data and local studies, it has been ascertained that about 3.2% of the volume, will be available as plywood material, 34.9% will be the sawnwood or industrial wood component, and the balance of 61.9% will be fuelwood part of which can also be used for pulping. Based on these considerations, the yield per thousand hectares of different categories of wood from the clear-felling areas will be as follows:

Assortment	Yield/1000 ha.		Rounded off value
Plywood material	3,160 cu. ms.	or	3,000 cu. ms.
Industrial wood	34,500 cu. ms.	or	34,000 cu. ms.
Fuelwood/pulpwood	62,340 cu. ms.	or	62,000 cu. ms.

(ii) Coppice with reserves: In coppice forests, about 25% of the standing volume will be retained as "reserves" and steep areas i.e. with slopes more than 100% which also occur mixed in these forests will be completely excluded from working. These results show that on an average about 3% of the area (21,700 ha. out of a total area of 654,000 ha.) is very steep. Therefore, for the purpose of calculation, only 970,ha. from a gross area of 1,000 ha. will be considered as available. With these restrictions, yield from 1,000 ha. of coppice forests works out to as under:-

Assortment	Yield/1000 ha.	Rounded off value
Plywood material	1,800 cu. ms.	2,000 cu. ms.
Industrial wood	18,300 cu. ms.	18,000 cu. ms.
Fuelwood/pulpwood	34,800 cu. ms.	34,000 cu. ms.

If yield is expressed in units of 1,000 cu. ms., the two tables given earlier can be summarised as follows:

System	Yield of produce in '000 cu. ms.			
	Plywood	Industrial wood	Fuelwood/ pulpwood	Total
Clear-felling	3	34	62	99
Coppice with reserves	2	18	35	55

Following two tables present expected yield for varying intensity of cutting under two systems of management. These tables have been prepared to serve as ready reckoner:

Table 1 : Expected yield under varying targets of annual plantation ('000 cu. ms).

Plantation area (ha.)	Yield of various utility volums - 1000 cu. ms.		
	Plywood	Other industrial wood	Fuelwood/pulp wo
1000	3	34	62
2000	6	68	124
3000	9	102	186
4000	12	136	248
5000	15	170	310

Table 2: Yield under varying targets of annual cut under Coppice with reserves.

Total coppice with reserve area (ha.)	No. felling area (ha.)	Net felling area (ha.)	Growing stock in felling area ('000 cu. ms.) To be retained	Plywood	Other industrial wood	Fuelwood/ pulpwood	Total
1000	30	970	18	2	18	35	55
2000	60	1940	38	4	38	70	110
3000	90	2910	54	6	54	105	165
4000	120	3880	72	8	72	140	220
5000	150	4850	90	10	90	175	275
10,000	300	9700	180	20	180	350	550
20,000	600	19400	360	40	360	700	1100

3. Model cutting calculation for year 1975 and 1980: Some model cutting calculations are presented in following sections. They depict the situation in years 1975 and 1980. At the end of calculation final balance is presented and consequences of accepting the model are discussed.

In light of earlier discussion supply and demand balance for the year 1975 are given below:

Table 3: Supply and demand balance in the year 1975

Items	Category of produce in units of 1000 cu. ms. Plywood	Industrial wood	Fuelwood and pulpwood	Total
Demand	-30	-147	-932	-1109
Yield from felling 5 units for planting	+15	+170	+310	+495
Balance	-15	+23	-622	-614
Yield from felling 8 units under coppice with reserve	+16	+144	+280	+440
Final Balance	+1	+167	-342	-174

By felling 5 units for raising plantations, there is a deficit of 614 units in all, of which 15 units are in plywood and 622 units in fuelwood. There is a surplus of 23 units of industrial wood which has no demand. To meet the deficit further areas will be felled under

coppice with reserves system. If 8 area units are felled, the plywood requirement is fulfilled but in fuelwood, there will still be a deficit of 174 units. On the other hand, there is surplus of 167 units of industrial wood. Now a policy decision has to be made whether the fuelwood deficit will be met from the reserved forests or not and how the surplus of industrial wood is going to be disposed of.

From this cutting calculation, following facts emerge:

i. Fuelwood is the most critical produce mainly for which additional fellings under coppice with reserves felling are required.

ii. There appears to be enough reason for expanding the saw milling industry so as to absorb production of 167 units of saw quality material. Some of the superior quality material could be diverted to meet plywood deficit of 15 units and stop fellings under coppice with reserve at stage 1 and accept clear-felling and planting of 5 units only with no fellings under coppice with reserve system;

iii. A policy decision needs to be taken as regards meeting the deficit of 614 units of fuelwood from forest areas occurring under land use classes shifting cultivation, cultivation etc. containing about 1,147,000 cu. ms.

iv. Possibility of starting fuelwood plantation should receive immediate consideration to avoid over-cutting of the natural forests.

Similarly, calculations for the year 1980 are given in Table 4.

Table 4: Supply and demand balance for the year 1980

Item	Category of produce in units of 1000 cu. ms.			
	Plywood	Industrial wood	Fuelwood/ pulpwood	Total
Demand	-40	-173	-1153	-1366
Yield from 8 units of planting	+24	+272	+496	+792
Balance	-16	+ 99	-657	-574
Yield from felling 8 units under coppice	+16	+144	+280	+440
Balance	0	+243	-377	-134

In this case 8000 ha. will be clear-felled and 8,000 ha. will be felled under the coppice system. Conclusions emerging from this

model study also are very similar to the ones described for the year 1975.

Summary of calculations for the year 1975 and 1980 is as follows:

Year	Annual area for clear felling and planting	Annual area for felling under coppice system	Total
1975	5000 ha.	8000 ha.	13000 ha.
1980	8000 ha.	8000 ha.	16000 ha.

The analysis of above series of cutting calculations shows that the fuelwood requirement controls the area of felling. The plywood and industrial wood requirement can be met by felling less areas. After these demands are met, the plywood and industrial wood that comes out by felling more areas will have to be marketed in other wood-deficit areas of the State. For best utilization of material, these calculations suggest that the sawmilling industry should be expanded and that the fuelwood needs be met either from the shifting cultivation areas or by raising fuelwood plantations.

As per model cutting calculations, forest areas to be worked during the 10 year period is as under:

Table : 5. - Statement of area proposed for working during period 1973-82

Period	Area felled for planting '000 ha.	Area felled for coppice '000 ha.	Total area worked
1973-74 3 years	9	3	12
1975-79 5 years	25	40	65
1980-82 2 years	16	16	32
Total	50	69	119

This intensity of working can be sustained for about 45 years in future.

After 10 years the fast-growing species plantations will be ripe for harvest. It is expected that in about 40 years time 25% of the growing stock left under the coppice with reserve system will be fit for utilization as industrial wood.

Delineation of area under the systems of management for a 10 year period.

From calculations done it is seen that about 50,000 ha. of high volume forest area have to be set apart for clear-felling and planting and about 75,000 ha. under coppice with reserve to satisfy the present and future demand in the coming years. This will work out to about 5,000 ha. of planting and 7,500 ha. of coppicing annually on an average. In reality, however, planting will start with about 3,000 ha. and coppicing with 1,000 ha. and will reach a target of 8,000 ha. and 8,000 ha. respectively by the end of this 10 year period. This intensity of forest management operations during this period has to be synchronised with infra-structural development activity. Year by year both have to keep pace with each other. From total and annual area of working indicated above, cost of infra-structure development for the 10 year period and its annual break-up can easily be calculated. For preparing the 10 year, and annual forest management, and road development plan, stock and cost-class maps prepared by the project may prove to be useful.

5. Delineation of area for annual working: Area to be taken up annually is determined primarily by following factors:

1. Saleability of felled-material;
2. Funds for road development;
3. Availability of funds and personnel to take up plantation activity.

Aggregate demand for the 10 year period has already been indicated. This will enter as a variable in the cutting calculation.

Costs for develop-ment of new roads and maint-nance of existing roads will be discussed later on. For the purposes of following cutting calculation, it is presumed that sufficient funds will be available for construction of new roads to make the annual area completely accessible.

Out turn of various utility volumes from plantation area can easily be obtained with help of tables 3, 4 and 5. These yields can then be compared with aggregate demand table given earlier and a balance can be obtained for each category of produce. In case, supply is found less than the demand for a particular category of produce, additional areas may be felled under coppice with reserve system so as to meet this deficit. While making final decision on total cutting area in a year, a long term view about possibility of sustaining the supply should be kept in view. If it is found that rate of annual cutting is fast, the pace of fellings will have to be slowed down or possibility of increasing future supply by additional planting should be kept in view.

6. Bamboo balance: The present yield of bamboo is 124,000 tonnes annually, of which 74,000 tonnes is used by the Andhra Pradesh Paper Mills. The paper mill imports about 28,000 tonnes of bamboo from Kurnool forests. The requirement of bamboo for the paper mill increase when the mill is expanded. Similarly, the other consumption will also increase in the course of time.

The inventory results show that the potential yield of bamboo from these forests is of the order of 220,000 tonnes per year. It is assumed that the present yield will increase to 150,000 tonnes by 1975 and 200,000 tonnes by 1980.

The production and requirement position is as follows:

Year	Production ('000 tonnes)	Requirements '000 tonnes			Balance of deficit ('000 tonnes)
		Paper mill	Other use	Total	
1972	124	100	-	130,	-26
1975	150	162	50	212	-62
1980	200	270	60	330	-130

This reveals that bamboo will be the limiting factor for the expansion of the paper mill. Part of the deficit will be made good from the new plantations which will yield from the 9th year onwards and the constant supply from the 21st year will be of the order of 60,000 tonnes per year. This will still leave a big deficit. Research should be intensified to use a greater percentage of hardwoods in making paper and intensive research should be carried out for introducing tropical pines with a view to supplementing the long-fibre furnish of raw material for the pulp and paper industry.

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CHAPTER - 5.

WOOD BALANCE

5.1. Determining Wood Balance:

For a sound development of wood-based industries it would be necessary, as a first step, to assess the present quantum of consumption by the public and to make realistic projections into the future. The next step involved would be to set apart this quantity for meeting the requirements of the public and the markets, and base the planning of industries and capacities on the balance left from the potential annual cut. All the ingredients required for evolving a sound development plan are available in the data collected in the survey, and the calculations made in Chapter 4 of this report.

5.2. Industrial Wood Balance:

As shown in Chapter 3 "Market Study and Consumption Pattern", the consumption of industrial wood at the 1968 level and the projections made for 1975 and 1980 are as shown below:

Demand of wood in the Zone in cu. ms.

Item	1968	1975	1980
Industrial wood	121,500	148,800	173,000

In addition to the consumption of 121,500 cu. ms. of industrial wood in 1968, there is an export of re-export of 27,500 cu. ms.(r). Thus, the total requirement of industrial wood in 1968 could be taken as 149,000 cu.ms. (r). As against this figure of requirement, the total removal from the forests of the survey area including both the recorded and unrecorded sources, was of the order of 27,500 cu. ms.(r).

The annual potential cut of industrial wood for the entire forested area as worked out under Model I in Chapter 4 would be 650,000 cu. ms. Thus, taking the demand figures as given above, the surplus of industrial wood at the three levels of production would be:-

1968 level	—	528,500 cu. ms.
1975 level	—	503,200 cu. ms.
1980 level	—	477,000 cu. ms.

