Abstract

The land use /land cover dynamics of the Kolleru Lake in and around Andhra Pradesh have been characterized and evaluated using Remote Sensing and Geographical Information System (GIS). Visual interpretation techniques have been followed to determine to aerial extent and distribution of Level-I and Level-II Land Use/ Land Cover categories. The land use /land cover types as identified are Rural and Urban Built up land, Agricultural Land, Aquaculture, Water bodies, Forest and Waste lands Maximum area (60.72% of total geographical Area of the Study area) is covered by Agricultural land followed by Aquaculture (27.91% of TGA), Water bodies (5.84%of TGA), Waste lands (1.05% of TGA), while Forest Land covers only 0.84 percent of TGA as compare to 33 percent recommended by National Forest Policy for environmental protection.

Key Words: Land Use, Land Cover, Remote sensing, GIS, Agricultural land, Aquaculture and Water bodies

Introduction

Land use is referred to “Man’s activities and the various uses which are carried on land”. Land cover is referred to “Natural Vegetation, Water bodies, Rock/Soil, artificial cover and other noticed on the land” (NRSA 1995). Remote Sensing is the process of Sensing, identification, delineation, measurement of surface features and their process from a distance without directly coming into physical contact. Remote Sensing techniques have been successful in carrying out land use/ land cover mapping.


Land is one of the critical natural resource on which most developmental activities (Jitendra Kumar, 2011). Land use/ land cover perspective of Oussudu Lake and its catchments would be an appropriate method of inquiry to understand the environmental status of Oussudu Lake (NarayanaKumar and KumarSwamy, 2006). The susceptibility of the Wular Catchment to degradation is high which is highlighted by the rapid increase of barren land (Kantha and Zahoor ul Hassan, 2010).

Kolleru Lake is the largest freshwater lake and is located in Andhra Pradesh. Kolleru is located between Krishna and Godavari delta and covers an area of 248 km². The lake serves as a natural flood-balancing reservoir for these two rivers. The lake is fed directly by water from the seasonal Budameru and Tammileru streams, and is connected to the Krishna and Godavari systems by over 68 inflowing drains and channels. It serves as a habitat for migratory birds. It supports the livelihood of fishermen and riparian population in the area.

Land use is obviously constrained by environmental factors such as soil characteristics climate, topography and vegetation. But it also reflects the importance of land as a key and finite resource for most human activities including Agriculture, Aquaculture, settlement, recreation and water bodies and storage. Land is fundamental factor of production and through
much of the course of economic growth. Often improper land
use is causing various forms of environmental degradation.
For sustainable utilization of the land ecosystem, it is essential

to know the natural characteristics, extent and location. Its
quality, productivity, suitability and limitations of various land
uses.

Land use changes take place according to the needs
of mankind, misuse and over exploitation of land. Increasing
pressure of population and consequent rising demand for food
and shelter are putting great pressure on water body areas,
fallow land and other vacant lands. Many of the peoples have
last substantial portions of their water cover due to conversion
of water body areas into Aquaculture land in order to feed the
growing population. Land use/Cover arrangement makes
landscape patterns. Today Earth resources satellites data are
very applicable and useful for land use/land cover studies.
Natural conservation area plays vital role in biodiversity.

Study Area

The study area is located in between 16°17’00’’ and
16°59’00’’ N latitudes and 80°50’00’’ and 81°39’00’’ E
longitudes, covering in and around Kolleru lake region (Fig.
1). Water source to this lake is from its tributaries –
Budameru, Tammileru and Ramileru, originating from the
Eastern Ghats.

Objective

To Analyze the existing land use/ Land cover in and Around
Kolleru Lake using Remote Sensing and Geographic
Information system techniques (GIS).

