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CREATION OF REMOTE SENSING & GIS BASED LAND RESOURCES INFORMATION SYSTEM FOR LAND RESOURCES MANAGEMENT

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ABSTRACT

The present study is aimed to prepare the Land use/Land cover characteristics micro level planning for sustainable development of study area in this digital data of Land use/ Land cover using satellite imageries on ARC/INFO GIS platform. This constitutes the spatial database and to create information system for micro level development. The study is part of Nellore district. The present study resulted in information system for micro level planning of Land resources with a scope to develop the further by providing the information necessary about the resources. This system is user friendly and many decisions can be made by the user according to his choice. The Land resources utilization Decision Support System developed here can further serve as a replica to other study areas.

Key words: Remote sensing, Geographical Information System, Sustainable development, Land Resources Management.

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1. INTRODUCTION

Land use refers to man's activities and various uses, which are carried on land. Land cover refers to natural vegetation, water bodies, rock/soil, artificial cover and others resulting due to land transformation. Although land use is generally inferred based on the cover, yet both the terms land use and land cover are closely related and interchangeable. Information on the rate and kind of change in the use of land resources is essential to the proper planning, management and regulation of the use of such resources. Knowledge about the existing land use and trends of change is essential if the nation is to tackle the problems associated with the haphazard and uncontrolled growth. A systematic framework is needed for updating the land use and land cover maps that will be timely, relatively inexpensive and appropriate for different needs at national and state level. The rapidly developing technology of remote sensing offers an efficient and timely approach to the mapping and collection of basic land use and land cover data over large area. The satellite imageries are potentially more amenable to digital processing because the remote sensor output can be obtained in digital format. Land use data are needed in the analysis of environmental processes and problems that must be understood if living conditions and standards are to be improved or maintained at current levels.

2. DESCRIPTION OF STUDY AREA

The study area extends from the Nellore ayacut on PennaruptoBay of Bengal about 25 kms downstream of Nellore. The area is included in SOI Toposheets 66/B2andB3.The study area is underlain by alluvium of recent age. It includes all the areas irrigated by Pennar .The study area is a part of Nellore district, the southern most coastal district of Andhra Pradesh with a sea coast of 38.95 Km with a perimeter of 882.79 Km it is an agrarian district and agriculture is the mainstay for about 42 per cent of the population. (Census of India 2001). The area under study extends from the Nellore to Bay of Bengal about 20 km down stream of Nellore. The extent to be covered all area is included in Surrey of India toposheets 66B/2 and 66B/3 on 1:50000 scales between longitude and latitude $80^0\,0^{'}$, $14^0\,45^{'}$ NW $80^0\,15^{'}$ $14^0\,25^{'}$ SE.

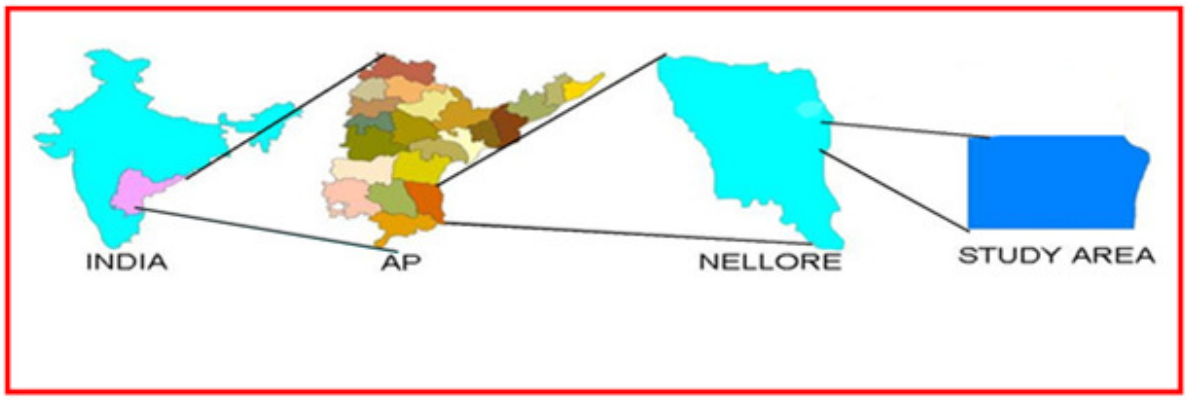


Figure 1 Location map of study area

2.1. Study Objectives

- To prepare digital thematic map of Land Use/Land Cover. using satellite imageries on ARC/INFO GIS platform. This constitutes the spatial database.