This huge surplus would necessitate planning in a concerted way for the expansion of existing industrial capacities and setting up of new industries. This large surplus could also take care of any expansion of exports of industrial wood from the region and also any wide ranging shifts in demand, such as the projected demand of hardwoods for pulping by the pulp and paper industry. Likewise, if there is not an adequate demand for pulpwood, then, as much of it, as is surplus, could be diverted as fuelwood supplies.

The annual potential availability of plywood size material is quite large (nearly 30,000 cu. ms. from Reserve and Protected Forests) and there is at present not a single plywood manufacturing unit in the region. For this item, therefore, there is a good future in the tract.

5.3. Fuelwood Balance:

The consumption study of firewood has put the demand at nearly 3.6 million cu. ms., which is expected go upto 3.8 million cu. ms. in the year 1980. A bulk of the requirement of fuelwood is met from unrecorded sources. The existing (1968) drain from the surveyed area has been estimated to be nearly 680,000 cu. ms.

The potential annual availability of fuelwood as per the management model does not promise to ease the demand situation for firewood in the area. The potential annual availability of firewood has been shown to be 668,000 cu. ms. But if a part of the potential annual availability of pulpwood of 323,000 cu. ms. could be diverted to fuelwood supply, then some slight relief would be available. However, this will mean higher demand of bamboo for the same capacity of the mill.

5.4. Bamboo Balance:

The consumption of bamboo in 1968 has been estimated as 100,000 tonnes by the Andhra Pradesh Paper Mills and 50,000 tonnes by the non-industrial sector. Thus, the total bamboo consumption in that year was 150,000 tonnes. On this quantity, 124,000 tonnes of bamboo were from the surveyed area and the remaining 26,000 tonnes were extracted from Kurnool Circle by the Paper Mill.

As against the consump-tion figures given above, the potential annual availability of bamboo has been calculated to be 255,000 tonnes and the accessible quantity from the Reserve and Protected Forests has been estimated to be 191,000 tonnes. There would, therefore, be a clear scope of augmenting the present availability of bamboo by 67,000 tonnes. If anticipated yields from the bamboo plantations from the 9th year onwards after formation are taken into consideration, then the future potential annual availability of bamboo would be increased by a further 60,000 tonnes. These figures could have a good deal of significance for the pulp and paper industry, in that they point favourably towards sizable expansion of capacities for production of pulp and paper.

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CHAPTER - 6.

ECONOMIC AVAILABILITY AND COST OF RAW MATERIAL DELIVERY

6.1. Why Cost Studies:

Besides acquiring knowledge about total wood and bamboo resources, information as to the availability of industrial raw materials within reasonable economic limits, has been one of the main objectives of the forest resources survey in East Godavari region of Andhra Pradesh. Annual cuts will vary with the change in the cutting or management models which in turn further depend upon silvicultural systems, management practices and other allied factors applied and peculiar to the area. Since regulation of removals from particular forests is a/scope of the present survey, it will not, therefore, be possible to relate the logging costs with the cuts and removals at this stage. A simple study has, therefore, been undertaken to determine the accessibility and the cost of delivery of wood and bamboo under broad assumptions related to the present disposition of the forests without anticipating any changes in costs and the pattern of logging practices except the construction of some new roads.

/matter for micro-planning as well as detailed study which is beyond the

For this study two alternative delivery sites viz: Rajahmundry and Bhadrachalam were chosen on the basis of existing and proposed infrastructure and in consultation with the State Forest Department.

6.2. Objectives:

The main objectives to be achieved through this study are briefly outlined as follows:

(i) To indicate broadly the distribution of the total growing stock into various cost zones assuming that the current wage rates, prices and the logging techniques will continue to prevail throughout the first conversion period.

(ii) To suggest road network for facilitating extraction of wood and bamboo from the area (Next Chapter has been completely devoted to tentative road planning).

(iii) For determining priorities for carrying out detailed logging planning, road planning and likely investments for intensive management.

(iv) To help industries and industrialists to plan for installation and capacities of the plants and economic considerations thereof more rationally.

(v) For comparability between the two alternative sites mentioned above.

(vi) And, lastly, to provide with basis and foresight for carrying out improvements in respect of logging and management practices etc. to effect reduction in the costs of delivery of raw materials.

Presumptions or conceptions that to an agency working any particular lot inside a particular cost zone, the extraction charges will work out within the cost class of the zone, may not always hold true as the study has not been designed in order to meet all such requirements.

6.3. Premises Adopted:

The sampling design for this study can be described to be a systematic point sampling. The same sampling frame as the one adopted for the ground inventory was used for this study. Centre of the grid acted as the sampling unit in each grid. For each sampling unit the logging costs were worked out as per description in the following paragraphs. Out of the total range of logging costs, a few cost classes were formed for classification purposes. On the basis of extraction costs for each sampling unit, the same were grouped into either of the cost classes. Treating each group of grids as one stratum, the growing stock for this stratum was arrived at like any other strata of the ground inventory or of photointerpretation.

6.4. Logging Operations:

Logging costs are defined normally as the costs incurred on contingencies and various operations carried out to help handling of wood from the stump to the delivery site. Usually recognised major operations in the area are:

1. Felling of trees and cross cutting them into logs/billets, etc.
2. Off road transport i.e. transport of materials inside/outside the forests upto the road head.
3. Road transport.
4. River transport.
5. Loading and unloading of trucks.
6. Bundling and stacking of fuel and pulpwood in forests.
7. Launching and rafting etc. in case of floating.
8. Exploitation of bamboos.

Besides the costs on account of the operations mentioned above, expenditure towards staff, buildings, roads, conversion and other losses and contingencies has to be added up.

6.5. Logging Rates:

Detailed studies were not, however, carried out to find out the effects of variables or parameters like quantity of wood available for felling from unit area, its size class, nature of the terrain, distance of the forests from the habitations, seasons of working, labour problems, introduction of mechanised methods of logging, contractors working and departmental extraction etc., on the rates for felling and cross-cutting of trees, loading and unloading of trucks, bundling, stacking, launching floating rafts, and even exploitation of bamboos. After consultation with the officers of the State Forest Department, rates normally being paid under similar conditions, with slight adjustments, were adopted for these operations.

6.6. Transportation Costs:

For off-road as well as on-road transportation, on the basis of tentative planning, a network of roads has been proposed. (for proposed roads, please see next chapter). Detailed road planning was not done and could be undertaken at the time of preparation of logging as well as management plans. From the likely investments on the improvements and construction of roads, their contribution towards cost per unit of standing volume was ascertained. With the help of this road planning, off-road transport was assumed to cost at a constant rate per unit of wood for each of the sampling units. For each grid, road distances were computed from the two delivery sites. A flat rate per unit of wood per kilometer of distance was also adopted for calculation of road transport costs. Schedule of rates made applicable in this study has been given in Technical Report 5. Total costs for each grid were then worked out after adding up all costs on various operations listed above and a percentage of them on contingencies and staffing, etc.

6.7. Cost Classes:

The different cost classes under which the grids and the standing volumes were classified for the delivery of a cubic metre of timber, a tonne of pulpwood or fuelwood, and a tonne of bamboos at both the delivery sites, are given below:-

Delivery Cost Classes

S.No.	Cost class	Rate per cubic metre of timber	Rate per tonne of	
			Pulpwood/ fuelwood	Bamboo
1.	Low (A)	Upto Rs. 90/-	Upto Rs. 40/-	Upto Rs. 60/-
2.	Medium (B)	Rs. 90/- to Rs. 110/-	Rs. 40/- to Rs. 50/-	Rs. 60/- to Rs. 75/-
3.	High (C)	Rs. 110/- to Rs. 130/-	Rs. 50/- to Rs. 60/-	Rs. 75/- to Rs. 90/-
4.	Very high (D)	Over Rs. 130/-	Over Rs. 60/-	Over Rs. 90/-

6.8. Distribution Of Resources Into Cost Classes:

As per procedure described earlier, the distribution of growing stock (i.e. volume under bark) of the forested area by cost classes and by volume strata arrived at in the inventory tables for both Rajahmundry and Bhadrachalam is as shown below:

SITE RAJAHMUNDRY

Volume in 1000 cu. ms.

Strata	Cost Classes A	B	C	D	Total
Low volume	3070	2170	318	370	5928
Medium volume	5485	4388	2869	2362	15104
High volume	14075	12191	1441	3768	31475
Total	22630	18749	4628	6500	52507
% of total volume	43.1	35.7	8.8	12.4	100.0

SITE BHADRACHALAM

Low volume	900	900	1429	2099	5928
Medium volume	2531	3291	1603	7679	15104
High volume	6095	11859	3214	10307	31475
Total	9526	16050	6246	20085	52507
% of total volume	18.1	30.6	12.0	38.3	100.0

6.8.1. Timber and pulpwood:

Ratio of timber to pulpwood (including fuelwood) works out to be 60 : 40 approximately according to the inventory results. Applying this ratio to the volumes under the different cost classes the break-up would be as shown below:-

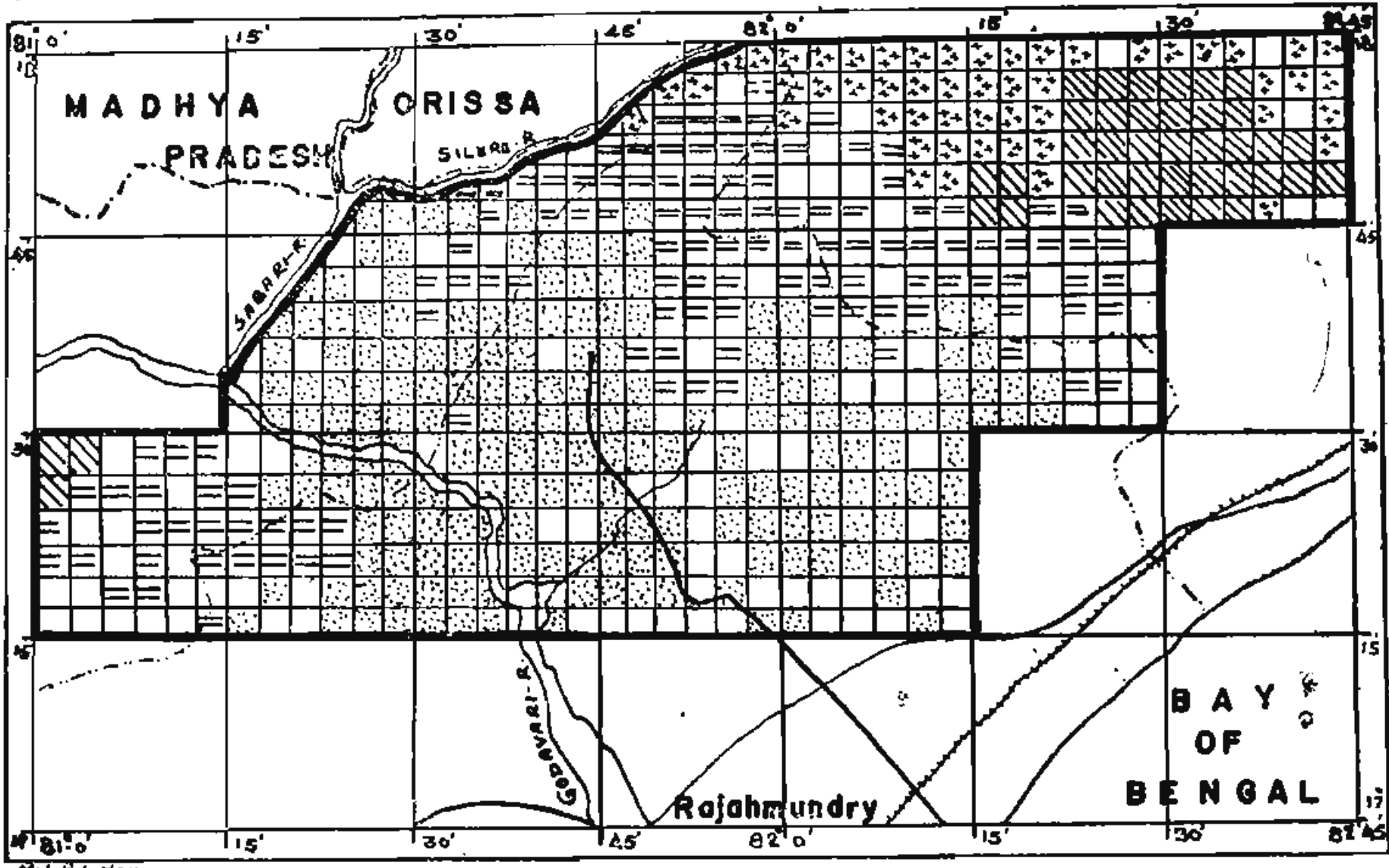
Volume in '000 cu. ms.

