ANTHROPOGENIC IMPACT ASSESSMENT ON FOREST BIODIVERSITY IN COASTAL REGION OF UTTARA KANNADA DISTRICT USING RS AND GIS TECHNIQUE

A. G. Koppad and Pavan Tikhile

KEYWORDS

Remote sensing
GIS
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Anthropogenic effect
The study was taken up in coastal region of UK district to study the anthropogenic impact on forest resources. The anthropogenic effect on forest from 1989 to 2006 was analyzed using LANDSAT TM and ETM+ imageries in ERDAS IMAGINE 2011 and Arc GIS. Results indicated that the mixed forest area in the year 1989 was 64.6% which was reduced to 57.66% in the year 2006 mainly due to human interference which leads to increase in agriculture area from 9.94% in 1989 to 14.29% in 2006. The water body was also increased from 3.4 to 3.95% due to the construction of dam. The detection of change in vegetation was clear through NDVI maps. The agricultural land increase was due to extension of cultivation in forest land. The water body increased due to construction of dams and reservoirs which decreased the forest area. The result indicated the decrease in forest resources year by year due to human activities.

ABSTRACT

The study was taken up in coastal region of UK district to study the anthropogenic impact on forest resources. The anthropogenic effect on forest from 1989 to 2006 was analyzed using LANDSAT TM and ETM+ imageries in ERDAS IMAGINE 2011 and Arc GIS. Results indicated that the mixed forest area in the year 1989 was 64.6% which was reduced to 57.66% in the year 2006 mainly due to human interference which leads to increase in agriculture area from 9.94% in 1989 to 14.29% in 2006. The water body was also increased from 3.4 to 3.95% due to the construction of dam. The detection of change in vegetation was clear through NDVI maps. The agricultural land increase was due to extension of cultivation in forest land. The water body increased due to construction of dams and reservoirs which decreased the forest area. The result indicated the decrease in forest resources year by year due to human activities.

INTRODUCTION

Anthropogenic impact is influenced the change in vegetation mainly due to urban growth and population which altered natural vegetation cover. UK district which is the part of the Western Ghats is the famous tourism spot of the Karnataka state. For tourist halting and lodging, people construct resorts and hotels in forest area and destroy the forest biodiversity including flora and fauna. The change detection techniques were the process of identifying changes in same area with respect to temporal time (Singh, 1989). Change detection as defined by Hoffer (1978) was temporal effects as variation in spectral response involves situations where the spectral characteristics of the vegetation or other cover type in a given location change over time. Change detection analysis provide the past and present information about the area which helps for understanding relationship between human activity with natural resource utilization and provide the precautions to be taken to conserve the natural resources. The knowledge of land use/land cover was helpful for proper management, planning and monitoring of natural resources (Zhu, 1997).

Remote sensing technique is most effective method for identify change detection in spatial data and it provides real time data with temporal resolution. Remote sensing method like vegetation indices among other methods has been reliable in monitoring vegetation change. One of the most widely used indices for vegetation monitoring is the Normalized Difference Vegetation Index (NDVI). Techniques and methods of using satellite imageries as data sources have been developed and successfully applied for land use classification and change detection (Shepard, 1964; Munsi et al., 2010). Image processing software is most useful technology for data processing and creating the maps. Keeping these points in view study was taken up in coastal area of UK district.

MATERIALS AND METHODS

The study was conducted in coastline of Uttar Kannada district which is part of Western Ghats. The area includes Karwar, Ankola, Kumta, Honnavar and Bhtkal talukas of UK District of Karnataka (Fig. 1). This region lies between 13º56' 0"N to 15º3' 0"N Latitude and 74º5' 0"E to 74º45' 0"E Longitude covering a surface area about 338660 hectares. Kali, Gangavali, Aghanshini, Sharavati, and Venkatapur was the main rivers flowing in this region. The mean average rainfall was 2835 mm. but the Bhtkal taluk records highest average rainfall of 4015 mm. The average temperature in the study area was 33ºC during the summer and 20ºC during the winter. The main geographic feature of the study region is the Western Ghats which runs from north to south mainly covered by evergreen forest.

The SOI topo-sheets of the study area are 48J/1, 48J/2, 48J/5, 48J/6, 48J/7, 48J/8, 48J/9, 48J/10, 48J/11, 48J/12, 48K/9 and 48J/8 with scale 1:50,000 were procured from SOI Bangalore. The Landsat Satellite imagery of Thematic Mapper (TM) for the year 1989 and Enhanced Thematic Mapper plus (ETM+) for the year 2006 was downloaded from GLCF site http://glcf.umiacs.umd.edu/data/srtm/. The data were analyzed using ERDAS IMAGINE 2011 and Arc GIS 10.
Table 1: Land use land cover class in 1989 and 2006 and change in area over 17 years