3. METHODOLOGY

Flowchart showing the methodology adopted for land use/land cover mapping is given in Figure 1. For analysis and interpretation two types of data are needed:

1. Basic data 2. Ground data

1. Basic data includes

- Satellite data of LISS-III
- Toposheets
- Local knowledge
- Area map on any scale to transfer details
- Reports and other literature of the study area

2. **Ground data:** Ground data is very much essential to verify and to increase the accuracy of the interpreted classes and also to minimize the field work.
3. **Data analysis**: For analysis and interpretation of satellite data, the study can be divided into three parts:
    - Preliminary work
    - Field work
    - Post field work

Preliminary work includes

- to see the limitation of satellite data
- to lay down the criteria for land use classification to be adopted
- to fix the size of mapping units, which depends upon the scale
- interpretation of different land use/land cover classes
- demarcation of doubtful areas
- preparation of field land use/land cover map

Field work

- Type of ground data to be collected
- Selection of sample area for final classification
- Checking of doubtful areas
- Change in land use/ land cover due to wrong identification, fresh development, nomenclature.
- General verification

Post field work

- reinterpretation or analysis or correction of doubtful areas
- transfer of details on base map
- marginal information
- preparation of final land use/land cover map

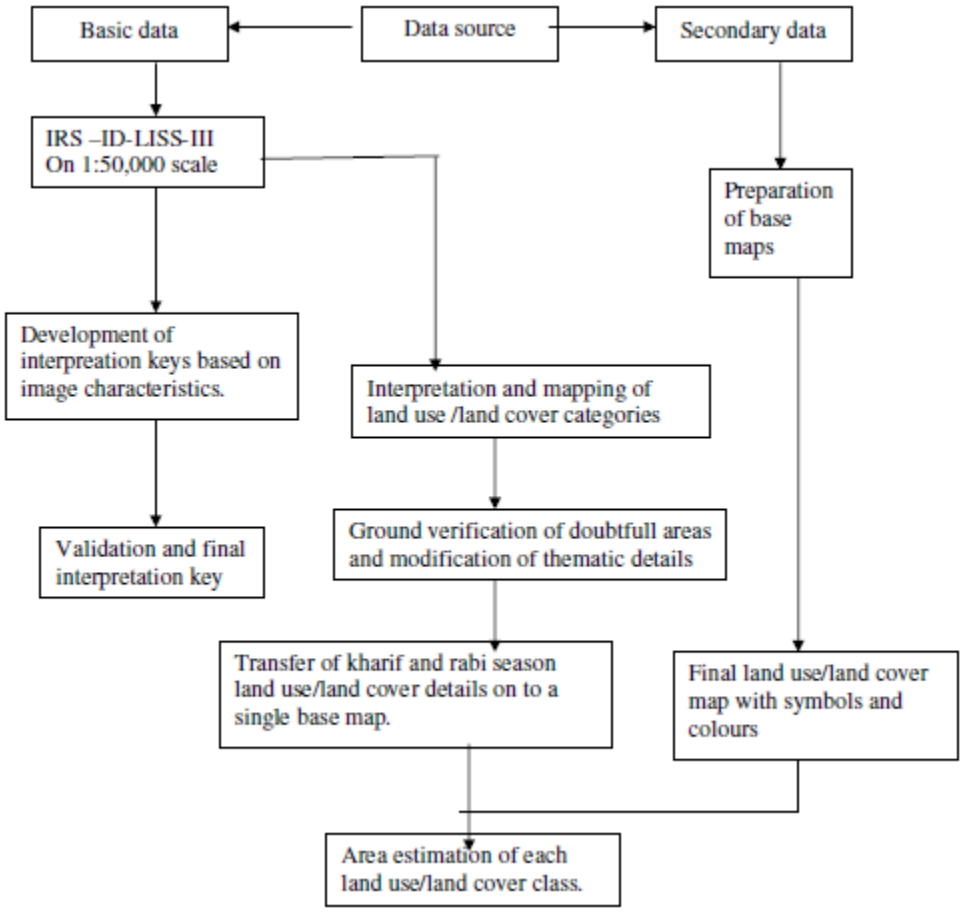


Figure Methodology Adopted for Land Use/Land Cover Mapping

4. RESULTS AND DISCUSSION

Present land use/land cover map showing the spatial distribution of various categories and their areal extent is vital for the present study. The spatial distributions of various land uses are interpreted based IRS-ID, LISS III data. The different land use/ land cover classes existing in the area over space and time are briefly discussed here in their dimension.