Cost Class	Rajahmundry Timber	Rajahmundry Pulpwood	Bhadrachalam Timber	Bhadrachalam Pulpwood
A	13578	9052	5716	3810
B	11249	7500	9630	6420
C	2777	1851	3748	2498
D	3900	2600	12051	8034

6.8.2. Bamboo Resources: Total bamboo resources in the surveyed area, under different cost classes and for the two alternative sites are tabulated as under:

COST CLASS MAP- EAST GODAVARI CATCHMENT - (A . P.)

R. MAT :- TIMBER & PULPWOOD **DELIVERY POINT: RAJAHMUNDRY**



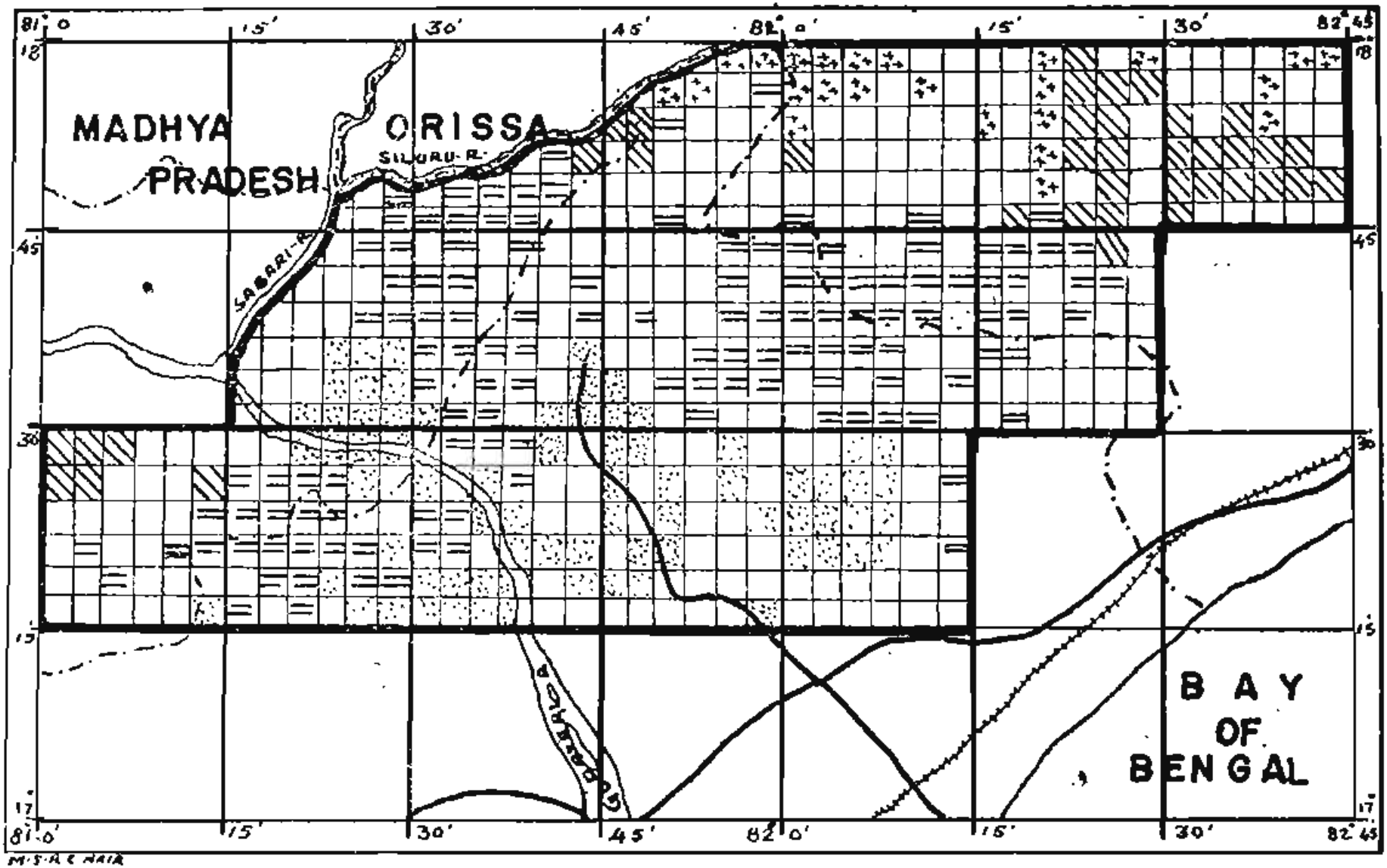
M.S.R.E. Nov.

COST CLASS: T . UP TO RS 90 RS 90— RS 110 RS 110—RS 130 RS OVER 130

P. UP TO RS 40 RS 40— RS 50 RS 50—RS 60 RS OVER 60

COST CLASS MAP — EAST GODAVARI CATCHMENT (A.P.)

Raw-Mat : BAMBOO **Delivery point :— RAJAHMUNDRY**



M.S.A.C.HAIR

COST CLASS :—

RS 45 — RS 60

RS 60 — RS 75

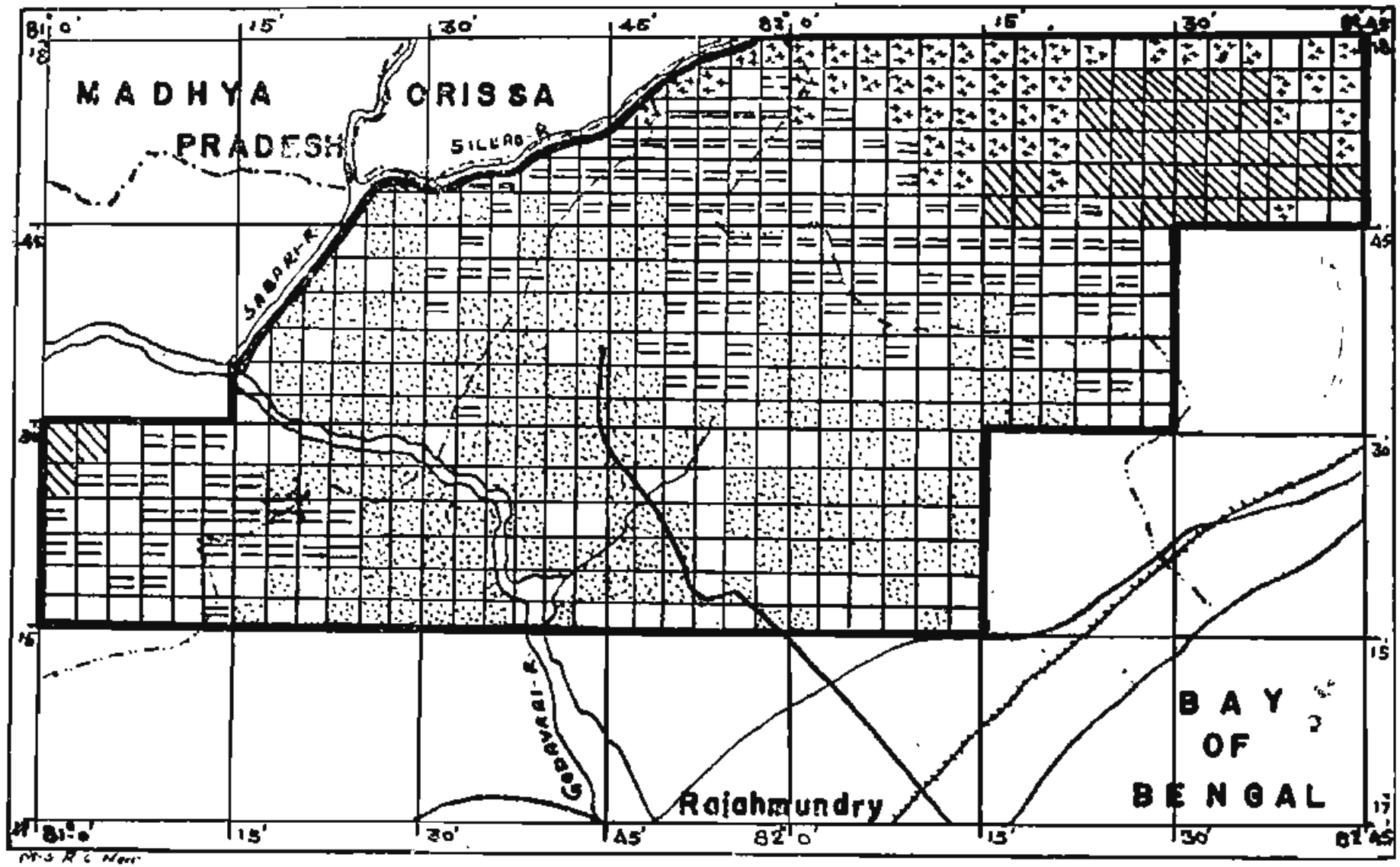
RS 75 — RS 90

RS OVER 90

COST CLASS MAP- EAST GODAVARI CATCHMENT - (A . P.)