Data base and Methodology

The present study was based on primary and secondary data
sources. The supervised and unsupervised classifications are
two popular methods of Land Use/Land Cover classifications.
The analysis is based on IRS P6 LISS IV Satellite image of
Kolleru Lake and surroundings, Andhrapradesh. The Survey
of India (SOI) topographical maps no’s 65D/13, 65D/14,
65D/15, 65H/1, 65H/2, 65H/3, 65H/4, 65H/5, 65H/6, 65H/7,
65H/8, 65H/9, 65H/10, and 65H/11 (Scale-1:50,000) were
scanned, geo-referenced and all the maps were joined using
ERDAS imagine environment. The image processing software
ERDAS IMAGINE 9.1 and Arc GIS 9.2 has been used.

Results & Discussions

Land use/land cover information is the basic pre-


Fig.1: Location map of the study area

Fig.2: IRS P6 LISS IV Satellite imagery of the study area


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adequate, inconsistent and don’t provide up-to-date information on the changing land use patterns, process and their spatial distribution in space and time. It is here, satellite Remote Sensing offers alternate, accurate and faster mode of data collection and updating the land use/land cover information and to arrive at a standard classification and explanation of different land use/land cover classes.

It is seen from the area under broad (Level – I) Land use/land cover, the Agricultural land is 60.72 % area, Aquaculture 27.91%, Water bodies 5.84%, Built up land 3.65%, Waste land 1.05% and Forest area 0.84% to the total Geographical Area (TGA) of the study area. The detailed (Level-II) land use/land cover classes of 31 classes and their area statistics are shown in Table 1, Fig.3 and Fig.4.

Agricultural Land

The state of Andhra Pradesh is popularly known as ‘rice bowl of India’. As the Lake Kolleru is located between the deltas of the Godavari and Krishna rivers, the lakebed is very fertile and suitable for agriculture. The agricultural land was cultivated both in Kharif as well as Rabi seasons and Agricultural plantations. The total area under this category in the study area was 2344 km² which comes out to be 60.72 percent of the total geographical area of the study area. The area under fallow land, Agricultural Plantations, Horticulture plantations and Bamboo plantations was also included. Paddy and Sugarcane is the main crop of the study area. The Agricultural plantations in scattered patches were also present in the study area. Palm oil, Coconut and Mango plantations were the main plantations. The total area covered by these plantations was 270 km² which comes out to be 7 percent of the total geographical area of the study area. Threats from floods every year changed the behavior of farmers by shifting to aquaculture. In this process many of the farmers converted their agriculture land into aquaculture ponds (CSE, 2006). In India, the agricultural sector provides livelihood to 70% of the population directly or indirectly (Wikipedia, 2007). Even in Kolleru the inhabitants used to practice agriculture as their main occupation till 70s and later adopted practicing fish farming in large scale converting their crop lands to fish ponds. Only minor part of the lake still holds agricultural lands, but only useful for second crop. However the agriculture contributes less damage to the lake compared to other pressure factors.

Fig.3: Land use/Land cover map of the study area
Aquaculture

Aquaculture is one of the fastest growing food industries and the rapid growth of aquaculture worldwide has resulted in growing concerns about its impact on important ecosystems. Kolleru Lake, India’s largest fresh water body and Ramsar site have undergone tremendous changes due to the development of aquaculture. The total area under this category in the study area was 1077.58sq.km which comes out to be 27.91 percent of the total geographical area of the study area. The area under Aqua ponds-demolished, Aqua ponds-hyacinth and Aqua ponds-dry was also included. Aquaculture is extensively carried out in the lakebed. According to the Kolleru Lake Development Scheme officials, the aquaculture is the most lucrative occupation in the area among other occupations. There are 58 Fishermen Co-operative Societies in the lake area, which consist of 5500 members.

The illegal encroachments in the lake to construct fish ponds continued till 2004 with great vigor and occupied an area of 99.74 Km2 out of 180.38 Km2. The aquaculture is one of the factors in polluting the lake with pesticides and other chemicals used and it is considered as a main factor for causing floods in the area obstructing the free flow of the water. The fish business with high profits attracted many big investors in fish farming in the Kolleru.