4.1. Settlements

It is defined as an area of human habitation developed due to non agricultural use and that which has a cover of buildings, transport, and communication, utilities in association with water, vegetation and vacant lands Settlements appears as dark bluish green in the core and bluish on the periphery on satellite imagery. It may be either big or small in size, irregular in shape with coarse or mottled texture. The total settlements area in the present study is about 14.0 Sq.km, which includes some parts of Nellore urban area, Alluru, pallepaadu, kotturu, utukuru, veguru etc.

4.2. Agriculture Area

It is defined as the land primarily used for farming and for production of food, fiber, commercial and horticultural crops. It include land under crops (irrigated and unirrigated), fallow and plantations etc.

4.3. Crop land

It is evident from the study of the two seasons data that most of the double cropped area is seen under canal command or ground water irrigation area. The cropping intensity is high in these areas because of the physical factors like flat terrain, good alluvial soils, good rainfall and assured irrigation from delta canals of Somasila reservoir. Most of the double cropped area was found in both banks of Pennar river and area is estimated to be 224.8Sq.Km ha. Single crop area found to be 125.5 Sq.Km.

4.4. Fallow lands

Fallow land is described as agricultural land which is taken up for cultivation but is temporarily allowed to rest, un cropped for one or more seasons, but not less than one year. These lands are particularly those which are seen devoid of crops at the time, when imagine taken up for both seasons. The area under this category is estimated as 7Sq.Km.

4.5. Plantations

It is described as an area under agricultural tree crops, planted adopting certain agricultural management techniques. It includes coconut, arecant, citrus, orchards and other horticultural nurseries. This mostly confined to the beach ridges, sandy areas and along river courses. Plantation can be seen very prominently on the imagery with a dark red to red tone, regular in shape, sharp edges and coarse to medium texture. Their size varies from small to medium. The area under this category forms 18.5 Sq.Km.

4.6. Scrub forest

It is an area bearing an association predominately of trees and other vegetation types capable of producing timber and other forest produce. The scrub forest describes as a forest where the vegetative density is less than 20% of the canopy cover. It is the result of both biotec and abiotic influences. Scrub is a stunted tree or bush/ shrub. Most of the low lying hills are in degraded conditions consistingof mixed dry deciduous types of species and it appears as light green colour in satellite image. In the present study scrub forest identified as 20.4. Sq.Km

4.7. Aqua Culture

Swampy areas and double cropped areas are converted into fish tanks by specially constructed ponds according to specifications for pisciculture. Due to its high economic yields, this culture is fast spreading in all the suitable areas. Most of the aquaculture activities are identified and mapped near the coastal marshy lands and right bank side of the Pennar, area under aquaculture is estimated 162.8 Sq.Km.

4.7. Marshy/ Swamp Lands

Marshy land is that which is permanently or periodically inundated by water and is characterized by vegetation which includes grasses and weeds. This category of land is estimated to be 23 Sq.Km.

4.8. Land with Scrub

It is the land, which has an undulating topography with thin soil cover and scattered trees/ scrubs. These lands are being used for grazing and are ideal sites for plantations. 22 Sq.Km

4.9. Water Bodies

The water bodies are identified based on their tone, regular to irregular shape & smooth to mottled texture on the satellite imagery. Surface water spread of the tank or lake varies from

season to season. The major river present in the study area includes the Pennar river. It appears as long, narrow to wide feature on the imagery with an irregular shape and a smooth texture. The water bodies mainly dry tanks in the study area occupied 12 Sq.Km and dry river and tanks estimated to be 14.4 Sq.Km and 26 Sq.Km.

4.10. Sandy Area

These are the areas which have stabilized accumulations of sand in situ or transported in coastal or riverine areas. The sand area occurs in the form of sand dunes, beaches, channel islands etc. The sand area appears in satellite image as white colour and area estimated as 13 Sq.Km.

4.11. Salt Pans

It is estimated 7 Sq.Km, observed in near brackish water areas. Saltpans appear as white and light bluish colour with regular pattern.

4.12. Waterlogged Areas

Waterlogged land is that land where the water is at/ or near the surface and water stands for most of the year, such lands usually occupy topographically low lying areas. The area is estimated as 6 Sq.Km.

4.13. FFECTS of Land use / Land cover changes ON WATER QUALITY

It is often difficult to define water quality because it depends not only on the concentration of pollutants in the water but also on its intended use. Various usability for an identified use. Various land uses can potentially introduce many pollutants into aquatic ecosystem. Some water pollutants, which become extremely toxic in high concentrations, are, however, needed in trace amounts. Copper, Zinc, Manganese, Boron and Phosphorus, for example, can be toxic or may, otherwise, adversely affect aquatic life when present above certain concentrations, although their presence in low amounts is essential to support and maintain function in aquatic ecosystems.