R. MAT :- TIMBER & PULPWOOD

DELIVERY POINT: RAJAHMUNDRY



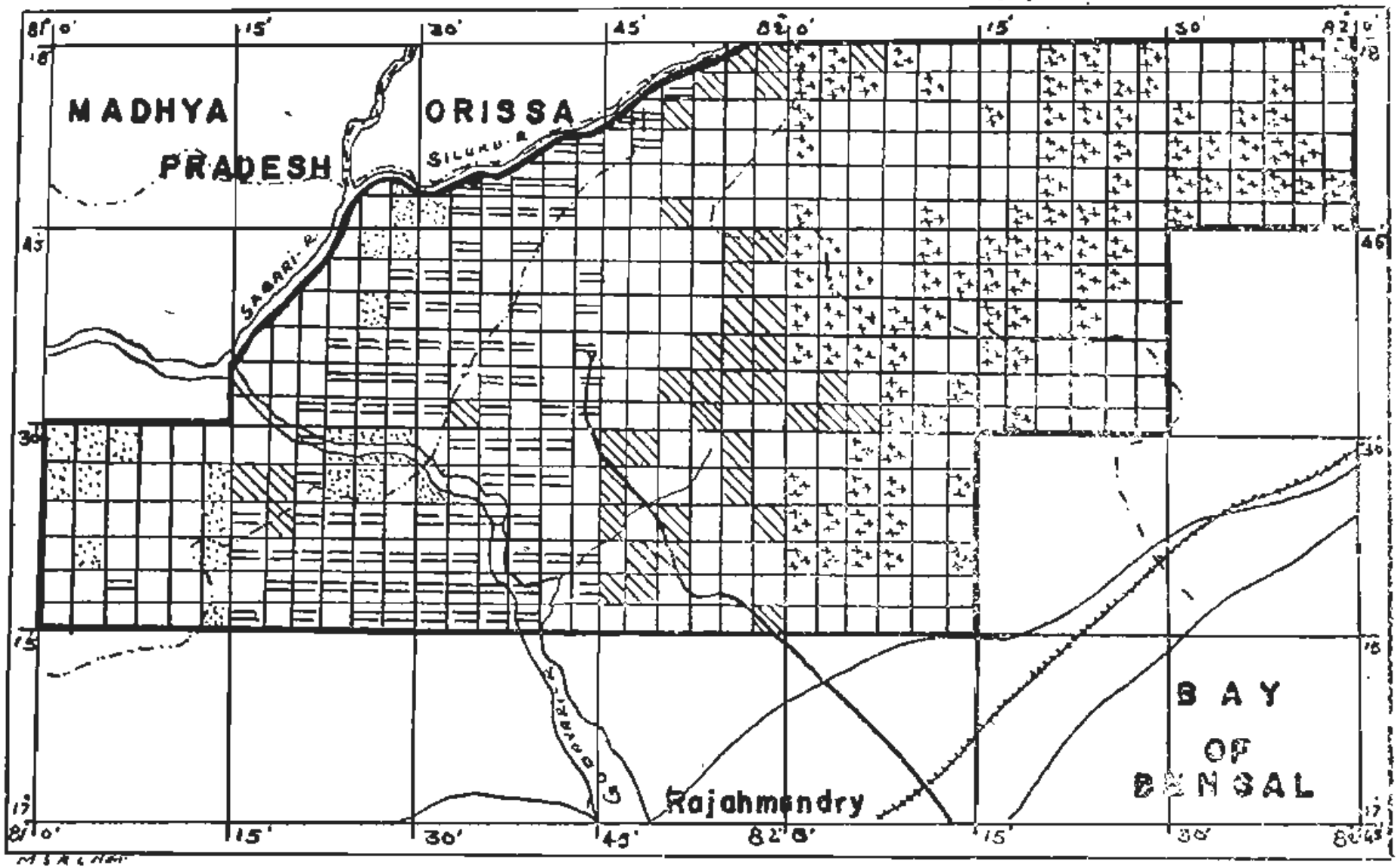
COST CLASS: T . UP TO RS 90 | RS 90 — RS 110 | RS 110 — RS 130 | RS OVER 130

P. UP TO RS 40 | RS 40 — RS 50 | RS 50 — RS 60 | RS OVER 60

COST CLASS MAP. - EAST GODAVARI CATCHMENT (A . P.)

R : Mat: Bamboo

Delivery point Bhadrachalam



·COST CLASS :

RS 45—RS 60

RS 60—RS 75

RS 75 —— RS 90

RS OVER — 90

'000 tonnes

Mill sites	Cost Classes				Total
	A	B	C	D	
Rajahmundry	465	667	232	137	150.0
	% 31.0	44.5	15.4	9.1	100.0
Bhadrachalam	88	370	393	650	150.0
	% 5.9	24.6	26.2	43.3	100.0

6.9. Which Is A Better Site:

Results produced above confirm that Rajahmundry is a much better site than Bhadrachalam because 78.8% of wood and 75.5% of bamboo resources are available in low and medium cost classes at the former site, when compared to 48.7% of wood and 30.5% of bamboo for the latter. Maps showing the sampling grids and their classification into the cost classes are enclosed. The study would be applicable to the whole area in a cost class and it should not be inferred that for individual compartments or any smaller parts, the logging costs should necessarily lie within the cost class. For this purpose micro studies would be necessary. It remains, however, to be seen as to what effect other factors like intensity of logging and extra-ctions features etc. will have on these costs. Detailed logging plans can only provide answers to all such queries.

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CHAPTER - 7.

DEVELOPMENT OF ROADS

7.1. Development of Roads Is The First Pre-Requisite:

The road density in any area is generally a good index of the state of development in it. This statement applies in a full measure to the area under report. The existing road/in it is as low as 13 kms. /density per 100 sq. kms., and that too most of the roads are situated in the plains areas and on easy terrain. As for the hilly areas, the density would be even thinner.

A much denser network of roads and extraction routes would be required to be laid in the surveyed area if the plans for intensification of management, creation of extensive man-made forests and establishment of forest-based industries is to make any headway.

The density and the quality of a road network will depend on several considerations, the important ones among them being the type and intensity of management and the extent of industrial development. The norm for industrial plantation areas could be as high as 1 km. per sq. km. But when dealing with a large area, as in this report, an average road density of nearly 30 kms. per 100 sq. kms. could be considered as a desirable norm.

The main roads passing through the surveyed area are:

1. Black-topped road from Rajahmundry to Maredumilli;
2. Rajahmundry to Narsipatnam and thence to Chintapalli to Upper Sileru
3. Upper Sileru to Chinturu (this road is under construction);
4. Metalled road from Maredumilli to Chinturu (this road also is under construction).

7.2. Planning For New Roads:

A network of roads would have to be spread over the entire area in order to tap the raw materials. A study has been carried out to determine a suitable road network and the estimated outlay on each category. This study is based on field observations, scrutiny of maps and scanning of aerial photographs. The aim is to provide a network of roads which will make the forests accessible. The economic aspect of the planning for new roads as well as the improvement of existing roads could be dealt with in greater detail during the preparation of logging plans for the forests in the area.

The proposed network of roads has been concentrated in areas with good forests on the basis of field observation. Distances have been measured on the map which have been proportionately increased for different types of topography and terrain. The conversion factors adopted for different kinds of terrain are as follows:

S.No.	Nature of terrain	Distance on the map	Length of the proposed roads
		Units	Units
1.	Plain and gently rolling	1	1
2.	Hilly terrain	1	2
3.	Very hilly terrain	1	3

The factors are just a thumb rule for mere approximation and have been arrived at from the scrutiny of existing roads in the area vis-a-vis the distances on the map between two points on an existing road.

7.3. Roads Existing In The Area:

The following roads are existing in the surveyed area:

Black-topped roads:- There are 10 black-topped roads in the surveyed area with a total length extending to 489 kms.

Metalled roads:- 16 metalled roads are existing in the surveyed area. The total length of metalled roads is 480 kms.

Kutcha roads:- 14 Kutcha and fair-weather roads are present in the area surveyed. The total length of these roads is 346 kms.

The list of all the above roads with their lengths has been given in Technical Report No. 5.

7.4. Preparation of Estimates:

The road estimates have been drawn up under the following five categories:-

1. Improvement of existing roads
2. Construction of new roads
3. Construction of extraction routes
4. Maintenance of existing and new roads
5. Maintenance of extraction routes.

7.4.1. Schedule Of Rates:- The schedule of rates made applicable to the different categories of works of construction, maintenance and improvement has been based on the schedules being used by the P.W.D. and Forest Departments in the area and is:

S.No.	Operation	Approximate, estimated average cost per km. in Rs.
1.	Construction of new roads	45,000/-
2.	Construction of extraction routes	3,000/-
3.	Improvement of existing Kutcha roads to metalled roads	30,000/-
4.	Annual maintenance of existing roads	3,000/-
5.	Annual maintenance of existing extraction routes.	500/-

7.4.2. Improvement Of Existing Roads:- Many of the present existing roads require improvement before timber and pulpwood could be transported over them.

The following existing roads require upgrading from Kutcha to

metalled roads.

S.No.	Name of the road	Length
1.	Maredumilli to Bodalanka	26 kms.
2.	Kuruturu to Kannapuram	25 kms.
3.	Dammapeta to Palvancha	50 kms.
4.	Kondamudulu to Devipatnam	16 kms.
5.	Kondamadulu to Gujjimamedivalsa	20 kms.
		137 kms.

Thus, the total outlay on improvement of 137 kms. of existing roads at Rs. 30,000/- per km. comes to Rs. 4.11 million. This amount need not be invested in full in the initial stages, but will have to be invested in a phased programme according to the priority of areas taken up for working.

Considering that the existing black-topped metalled roads will continue to be maintained by the agency currently doing it and kutcha roads will be maintained by the Forest Department, the total cost of maintenance for the existing kutcha and fair weather roads will be Rs. 3,000 x 346 kms. = Rs. 1,038,000 annually.

7.4.3. Construction Of New Roads:

The forest areas of Rampa and Gudem agencies are devoid of roads and therefore, 21 new roads have been proposed for construction to open up the area. Their names along with their estimated lengths are given below:

S.No.	Name of proposed Road	Estimated length
1.	Bodlanka to Dharakonda	40 kms.
2.	Pansalapalam to Bodlanka	20 kms.
3.	Kota to Bodlanka	18 kms.
4.	Kota to Mohanapuram	15 kms.
5.	Bodlanka to Vakkaloro	15 kms.
6.	Bodlanka to be connected to the Siluru Chintur Road	40 kms.
7.	Madalur to Lakavaram	26 kms.
8.	Madalur to Somanamallur.	20 kms.
9.	Somanamallur to Tummaleru	15 kms.
10.	Somanamallur to Darapalle	10 kms.
11.	Marripakala to Gudem	26 kms.
12.	Marripakala to Gurthedu	18 kms.
13.	Chintapalli to Dharakonda via Jerrana	40 kms.
14.	Sanivaram to Vantimamidi to Lammasingi	16 kms.
15.	Sanivaram to Busikota Kondasantha	16 kms.
16.	Koyyuru to Gudem	35 kms.
17.	Korruru to Maripakalu	20 kms.
18.	Koyyuru to Adathig-ala	35 kms.
19.	Podlanka to Kutrowada	18 kms.
20.	Kunnavaram to Kondamadalu	42 kms.
21.	Kannapuram to proposed road to Kokunnuru	25 kms.
		510 kms.

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The cost of construction for 510 kms. of new roads @ Rs. 45,000/- per km. works to Rs. 22.95 million. Their maintenance will further cost 510 x 3000 = Rs. 1,530,000 annually.

7.4.4. Construction of Extraction Routes:- In order to economically transport the material from the felling sites to the main arterial roads, extraction routes have been proposed.

The total length of the extraction routes proposed over the entire area comes to 800 kms. Estimated total outlay on construction of these roads @ Rs. 3,000/- per km. comes to 800 x 3,000 = Rs. 400,000/- approximately

7.5. Estimate of Formation and Maintenance Costs - Its Contribution to Logging Costs:

Summarising the estimated outlay under each category, the total outlay on infrastructure of roads and extraction routes for the entire area would be:

Category	Estimated total outlay	
	Construction or improvement in Rs.	Annual maintenance in Rs.
1. Improvement of existing roads.	4,110,000	1,038,000
2. Construction of roads	22,950,000	1,530,000
3. Construction of extraction routes	2,400,000	400,000
	29,460,000	2,968,000

Thus, taking figures in the round, the total outlay for construction of new roads and extraction routes will be to the tune of Rs. 29.5 million and that on maintenance of these roads will be Rs. 3 million annually.

The total length of all types of roads on the basis of items discussed above comes to 2605 kms. for a survey area of 10,416 sq. kms. The density per 100 sq. kms. thus works out to nearly 26, which could be considered quite reasonable.