<table>
<thead>
<tr>
<th>Class Name</th>
<th>Year 1989 Area in ha</th>
<th>Year 1989 Area in %</th>
<th>Year 2006 Area in ha</th>
<th>Year 2006 Area in %</th>
<th>Difference Area in ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>33658.60</td>
<td>9.94</td>
<td>48379.00</td>
<td>14.29</td>
<td>14720.4</td>
</tr>
<tr>
<td>Coastal land</td>
<td>1074.69</td>
<td>0.32</td>
<td>997.83</td>
<td>0.29</td>
<td>-76.86</td>
</tr>
<tr>
<td>Mixed Forest</td>
<td>218791.00</td>
<td>64.60</td>
<td>195259.30</td>
<td>57.66</td>
<td>-23532</td>
</tr>
<tr>
<td>Open land</td>
<td>65391.00</td>
<td>19.30</td>
<td>77678.80</td>
<td>22.93</td>
<td>12287.8</td>
</tr>
<tr>
<td>Stony land</td>
<td>8215.38</td>
<td>2.43</td>
<td>2982.33</td>
<td>0.88</td>
<td>-5233.05</td>
</tr>
<tr>
<td>Water body</td>
<td>11529.70</td>
<td>3.40</td>
<td>13363.10</td>
<td>3.95</td>
<td>1833.4</td>
</tr>
<tr>
<td>Total Area</td>
<td>338660.40</td>
<td>99.99</td>
<td>338660.40</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

The toposheets of the study area are geo-referenced in Arc GIS with UTM projection system. The clipping of topo-sheets and mosaic of all the toposheets was done Arc GIS. The boundary of the study area was digitized in Arc GIS and the same was placed over mosaic topo-sheets and the area was extracted by mass (area shape file). The shape file was taken to ERDAS IMAGINE 2011 and convert into AOI file. The AOI file was placed over satellite image and subset the area. The land use and land cover maps of study area for the year 1989 and 2006 was prepared using supervised classification. The Normalized Difference Vegetation Index (NDVI) map of the

Figure 1: Location map of study area in UK district of Karnataka

Figure 2: Flow chart showing the methods followed to get the change detection images.

Figure 3: Land Use / Land Cover map of the study area in the year 1989 and 2006
study area for both the year 1989 and 2006 was also prepared. The satellite image for the year 1989 was taken as before image and 2006 image as after image and difference and highlighted images were obtained in ERDAS. The change detection image was taken to show the change in forest area from 1989 to 2006. The methodology followed is shown in flow chart Fig. 2.

RESULTS AND DISCUSSION

The land use/land cover of the study area for the year 1989 and 2006 is shown in the form of map in Fig. 3.

The NDVI map of the study area for the year 1989 and 2006 is shown in Fig. 4. NDVI was calculated as a ratio of red and the NIR bands of sensor system. NDVI values range from -1 to +1, because of high reflectance in the NIR portion of the EMS, healthy vegetation is represented by high NDVI values between 0.1 and 1. Conversely, non-vegetated surfaces such as water bodies yield negative values of NDVI because of the electromagnetic absorption quality of water. Bare soil areas represent NDVI values which are closest to 0 due to high reflectance in both the visible and NIR portions of the EMS (Lillesand and Kiefer, 1994). The land use and land cover class area in hectare and percentage area coverage in different classes in the year 1989 and 2006 and the difference in increase or decrease in these natural resources over 17 years is shown in Table 1.

The results indicated that about 9.94% of the areas are occupied by agriculture land during 1989 and about 14.29% occupied during 2006. The mixed forest covers maximum percentage of area which is 64.6% in the year 1989 and it was 57.66% in 2006. Whereas open land was 19.3% and 22.93% in the year 1989 and 2006 respectively. The agricultural land area increase from the year 1989 to 2006 was 14720.4ha due to extension of cultivation in forest land. The water body was increased due to construction of dams and reservoirs which might result in decrease in the forest area. Satellite remote sensing imagery is a most suitable source of gathering land cover information at local, regional and global scales.

Some of the anthropogenic activities which lead to distraction of forest biodiversity is shown in Plate 1.

The change detection in forest area between the year 1989 to 2006 is show in fig 5. The maximum forest area decreases in upper north region of study were due to construction of dam and expansion of agricultural land and anthropogenic activity like mining for laterite bricks (Biswajit Majumder, 2011), resorts, roads for transportation, cutting the forest trees for fuel and timber which lead to destroying biodiversity (Yasodharan et al., 2011) in the coastal region of UK district. There was an increase in non-forest area which may be attributed to an increase in settlement area, agriculture land and deforestation activities (Biswajit Majumder, 2011). Similar study conducted in China shows that the land use changes produced realistic description of environmental degradation (You Yanli et al., 2012). It is estimated that decrease in dense forest area is due...
to the fact that forest land have been utilized for mining and related activities and also due to human pressure on forest for firewood as well as grazing of cattle in the forested area. The high growth of population, climate change, and over consumption of ecosystem services are the greatest threat to degradation of forest. The population growth (anthropogenic factors) among communities around the forest imposes a lot of pressure on the forest plantation (Ayoola et al., 2012).

CONCLUSIONS

This study has demonstrated that the recent advancements in remote sensing and GIS technologies provide powerful tool for mapping and detecting changes in forest area and land use/land cover. The general trend observed in the present study was increase in agriculture land, open land and water body where as forest land had been decreased remarkably followed by stony land and coastal land. The results indicated that precautions should be taken to protect the forest to reduce further reduction and conserved biodiversity for environmental balance. The high growth of population, climate change and over consumption of ecosystem services are the greatest threat to degradation of forest.

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