The concentrations above which water pollutants adversely affect a particular water use may differ widely. Water quality requirements, expressed as water quality criteria and objectives, are use-specific or are targeted to the protection of the most sensitive water use among a number of existing or planned uses within a catchment.

Current data indicates that water quality management efforts should be mainly focused on controlling non point sources of pollution, which may be best achieved through land use controls. The effects of land use / land cover on the hydrologic cycle, on soil and on water quality may either be direct or indirect. Urban land uses have varying degrees of intensity and are related to the potential pollution. While the relationship between urban land use and water quality is complex, a fairly reliable correlation has been defined between the annual loading rates for various pollutants and land use based mainly on density. Water quality criteria often serve as a baseline for establishing water quality objectives in conjunction with information on water used and site-specific factors. Water quality objectives aim at supporting and protecting designated uses of fresh water, i.e., its use for drinking – water supply, live stock watering, irrigation, fisheries, recreation or other purposes. The relationship between land use and water quality and water quality are bi-directional. Land use activities have direct impacts on water resources, while water quality and quantity greatly influence the sitting of land use activities. Pollution can originate from a variety of sources. That coming from an identifiable source is termed point source pollution, while nonpoint source pollution comes from diffuse sources and may be more difficult to identify. A point source often originates from a pipe whereas a nonpoint source may be the result of land use practices throughout the study area.

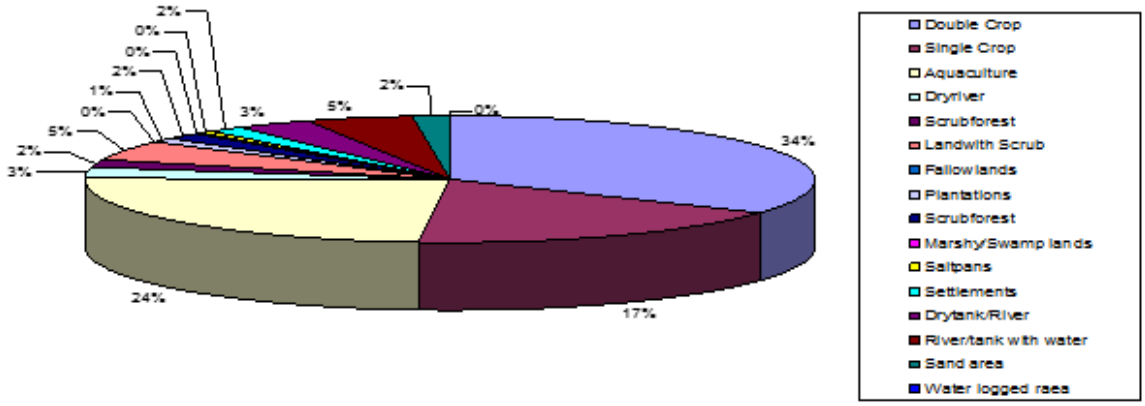
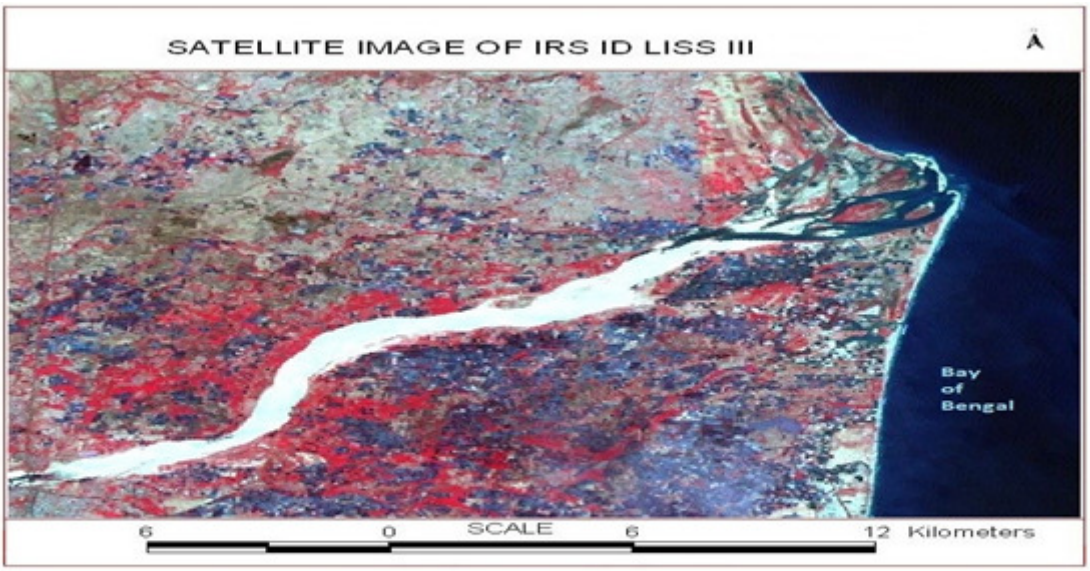