This huge amount estimated to develop road network in the area to the requisite standard is not necessarily to be spent immediately or in the first few years. Construction and improvement of roads can be phased out and can be regulated as per the requirements of a logging plan and in accordance with the priorities.

Besides forestry being the main beneficiary, there is going to be an overall development of the area because of this proposed road network. It will link a larger number of inhabited areas and will generate employment potential in a big way . Thus, as a result of these investments, a variety of social benefits will accrue, justifying a big chunk of them towards social costs.

Even if these investments on the development of road network are supposed to contribute nothing towards social costs and are attributed solely to the cause of forests and that too on logging alone, it will cost on an average at the rate of Rs. 4/- per cu. m. in the model where these investments for a period of 20 years are distributed over the potential yield for the same period. Looking at the matter in another way, it could be said that to make a bulk of the locked-up capital of growing stock of nearly 58 million cu. ms. accessible, an outlay of nearly Rs. 4/- per cu.m. cannot, by any means be considered as heavy. This investment should be viewed in the light of the tremendous benefits it could bring and the contribution it could make to the prosperity of the region.

A map showing existing and proposed network of roads on scale 1" = 8 miles is appended.

What has been discussed above, purports to be a general road plan for the entire survey area. For the planning exercise to be more meaningful and effective, it would be necessary to delineate a compact block of forest which would come under management, say for the first 15 or 20 years and then to plan a road network for it.

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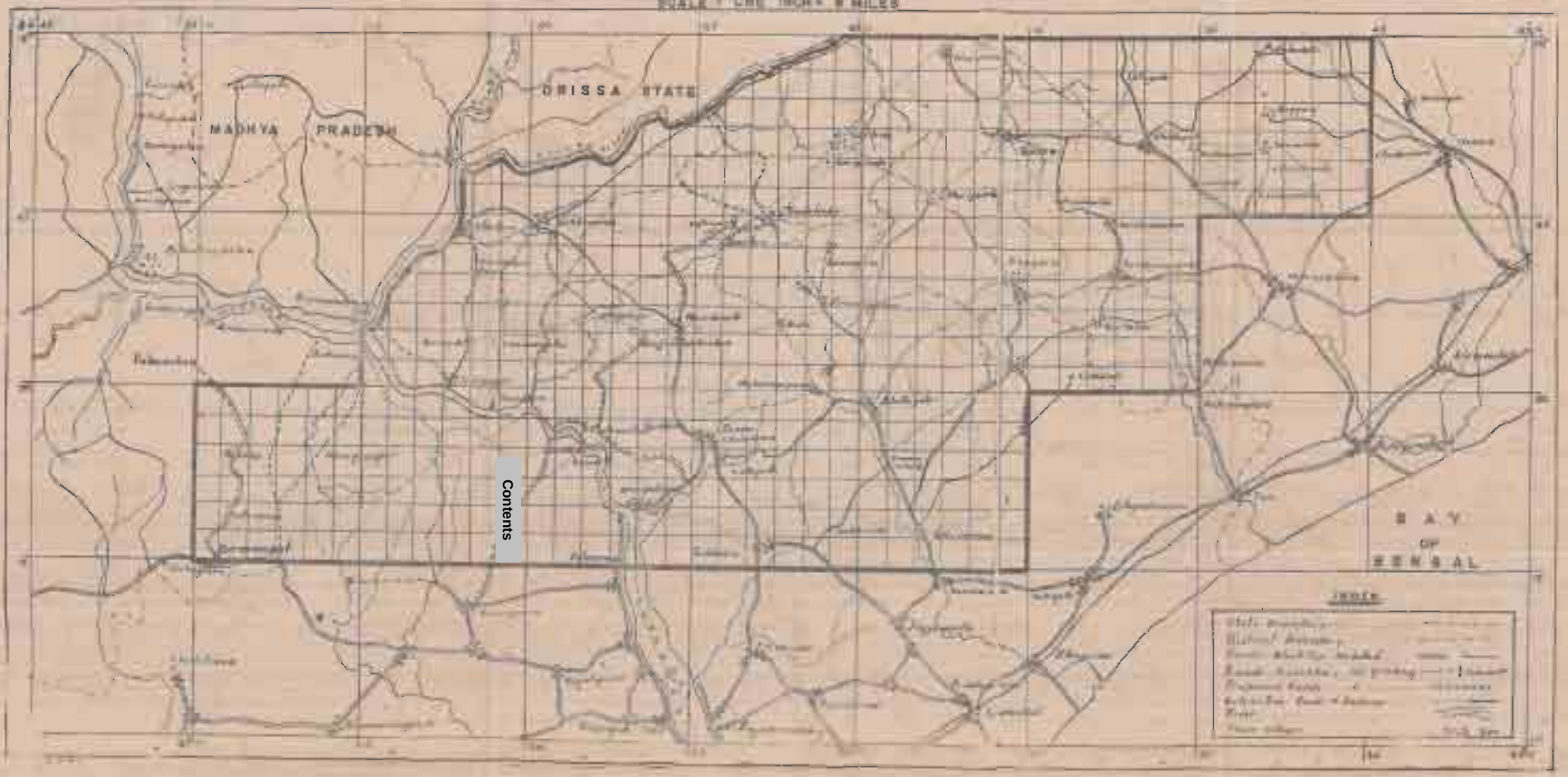
EXISTING AND PROPOSED ROAD MAP OF EAST GODAVARI CATCHMENT (A·P)

SCALE 1 CMS INCH = 8 MILES



CHAPTER - 8.

SCOPE OF FOREST-BASED INDUSTRIAL DEVELOPMENT AND ASSESSMENT OF INVESTMENT REQUIREMENTS, BENEFITS AND EMPLOYMENT OPPORTUNITIES.

8.1. Scope Of Forest-Based Industrial Development.

All the elements which are necessary for the formulation of an integrated industrial development plan based on forest resources have been dealt with in the previous chapters. The survey and other connected studies have revealed rich frozen resources, which even though they are economically accessible, have not made any significant contribution to the economy of the region. These rich resources if tapped systematically and intensively could yield rich dividends to the forestry sector and provide an effective lever for improving the lot of backward tribal people. The problem of podu (shifting cultivation) proves quite a serious problem in this region, and perhaps an effective way of tackling it could be to provide better and gainful employment to the tribal populace in forestry and forest-based industrial development programmes.

There is a good nucleus of wood-based industries in the region and there would be ample scope for enlarging it and expanding capacities as well as for setting up new units. Looking to the over-all development of the region, it could safely be presumed that the question of complete utilization of the considerably increased cut from the forests of East Godavari Catchment and marketing the finished products would not present any hurdle. Major industrial development programmes are on the anvil in Visakhapatnam and East Godavari districts, and it is anticipated that there would be a sharp rise in the demand for industrial wood and fuelwood in the region.

The intensive management programme being implemented by the Maharashtra Forest Development Board in Chanda and other potential forest areas in Vidharba should provide useful lessons. It was feared by forestry experts that the increased cut from areas clear-felled for the rising of Teak plantations would pose many problems regarding the disposal of wood and more especially of fuelwood. Subsequent experience gained in that tract has belied these fears. The Ballarpur Paper Mills and the Central Pulp Mill have come up in a big way to buy fuelwood stacks for use as pulpwood. The advantages of concentrated and intensive working of forests are tremendous and industries would definitely prefer to obtain raw material from compact areas, rather than from scattered or extensive areas. If that is the experience in Chanda district, then there would be enough justification for expecting the situation in the East Godavari Catchment to be more favourable from the market and utilization points of view.

With the market situation looking so promising, all that remains to be done is to formulate a bold and forward-looking integrated management plan of the forest resources and to translate it into action. This would require a good deal of investment on the development of infrastructure, on expansion of existing units and the setting up of new ones.

There have been significant developments in the technological field in the pulping of hardwoods. A major break-through has been achieved by the pulp and paper industry in this respect. Most of the existing pulp and paper mills are using increasing quantities of hardwoods as raw material and new units are being planned on the basis of more and more use of hardwoods. It may be of interest to point out here that a Panal set up by the Planning Commission on Raw Materials for the Pulp and Paper Industry in its report released in November, 1972, has based its projections of raw material requirement for the future on a progressively stepped-up use of hardwoods. It has been anticipated that ultimately the ratio of bamboo to hardwood will be 50/50. Based on these premises the Panel has suggested a raw materia production target of 5 million tonnes in 1978-79 and 10 million tonnes in 1988-89. The hardwood component in 1988-89 would be nearly 5 million tonnes (as against the present consumption of nearly 200,000 tonnes). It would thus be seen that hardwoods hold the key to the future development of the pulp and paper industry in the country. This aspect would have an important bearing on the development of the forest resources of East Godavari Catchment and invest the unutilized hardwood resources with quite a lot of economic value.

A good deal of research work has been done in the Forest Research Institute, Dehradun, on the pulping performance of hardwoods found in Bastar, Chanda and the forests of East Godavari Catchment singly or in mixture. The results as published by the Institute have been found to be encouraging. The break-up of pulpwood and fuelwood that has been made in the inventory results of the surveyed area is based on the results of the pulping tests on the more frequently occurring hardwood species. Taking into consideration the potential annual availability of bamboo and of suitable hardwood species for pulping, there would appear to be a good scope for considerably expandin the capacity of the Andhra Pradesh Paper Mills.

The survey has revealed an impressive annual potential of large sized material conforming to I.S.I. specifications which could sustain a plywood manufacturing unit of commercial plywood as well as decorative veneers. The establishment of a plywood unit in this region would go a long way in meeting the growing demand of plywood in the country. Actually this unit along with the pulp and paper mill at Rajahmundry could be considered as quite favourabl situated for undertaking sizable exports. Finished products could be transported cheaply by rail or by river barges to Kakinada port which is situated quite close to Rajahmundry for loading into ships. In the Fifth Plan period it has been stipulated that the export target should be 7% of the production and the tonnage for pulp and paper export has been set at 75,000 tonnes annually.

There is a brisk and growing demand for poles for use as pitprops in the coal mining industry at Kothagudum. The increased availability of poles from the new management model suggested in Chapter 4 could be absorbed by the coal-mining industry.

As a result of introduction of intensive management of forest resources and resorting to the idea of creation of man-made forests for providing specific and homogenous raw material for industries, there would be a significant increase in the production of timber logs and saw milling material. This would point to the need of exploring additional markets and setting up new and modern saw mills. The Andhra Pradesh Forest Department has already got a good deal of experience of running saw mills, supplying timber to Government departments and manufacturing furniture. An expansion of this activity and investments made on it would give a valuable support to forestry practices and pay rich dividends.

The situation with regard to fuelwood demand and consumption is quite unsatisfactory and a major portion of the supply comes from unrecorded sources. The increased supply of fuelwood resulting from the adoption of an intensive management plan would contribute a good deal to alleviating the problem. Moreover, even if there were to be some initial question of disposal of large stocks of fuelwood, their conversion into charcoal for supply of large towns in the State and outside it could be resorted to.

The barks of many of the hardwood species found in the surveyed area are rich in tannin content and since a good quantity of bark would be available (the quantity could be anything from 15 to 20 per cent of the volume of wood production, and, as such, the annual availability of bark for a potential annual cut of 1.2 million cu. ms. of wood would be 200,000 cu. ms.). It would be a worthwhile and paying idea to utilise some of the tannin-rich barks for the manufacture of tannin.