Water bodies

It is an area of impounded water, areal in extent and often with a regulated flow of water. It includes man-made reservoirs/lakes/tanks/ canals/, besides natural lakes, rivers/streets and creeks. The total area under this category in the study area was 225.43 km² which comes out to be 5.84 percent of the total geographical area of the study area. The area under canal, drainage net work, river streams and creek was also included. The area covered by major water body area was 63.60 km² which comes out be 1.65 percent of the total geographical area of the study area. The lake serves as a natural flood-balancing reservoir for Krishna and Godavari Rivers and is fed with several inflowing rivers, canals, streams and agricultural drains of which Budameru and Tammileru are the biggest (www.godavari.org, accessed on May 11, 2007). The lake discharges its excess water into the Bay of Bengal through a 72 km long out-flowing brackish water canal called Upputeru (uppu = salt, eru = canal). There are 46 island villages and 76 shoreline villages consisting of about two hundred thousand (200,000) inhabitants around the lake and the main occupations of the inhabitants are aquaculture, agriculture and duck farming (Anjaneyulu Y, 2003; Rama Raju T S, 2003; Alagarswami K, 1994).

Forest Land

There was no reserve forest in the study area. The total area occupied by these open forest, forest plantations and forest blank was 32.52 km² which was 0.84 percent of total geographical area of the study area. It is described as an area of trees of species of forestry importance and raised on notified forest lands. It includes eucalyptus, casuarinas, bamboo etc. This area was much less than the required area of 33 percent under forest plantations for ecological balance as per the National Forest Policy.

Waste Lands

In the waste land category mainly land with or without scrub was there and covered an area of 15.40 km² while at few places patches of gullied or ravenous land in the southern part of the study area. The marshy land was covered by 4.19 km². 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. It excludes lakes, ponds and tanks.
Table 1: Land Use/Land Cover Statistics of Kolleru Lake in and Around (2009)

<table>
<thead>
<tr>
<th>S.N O</th>
<th>Land use/Land Cover</th>
<th>Area in Ha</th>
<th>% of the Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BUILT UP LAND</td>
<td>141.09</td>
<td>3.65</td>
</tr>
<tr>
<td>2</td>
<td>AGRICULTURAL LAND</td>
<td>2344.9</td>
<td>60.72</td>
</tr>
<tr>
<td>3</td>
<td>AQUACULTURE</td>
<td>1077.5</td>
<td>27.91</td>
</tr>
<tr>
<td>4</td>
<td>WATER BODIES</td>
<td>225.43</td>
<td>5.84</td>
</tr>
<tr>
<td>5</td>
<td>FOREST</td>
<td>32.52</td>
<td>0.84</td>
</tr>
<tr>
<td>6</td>
<td>WASTE LANDS</td>
<td>40.43</td>
<td>1.05</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>3861.9</td>
<td>100.0</td>
</tr>
</tbody>
</table>

The present study has demonstrated the potential of Remote Sensing technology for, mapping the land use/land cover status of an area. The results shows that the Kolleru lake in and around has good aquaculture potential (27.91% of TGA area) and agricultural land is 60.72% (include plantations, fallow land and horticulture) total geographical area of the study area. These are evident from the satellite data analysis for the year 2009. We can see that aquaculture is rapidly expanding at the cost of the other sectors. Agricultural land and lake area are decreasing; Aquaculture is developing that is good cause, but whether to continue with this type of unplanned land use in the area or not needs to be seriously considered.

Satellite remote sensing technique allows collecting up to date accurate information of land use/land cover and further helps to monitor the changes periodically. There are number of implication of Kolleru lake in and around on the land use/land cover the landscape’s physiological destruction, illegal land encroachment and shrinkage of lake area. The Kolleru lake in and around must grow in harmony to share the population pressure on the lake area. So, it is expected that during the aquaculture development process the agricultural land and water body area converted into the aquaculture land result to decrease in lake area and increase in land value which can be used for financing of the aquaculture development.

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He is a pioneer in developing the design of roof water harvesting since 1990 and influenced the common man to accept the technology. He was member, Rajiv Gandhi National drinking water mission, ministry of Rural Development, Govt. of India, during 2002-2004.

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