Figure Pie Chart Showing Land Use / Land Cover Distribution

Landuse / Landcover	Area In Ha
Double Crop	12305.0
Single Crop	8615.0
Aquaculture	10812.0
Dry river	1921.0
Scrub forest	831.0
Land with Scrub	910.0
Fallow lands	11.0
Plantations	750.0
Scrub forest	784.0
Marshy/Swamp lands	220.0
Saltpans	131.0
Settlements	726.0
Dry tank /River	1343.0
River/tank with water	1546.0
Sand area	775.0
Water logged area	25.0


SATELLITE IMAGE OF IRS ID LISS III
Bay
of
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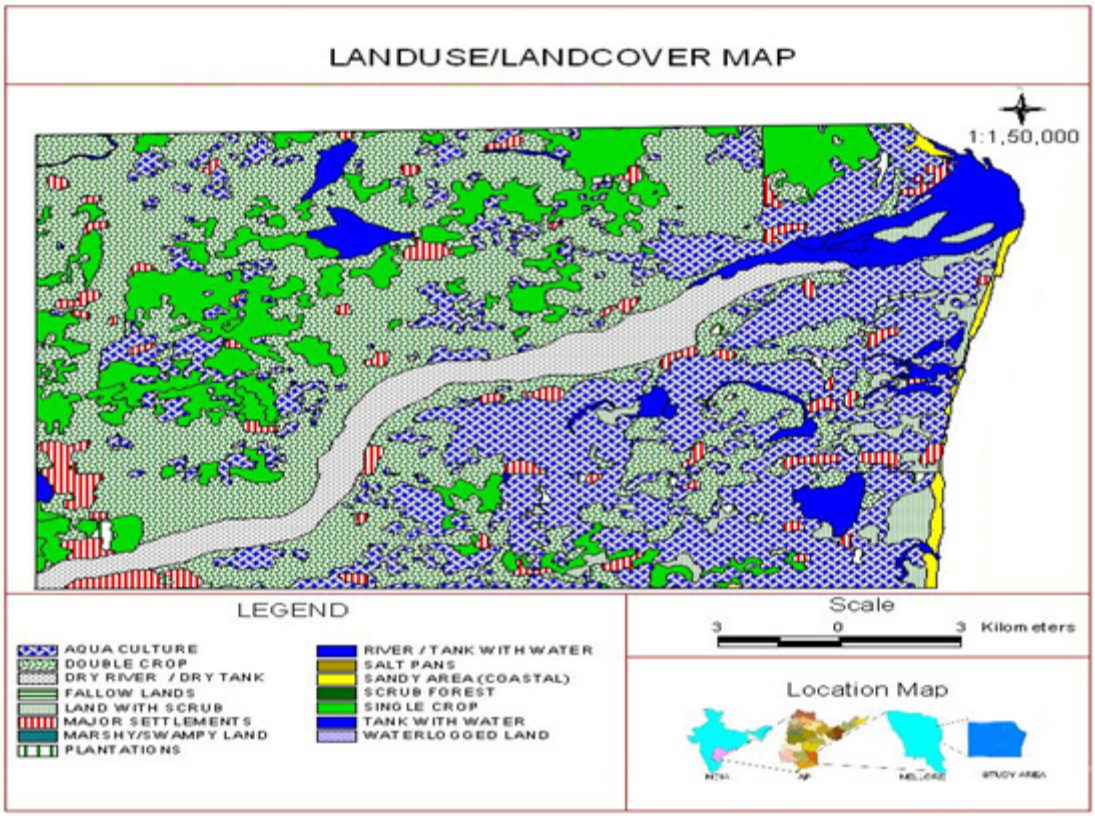
LANDUSE/LANDCOVER MAP
1:1,50,000
LEGEND
AQUA CULTURE
DOUBLE CROP
DRY RIVER / DRY TANK
FALLOW LANDS
LAND WITH SCRUB
MAJOR SETTLEMENTS
MARSHY/SWAMPY LAND
PLANTATIONS
RIVER / TANK WITH WATER
SALT PANS
SANDY AREA (COASTAL)
SCRUB FOREST
SINGLE CROP
TANK WITH WATER
WATERLOGGED LAND
Scale
3
0
3 Kilometers
Location Map

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