8.2. Raw Material Availability And Indication of Production Capacities:

Taking Model I as given in Chapter 4, the potential annual cut from the Government forests of the surveyed area works out to 1.2 mill. cu. ms. As for bamboo the corresponding potential annual cut is 191,000 tonnes. In addition to this availability of bamboo from the existing forest areas, there would be forthcoming an escalating yield of bamboo from the proposed plantation areas from the 9th year onwards rising from 12,000 tonnes annually in the first cutting cycle to 60,000 tonnes (from 21st year to 40th year).

The break-up of potential annual yield by assortment classes in round figures would be as shown below:

a)	Plywood material	- 30,000 cu. ms.
b)	Saw timber	- 186,000 cu. ms.
c)	Poles	- 78,000 cu. ms.
d)	Pulpwood	- 300,000 cu. ms.
e)	Fuelwood	- 601,000 cu. ms.

It would be worthwhile pointing out here that there would be fluctuations in the potential annual cut from the 11th year onwards, when the fast-growing plantation target would be achieved and then from 16th year onwards when the proposed bamboo plantation target would be achieved. There would be a decrease in the availability of plywood material and saw timber. This drop could either be made good by taking up fresh areas under plantations or revising the prescriptions of selection size removal of trees from the present prescription of 50 per cent retention of these to total removal under annual felling.

The drop in saw timber availability would be compensated by the yield of Teak timber from thinnings in the plantation areas. The first thinning could be done in the 11th year and subsequent thinnings done at intervals of 10 years.

The fast growing pulpwood plantations would be providing a sustained supply of 300,000 cu. ms. of homogenous raw material annually from the 11th year onwards.

As for bamboo plantations, they will provide additional yields from the 9th year onwards. For the purpose of planning capacities for the pulp and paper industry, the potential annual availability of bamboo from the forest areas will be increased by 35,000 tonnes from plantation areas (15th year yield).

Based on the above projection of potential annual availability of utility assortments, the following industries could be set up in the region:-

1. Plywood Manufacturing Unit:- The annual intake of raw material could be 30,000 cu. ms. and the unit could be set up either at Rajahmundry or at Maredumilli. A bulk of the raw material for this unit would be available within a radius of 100 kms. from Rajahmundry or 60 kms. from Maredumilli.

2. Saw-Milling Units:- The potential annual availability of saw timber has been shown to be 186,000 cu. ms. It is assumed that 86,000 cu. ms. would be marketed in the round and 100,000 cu. ms. would be sawn intwo modern and new saw mills, each with an annual intake of 50,000 cu. ms. The existing departmental saw mill at Rajahmundry could be expanded and modernized to take the place of one of the proposed units and the other new unit could be set up either at Visakhapatnam or Bhadrachalam.

3. Integrated Pulp and Paper Unit:- The production figure of paper of the Andhra Pradesh Paper Mills in 1971 was 57,000 tonnes. This unit is very favourably situated with respect to raw material supplies and it should be possible to plan for a substantial expansion of capacity during the next fifteen years.

The annual availability of pulpwood has been shown to be 300,000 cu. ms. from the forest areas. The pulp and paper industry could use this raw material for the first ten years and then switch over to homogenous raw material from plantations of fast-growing species. The potential annual availability of pulpwood from the Eucalyptus plantations has been shown to be 300,000 cu. ms.

The position with regard to availability of hardwood as raw material for pulping is quite satisfactory. But the limiting factor for determining the capacity of production of a pulp and paper unit would be the availability of bamboo from the forest areas. The bamboo potential of the surveyed area in the 15th year, taking into consideration the cut both from the forest areas and bamboo plantations would be 191,000 tonnes + 35,000 tonnes = 227,000 tonnes. In planning expansion of production capacities, a time horizon of 15 years is usually taken into consideration. It should now be possible to calculate the maximum capacity of growth of the pulp and paper industry in the region on the basis of availability of bamboo and hardwood resources.

After allowing for local consumption, the surplus bamboo available for industrial use would be sufficient to support a pulp and paper unit of 400 tonnes/day capacity (annual capacity 140,000 tonnes) on the basis of 50% use of bamboo and 50% use of hardwoods in the raw material furnish. The requirement of bamboo and hardwoods would be 175,000 tonnes each. In terms of volume of hardwoods this figure of weight would be taken as 362,000 cu. m.

If any planning of expansion of the existing pulp and paper mill at Rajahmundry is to be done, then it could reasonably be done for an annual production of 140,000 tonnes as against the present capacity of 57,000 tonnes (nearly 3 times). It needs to be stressed here that in case 35,000 additional tonnes of bamboo could be obtained from Kurnool Circle (as is being done at present), then the capacity of the pulp and paper unit at Rajahmundry could be raised to 500 tonnes per day (annual capacity 170,000 tonnes).

4. Tannin Manufacturing Unit:- Tannin extract is widely used in the manufacture of Sole leather and E.I. leather, which are mainly exported to U.S.A. and U.K. The demand for tannin extract from organised and unorganised sectors in the country is estimated around 70,000 tonnes while the manufacturing capacity within the country is around 8,000 tonnes. In view of the huge demand and the availability of large quantity of bark in the region, there is an excellent scope for setting up a unit for the manufacture of vegetable tannin extract. The location of this unit could be at Rajahmundry or Maredumilli.

The capacity of the unit could be 10 tonnes/day (3500 tonnes annually). The requirement of bark as raw material would be 15,000 tonnes annually.

8.3. Returns Likely To Accrue To Forest Department:

In drawing up any blueprint for the development of forest resources in any region, it would be both desirable and necessary to indicate the likely returns from it to the Forest Department. For doing this it would be necessary to assume stumpage values for raw material supplies to industries and other material that finds its way to the market. These assumed royalty values, even though they may be based on sound and reasonable prognosis, need not be considered as sacrosanct or as reflecting the expectations of the State Government or Forest Department. It needs to be stressed that the determination of royalty (or stumpage value) of raw material for any wood-based industry is essentially a matter of negotiation between Government on one hand, and entrepreneurs on the other, and the quanta of these values taken in this report should not be construed as an attempt to influence the issue in any way. In the final analysis the negotiated values of royalty could be substituted in the case studies to determine costs, investments and profitability.

The likely returns to the Forest Department on the basis of Model I of the cutting calculation given in Chapter 4 would be as shown below:-

(i)	Plywood size material 30,000 cu. ms. @ Rs. 200 per cu. m.	= Rs. 6.0 million.
(ii)	Saw Timber. 186,000 cu. ms. @ Rs. 100 per cu. m.	= Rs. 18.6 million.
(iii)	Poles. 78,000 cu. ms. @ Rs. 60 per cu. m.	= Rs. 4.7 million.
(iv)	Pulpwood. 300,000 cu. ms. @ Rs. 15 per cu. m.	= Rs. 4.5 million.
(v)	Fuelwood. 601,000 cu. ms. @ Rs. 10 per cu. m.	= Rs. 6.0 million.
(vi)	Bamboo. 191,000 tonnes @ Rs. 40 per tonne.	= Rs. 7.6 million.
(vii)	Bark for tannin industry. 15,000 tonnes @ Rs. 15 per tonne	= Rs. 0.2 million.
	Total	= Rs. 47.6 million

Thus if an integrated programme for the utilization of the potential annual out is formulated, the annual earnings of the Forest Department by way of royalties could be in the neighbourhood of Rs. 48 million. These earnings could further rise to Rs. 63 million when yields from fast-growing pulpwood plantations and bamboo plantations become available. And when the Teak plantations attain exploitable age (which could be anything from 45 to 60 years) the earnings could shoot upto Rs. 120 million annually. This would amount to nearly twice the present annual revenue of the entire Forest Department. It is pointed out here that the possible earnings from M.F.P. which are likely to be considerable have not been taken into account.

The above prognosis should afford strong justification for the intensive development of the forests of the surveyed area and any investment on road construction and development of infrastructure would bring in handsome returns.

8.4. Indirect Returns Which Could Accrue To The Exchequer:-

In order to assess the total impact of the investment of money in the forestry and industrial development programme on the general economy of the region, it would be necessary to consider generally the extent of indirect returns in the form of Excise Duty, Sales Tax and Income Tax in addition to the direct returns by way of royalties which have been indicated earlier in this Chapter. A rough break-up of these indirect returns would be as shown below:

1. Excise Duty (at the consumer's end):

a)	On commercial plywood and decorative veneer, annual production 3.3 million square metres @ Rs. 2 per sq. metre.	— Rs. 6.6 mill.
b)	On tannin extract, annual production of 3500 tonnes @ Rs. 250 per tonne.	— Rs. 0.9 mill.
c)	On writing and printing paper, annual production 140,000 tonnes @ Rs. 350 per tonne.	— Rs. 49.0 mill.
	Total	Rs. 56.5 mill.

2. Sales Tax (at the consumer's end):

a)	On writing and printing paper, annual sale value Rs. 280 million @ 2%	— Rs. 5.6 mill.
b)	On saw wood and poles, annual sale value Rs. 23.3 mill. @ 2%	— Rs. 0.5 mill.
c)	On bamboo annual sale value Rs. 7.6 million @ 2%	— Rs. 0.1 mill.
d)	On pulpwood and fuelwood, annual sale value Rs. 10.5 million @2%	— Rs. 0.2 mill.
e)	On commercial plywood and decorative veneer; annual sale value Rs. 59 mill. @ 2%.	— Rs. 1.2 mill.
f)	On bark supply to tannin industry; sale value Rs. 0.2 million @ 2%	— Rs. Negligible
g)	On tannin extract; annual sale value Rs. 6.3 million @ 2%	— Rs. 0.1 mill.
	Total	Rs. 7.7 mill.

The above returns from Sales Tax are based on a single point calculation, but since Sales Tax is multipoint, which is leviable on any number of transactions, the actual returns from this item would be much more than the figure indicated above. As such, the return of Rs. 10 million in round figures can be taken as a safe estimate.

3. Income Tax:- The salaried persons, dealers, and contractors, etc. will pay Income Tax on their earnings which would be approximately Rs. 3 mill. The industries will pay Income Tax on their profits which may be taken as Rs. 40 million.

The total indirect returns work out to Rs. 110 million in round figures annually.

8.5. Investments Required (And Profitability of Industries)

Under this item an indication will be given with regard to investments on the setting up of industries, their annual costs and the profitability of each. To complete the picture of over-all investments, the other items such as road construction and maintenance and the raising of plantations of Teak, bamboo and Eucalypts will also be dealt with.

8.5.1. Pulp and Paper Industry:- It has already been indicated earlier that the pulp and paper mill at Rajahmundry could be expanded considerably to produce 140,000 tonnes annually as against the present capacity of 57,000 tonnes. To achieve this, investments will have to be made to raise the production by an additional 83,000 tonnes. Taking the investments as Rs. 6000 per tonne, the total investment would work out to 83,000 tonnes x Rs. 6000 = Rs. 498,000,000, which could be rounded off to Rs. 500 million. This report is not concerned with the manner in which this requirement is to be met with. It would be for the Centre, State Government and the private sector industrialist to work out a mutually satisfactory arrangement of raising the finances for the expansion programme.

The annual cost of production of paper @ Rs. 1500 per tonne would be Rs. 210 million and the annual sale return at Rs. 2000 per tonne would be Rs. 280 million. The gross profitability before providing depreciation would be in the range of 14 to 15 per cent.

8.5.2. Plywood Unit:- The fixed capital investment on the setting up of this unit would be Rs. 6 million, and the annual recurring expenditure on the production of commercial plywood and decorative veneers would be Rs. 59 mill.

Taking 40 per cent as the conversion factor for finished product, the production of plywood and venear would be 12,000 cu. ms. which would be equivalent to 3.3 million sq. metres. Out of the total production 2/3 could be considered as commercial plywood and 1/3 as decorative veneers. The sale value of the finished products would be:-

1. 2.2 million sq. metres of commercial plywood = Rs. 11 million.
@ Rs. 5 per sq. metre.

2. 1.1 million sq. metres of decorative veneer = Rs. 60.5 million.
@ Rs. 55 per sq. metre.

The total profit would be Rs. 71.5 million - Rs. 59 million = Rs. 12.5 million which would amount to 21% on the annual expenditure.

8.5.3. Saw-Milling Units:- There are proposed to be two units equipped with treatment and seasoning plants with a capacity for handling 50,000 cu. ms. each annually. The capital investment on these would be Rs. 2 million and the annual recurring expenditure would be Rs. 7 million. The annual profit of the units would be 18 per cent before depreciation. Assuming a conversion factor of 60 per cent, the turnover of sawn wood annually would be 60,000 cu. ms.

8.5.4. Tannin Manufacturing Unit:- The capital investment on the installation of plant would be about Rs. 1 million and the annual recurring expenditure on production of 3500 tonnes of tannin extract at the rate of Rs. 1450 per tonne would be Rs. 5 million in round figures. The sale price of solid extract varies from Rs. 1600/per tonne to Rs. 2500 per tonne. Taking a sale price of Rs. 1800 per tonne the profitability works out to nearly 30 per cent before depreciation.

8.5.5. Other Investments On Road Construction And Maintenance And Raising Of Plantations:- The total investment on construction of new roads and their annual maintenance has been indicated in Chapter 7 to be Rs. 29.5 million and Rs. 3 million respectively.

The annual cost of raising 6000 hectares of plantations of Teak, Bamboo and Eucalypts and their maintenance would be Rs. 4 million.

8.6. Employment Potential:

When industrial wood is employed as raw material to produce processed goods, investment takes places at various levels, employment is generated at more than one place and the value of the combined operations triggered off by using wood as industrial raw material give a much higher return than when wood is used in the primary form. Once the proposed management model is implemented and the forest-based industries are established, the forestry sector will generate tremendous employment potential for skilled and unskilled workers.

The employment potential likely to be available under the different industrial and forestry items will be as follows:

S.No.	Industry		Estimated number of persons to be employed
1.	Pulp and Paper mill		
	a. Paper Mill staff	-	3,000
	b. Raw Material Supply	-	8,000
2.	Plywood Unit		
	a. Factory staff	-	300
	b. Raw Material supply	-	1,500
3.	Saw-Mill Units		
	a. Saw mill staff	-	1,000
	b. Raw Material supply	-	4,000
4.	Tannin Extract Unit:		
	a. Factory staff	-	50
	b. Raw Material supply	-	300

S.No.	Industry	Estimated number of persons to be employed
5.	Raising of 6000 ha. of Plantations	
	a. Technical, Supervisory and Mechanical Personnel	500
	b. Labour for various operations	4,000
6.	Construction of new roads, extraction routes and maintenance	
	a. Technical, Supervisory and Mechanical Personnel	300
	b. Labourers for the various operations	10,000

From all the items listed above, the employment opportunities would b

1.	Technical, Supervisory, Mechanical and other factory workers	5,150
2.	Labourers for carrying out various operations	27,800

In addition to the employment opportunities mentioned above, there would be additional opportunities for engineering, technicians, skilled and unskilled labourers to be employed on regeneration and tending of forestry areas, construction of factories, sheds, godowns and residential buildings. There would also be added employment opportunities within the Forest Department as well as better avenues of promotion for technical and administrative staff.

8.7. Conclusion:

The forest resources of the East Godhvari Catchment constitute the frozen wealth of the region which could generate a significant growth proces in the region. A proper development strategy for this region would, therefo be to entrust the teak to the Forestry Sector and to provide full scope and autonomy to it for implementing an action programme. Growth conditions in the region are extremely favourable and in the words of the National Commiss on Agriculture, there would be "ample incentives for a change-over from the low-cost low yielding forestry to a commercial high investment economic forestry." Raising of man-made forests of pulpwood and timber species could pay rich dividends. By way of illustration, it could be mentioned here that the returns from Teak plantations alone as proposed in the management model in this report, could yield an annual revenue of Rs. 60 million when the plantations attain maturity. This is the total annual revenue of the State at present.

The future of the forests of East Godavari Catchment could be quite bright provided a wise programme of their development is formulated and matching investments are made. This would call for radical reforms in the forestry sphere and a restructuring of the Department so as to enable institutional finances to be attracted. When laying claim to scarce resources, the question of profitability will have to be satisfactorily and successfully tackled and the only way in which it can be done is to have enlightened and pragmatic cash flow and cost/benefit studies for development programmes. Forestry investment programmes should generate adequate profits after allowing for the payment of high interest rates on borrowed money. This would place a major responsibility on the wood-based industries which will have to be prepared to pay equitable prices for raw material supplies. Any arrangement which is based on subsidized raw material supplies cannot provide a long term solution.

The survey of the East Godavari Catchment has highlighted the scope of setting up a large plywood industry in the region and of augmenting the saw-milling capacity. It is heartening to record that the Forest Department is already processing a case for the setting up of a plywood unit in the region. The existing pulp and paper unit located at Rajahmundry could also go in for a considerable expansion of its capacity on the basis of the existing bamboo and hardwood resources and those that are proposed to be created through man-made forests. In conclusion it could be said that the survey has put the search light on a potentially rich area which has remained backward, undeveloped and inaccessible. It would now be for foresters, planners and industrialists to chart out an ambitious development programme for the region within the context of an over-all perspective industrial and socio-economic frame.

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APPENDIX - I.

LIST OF TREES SHOWING BOTANICAL NAMES ARRANGED ALPHABETICALLY

S.No.	Botanical Name
1.	Anogeissus latifolia
2.	Adina cordifolia
3.	Acacia leucophloea + Lenticularis, Chundra
4.	Aegle marmelos
5.	Albizzia procera + odoratissima + amara
6.	Albizzia lebbek
7.	Acacia catechu
8.	Acacia arabica
9.	Azadirachta indica
10.	Anthocephalus cadamba
11.	Antidesma diandrum
12.	Alchansia lutea
13.	Albizzia stipulata
14.	Alstonia monophylla
15.	Alstonia scholaris
16.	Anogeissus accuminata
17.	Ailanthus excelsa
18.	Bridelia scuamosa + Retusa
19.	Boswellia serrata
20.	Bauhinia malabarica
21.	Bauhinia racemosa
22.	Bauhinia purpurea
23.	Bauhinia retusa + variegata
24.	Bischofia javanica
25.	Buchanania lanzan and latifolia
26.	Butea monosperma
27.	Bursera serratum
28.	Chloroxylon sweitenia
29.	Careya arborea
30.	Casearia tomentosa
31.	Casearia graveolens
32.	Cassia fistula
33.	Cochlospermum gossypium + religiosum
34.	Cochlospermum tomentosum
35.	Cleistanthus collinus
36.	Calycarpa arborea
37.	Cynnosporia spp.
38.	Cordia myxa
39.	Cedrela toona
40.	Cinamomum wightiana
41.	Calliscarpa spp.
42.	Dalbergia latifolia/Sissoo
43.	Diospyros melanoxylon
44.	Dalbergia paniculata
45.	Dillenia pentagyna
46.	Diospyros embryopteris
47.	Diospyros montana
48.	Emblica officinalis
49.	Elaeodendron glaucum

S.No.	Botanical Name
50.	Elæodendron lamarckii
51.	Erythrina indica
52.	Erythrina suberosa
53.	Eugenia laevis
54.	Erythroxylon monogynum
55.	Ficus spp.
56.	Ficus bengalensis
57.	Ficus religiosa
58.	Feronia elephantum
59.	Flacourtia ramontchi
60.	Gmelina arborea
61.	Gardenia turgida + latifolia + gummifera and Gardenia lucida
62.	Garuga pinnata
63.	Hardwickia binnata
64.	Hymenodictyon excelsum
65.	Holarrhena antidysenterica
66.	Kydia calycina
67.	Lagerstroemia parviflora
68.	Lannea grandis
69.	Mangifera indica
70.	Mitragyna parvifolia
71.	Madhuca latifolia
72.	Mallotus philippinensis
73.	Mimusops elengi
74.	Moringa tinctoria
75.	Mimusops hexandra
76.	Manilkara hexandra
77.	Millusa velutina
78.	Miso. spp.
79.	Memecylon edule
80.	Macaranga peltata
81.	Nyctanthus arbortristis
82.	Eugenia dalbergeoides
83.	Oroxylum indicum
84.	Pterocarpus marsupium
85.	Polyalthia cerasoides
86.	Plectromia dydima
87.	Planchonella wightii
88.	Pterospermum suberifolium
89.	Pongamia pinnata
90.	Premna tomentosa
91.	Randia dumetorum
92.	Randia uliginosa
93.	Shorea robusta
94.	Syzigium cumini
95.	Schrebera swietenoides
96.	Schleichera trijuga + oleosa
97.	Salmalia malabaricum
98.	Sterculia urens
99.	Sacconetalum tomentosum
100.	Semicarpus anacardium

S.No.	Botanical Name
101.	Strychnos potatorum
102.	Stereospermum suaveolens + Xylocarpum
103.	Soymida febrifuga
104.	Strychnos nuxvomica
105.	Spondias mangifera
106.	Spondias species
107.	Stereospermum chelonoides
108.	Sapindus emarginatus
109.	Tectona grandis
110.	Terminalia tomentosa
111.	Terminalia bellerica
112.	Terminalia chebula
113.	Trema orientalis
114.	Tamarindus indica
115.	Terminalia arjuna
116.	Vitex peduncularis
117.	Vitex altissima
118.	Weightia tinctorea
119.	Wendlandia exerta
120.	Wrightia tomentosa
121.	Xylia xylocarpa
122.	Xanthoxylum rhetsa
123.	Ziziphus xylocarpa
124.	Ziziphus jujuba

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APPENDIX - II.

BAMBOO FELLING RULES IN THE DIVISIONS OF BHADRACHALAM SOUTH, RAJAHMUNDRY, VISAKHAPATNAM SOUTH, LOWER GODAVARI, PALVANCHA AND KHAMMAM OF ANDHRA PRADESH

1. One year old culms in a clump shall not be cut.

2. Culm should be cut between the second and third nodes at a height of 1' - 2' and never below 6".

3. The number of standards left should be n + 6 (n is number of manus).

4. Felling should be made on one side of clump only i.e. the side opposite to that where the largest number of new culms are formed.

5. No portion of cut shoot should be left in the clump.

6. Removal of Rhizomes for walking sticks, knife handles etc. is prohibited.

7. No culm should be removed with the rhizome.

8. Felling should not be carried out from July to September.

9. All culms after working must be left free from over-hanging or half-cut bamboos.

10. The felling should be inspected at least twice a month by concerned beat guard, once in a month by the concerned Forester and once in a quarter by the Range Officers. Such a regime of regular inspection is bound to improve the efficiency of bamboo exploitation which at present leaves much to be desired.

11. No culm may be felled from a clump which is in flower until, after the end of May or after seed has fallen, then all culms may be felled.

12. All the dry and dead and cut bamboos must be removed from the clump before the end of May.

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APPENDIX - III.

STATEMENT SHOWING RESERVE FOREST AREAS DIVISION-WISE IN EAST GODAVARI CATCHMENT

Name of Division	Area in Ha.
1. Palvancha Division	37,344 ha.
2. Khammam Division	22,756 ha.
3. Eluru Division	47,350 ha.
4. Kakinada Division	275,042 ha.
5. Vishakhapatnam Division	190,927 ha.
6. South Bhadrachalam Division	85,581 ha.
Total:	659,000 ha.

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APPENDIX - IV.

STATEMENT SHOWING RESERVE FOREST AND RESERVE LAND AREAS IN EAST GODAVARI CATCHMENT

KAKINADA DIVISION

S.No.	Name of R.F. Block	Area in Acres	Area in Ha.
1	2	3	4
1.	Akuru	38,054	15,400
2.	Timmnedeo	10,218	4,135
3.	Vemulakonda	7,288	2,949
4.	Maredumilli	2,613	1,057
5.	Lakchmipuram	2,400	971
6.	Italpudi	576	233
7.	Kannaram	981	397
8.	Seethapalli	1,503	608
9.	Beerampalli	1,810	732
10.	Balagonda	4,160	1,250
11.	Bandapalli	3,088	1,250
12.	Valmalakota	1,785	726
13.	Murup-udi	1,711	692
14.	Maredumilli	6,104	2,470
15.	Kota	30,054	12,163
16.	Rummakonda	22,120	8,952
17.	Cheedipalam	10,532	4,282
18.	Marripakla	376	152
19.	Duseharti	6,368	2,577
20.	Vedullakonda	688	278
21.	Tapasikonda	2,224	900
22.	Pinjarikonda	4,504	1,823
23.	Addathigula	2,380	963
24.	Kalimamidi	5,504	2,227
25.	Puramamidi	6,844	2,770
26.	Lakkonda	12,165	4,923
27.	Molleru	8,711	3,525
28.	Sudikonda	4,802	1,943
29.	Mallavaram	7,614	3,081
30.	Veer Bhadrapuram	8,960	3,626
31.	Annavaram	8,307	3,362
32.	Lingamparti	6,582	2,664
33.	Jaddangi	5,568	2,253
34.	Amina Bada	5,108	-
35.	Labbarti	6,829	2,764
36.	Singampalli	3,520	1,425
37.	Ultimudalu	2,688	1,088
38.	Rayavomangi	7,905	3,199
39.	Bandapalli	5,703	2,308
40.	Lododdi	7,349	2,974
41.	Bodaluru	6,480	2,622
42.	Bhupatipalu	740	299
43.	Dandiluru	1,104	447
44.	Devarapalli	14,348	5,806
45.	Egavalasa	14,372	5,816

Contents

1	2	3	4
46.	Geeddada	1,690	684
47.	Kondamadilu	9,989	4,030
48.	Makur	17,830	7,216
49.	Kundada	15,700	6,354
50.	Maredumilli (North)	1,172	474
51.	Maredumilli (South I)	3,080	1,239
52.	Maredumilli (South II)	624	253
53.	Nurupudi (West)	3,138	1,269
54.	Pollangi	11,037	4,467
55.	Velamuru	21,812	8,827
56.	Antilova	28,148	11,391
57.	Batchluru	22,252	9,127
58.	Palagondi	9,480	3,837
59.	Parsivalsa (i)	2,508	1,015
60.	Parsivalsa (ii)	5,540	2,242
61.	Puttakota (west)	6,590	2,667
62.	Veerampalli (South)	1,416	575
63.	Veerampalli (East)	288	116
64.	Gudumur I (Indukuru - B.L.I.)	1,312	531
65.	Gudumuru (Part II)	10,000	4,047
66.	Batalpadu (West)	348	141
67.	Chendurthi	1,473	701
68.	Ditcherthi (East)	6,520	2,640
69.	Kalimamidi (South)	1,732	701
70.	Kota (East)	2,408	975
71.	Kota North II	3,125	1,235
72.	Kota South II	3,980	1,618
73.	Mohanpuram	2,708	1,096
74.	Pinjarikonda West	1,512	612
75.	Rayapalli	808	327
76.	Tapasikonda North	1,844	746
77.	Vedulakonda North	102	43
78.	Vedulakonda West	324	138
79.	Erragonda	872	353
80.	Cheedipalem (West)	1,788	724
81.	Girijanapuram R.L.	6,304	2,553
82.	Balagonda (North) R.L.	3,328	1,348
83.	Agency Veeravaram R.L.	7,800	3,152
84.	Satlavada R.L.	21,600	8,748
85.	Puttakota R.L.	45,006	18,227
86.	Gangavarma R.L.	1,984	803
87.	Balagonda West R.L.	1,184	479
88.	Kota South I R.L.	9,876	3,990
89.	Mantoor R.L.	2,600	1,053
90.	Angalur R.L.	450	182
91.	Rajavamarji R.L.	466	188
92.	Chikilinta R.L.	1,355	548
93.	Jadangi R.L.	654	285
94.	Gangampalli R.L. (V.R. Puram)	124	50

1	2	3	4
95.	Donamamidi R.L.	425	172
96.	Tlirumalayapalem R.F.	2,561	1,037
97.	Pedagaranji R.F. (Part)	8,674	3,513
98.	Pedagaraji R.F.(Part)	4,071	1,649
99.	Vligogula R.F. (Part)	8,674	3,513
100.	Vatangi R.F. (part)	5,299	2,146
101.	Saralanka R.F. (Part)	1,210	490
102.	Bavuruvaka R.L. (Part)	2,304	933
			275,042
VISAKHAPATNAM DIVISION			
1.	Bointy R.F.	43,028	17,426
2.	Sanivaram R.F.	27,000	10,935
3.	Vangasara R.F.	8,527	3,453
4.	Chintapalli R.F.	10,638	4,308
5.	Ebul R.F.	7,827	3,170
6.	Sarwgudeo R.F. 6	5,181	2,098
7.	Sarwgudeo R.F. 4	1,370	554
8.	Sarugudeo R.F. 3	370	150
9.	Peddavalsa R.L.	37,672	15,257
10.	Gargavara-m R.L.	18,020	7,298
11.	Climalapadi R.L.	8,012	3,245
12.	Krishnapuram R.L.	17,390	7,043
13.	Nagalakonda R.L.	1,480	599
14.	Valsapalem R.L.	1,210	490
15.	Kinnerla R.L.	5,386	2,173
16.	Lammasingi Bit I	6,401	2,592
17.	Lammasingi Bit II	958	388
18.	Kantaluru A : R.L.	1,615	654
19.	Kantaluru 'B' R.L.	960	389
20.	Tharakonda R.F. (Part)	45,496	18,426
21.	Gudem R.L. (Part)	79,783	32,312
22.	Sileru R.L. (Part)	59,894	24,054
23.	Sonkaram R.L. (Part)	50,803	20,578
24.	Machigadda (A) R.L. (Part)	9,995	4,048
25.	Arulova R.F. (Part)	633	256
26.	Karaka R.F. (Part)	3,188	1,283
27.	Kareka R.F. II (A)(Part)	1,037	420
28.	Sarugudi R.F. 2(Part)	12,037	4,875
29.	Sarugudi R.F. I (Part)	3,632	1,471
30.	Sanivaram R.E. Extn.I	124	50
31.	-do- II	43	17
32.	Paligogula & Gomulabonda RF	345	139
33.	Basikota and Royala-polem RF	385	156
34.	Lothrgadda R.F.	1,640	623
			190,927

1	2	3	4
	BHADRACHALAM SOUTH DIVISION		
1.	Rekapalli R.F.	82,332	33,344
2.	Marrigeora R.F.	45,617	18,475
3.	Nelakota R.F.	2,543	1,030
4.	Venulari R.F.	1,508	610
5.	Deurapalli R.F.	2,180	883
6.	Lakkavaram R.F.	7,306	2,959
7.	Kanasuluru R.F.	5,425	2,197
8.	Maduguru R.F.	4,082	1,653
9.	Kalleru R.F.	4,140	1,676
10.	Palusamamidy R.F.	5,292	2,143
11.	Mattapalli R.F.	7,277	2,947
12.	Walsugi R.F.	7,277	2,947
13.	Rekopalle Hill R.F. Extn. I (Pedda Konda)	788	319
14.	-do- (Enkuru II)	325	132
15.	Rekopalle (Gummidikonda III)	1,383	560
16.	-do- (Dhanua Konda IV)	760	308
17.	-do- -do- V)	318	128
18.	Vumuderia R.F. Extn. R.L.	372	151
19.	Marrigura R.F. Extn. R.L. I.	1,488	602
20.	-do- II	2,828	1,145
21.	Devarapalli, RF Extn. R.L.	1,380	080
22.	Lakkavaram R.F. Extn. R.L.	1,930	781
23.	Madugur R.F. Extn. R.L.	828	335
24.	Kalleru RF Extn. R.L.	2,138	866
25.	Kansuluru RF Extn. R.L. I	726	294
26.	-do- II	1,435	581
27.	Kattapalli RF Extn. R.L.	2,160	1,187
28.	Paluxmamidy RF Extn. RL I	2,932	1,187
29.	-do- II	1,250	505
30.	Walsugri RF Exten. RL I	2,430	984
31.	-do- II	1,250	506
32.	Lakkavaram Extn. RF	940	380
33.	Rkapalli Hill RF Extn.RL I	584	238
34.	--do- II	1,034	418
35.	--do- III	1,308	530
36.	--do- IV	970	395
37.	--do- V	830	332
38.	--do- VI	1,948	789
39.	Karusuluru RF Extn. RL III	72	29
			85,581
	ELURU DIVISION		
1.	Nagavaram Muta R.L.		9,673
2.	Kopalli R.F. (Part)		4,966
3.	Kovvada R.F. Block (Part) I		3,490
4.	Chintapalli R.L.		1,
5.	Kallumamidi R.L.		1,

1	2	3	4
6.	Kovvada Block II RF.		1,049
7.	Papikonda R.F.		4,407
8.	Pa-pikonda Extension		106
9.	Pydipaka R.L.		92
10.	Sirivaka R.L.		1,398
11.	Polavaram 'A' Block R.L.		2,516
12.	Udatlipalli R.L.		6,[illegible]
13.	Guddapalli R.L.		9,120
14.	Kankala R.L. (Part)		2,319
			47,350

PALVANCHA DIVISION

1.	Lachapet R.F.	3,283	1,329
2.	Damarduria Ext. Block	576	233
3.	Tbinamanupet Block (Part)	749	303
4.	Katkureo Block (Part)	30,504	14,987
5.	Damardurla Block (Part)	13,997	5,664
6.	Pereutapalli Block	33,485	13,551
7.	Medapalli Block	654	228
8.	Laolapeta Extn. Block	121	49
1.	Deradapadu R.L.	15,148	6,130
2.	Guntunladugu R.L.	3,678	1,488
3.	Katkur Block R.L. Part	9,799	3,969
4.	Vedantapur R.L.	5,568	2,255
5.	Katkur Ext. VII R.L.	544	220
6.	-do- VI	64	26
7.	-do- IX	40	16
8.	Vedontapuram Extension	1,788	724
9.	Durgongotlu R.L.	537	217
10.	Rachurpalli R.L.	477	193
11.	Lachapura Extension I (Part)	1,723	699
12.	Tirunuala Kanta (Part)	11,693	4,736
13.	Katkuru Extension VIII	103	42
14.	Guntinadugu Extension R.L.	895	362
15.	Errakonda R.R.	219	85
16.	Lonkapalli R.F.	1,622	657
17.	Togguda R.F.	280	105
18.	Laclapur R.F.	1,249	506
19.	Anambaopet (Part)	806	328
			23,756

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