

RESEARCH ARTICLE


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Land use / Land cover changes in Mandya taluk using GIS and remote sensing

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Abstract

Land and water are the most keys and pivotal factors for the progress of any region or locality. Land use and land cover transformation have turned out to be a dynamic factor in recent strategies for dealing with natural resources and monitoring environmental changes. The research aimed to analyze and monitor land use/land cover changes in Mandya taluk of Karnataka by using an integrated approach of remote sensing and geographical information system. The Mandya taluk satellite data were collected for the years of 1995, 2005, and 2018 and were classified by using a maximum likelihood algorithm, nonparametric parallelepiped classifier in ERDAS Imagine software. Multi-spectral pixels of the study area were classified and mapped into four broad land cover classes i.e., Waterbody, Open space, Agriculture area, and urban or built-up land. Change detection analysis was performed to compare the quantities of land cover class conversions between time intervals. Significant shifts from some classes to others were also observed. The accuracy assessment was computed using user, producer, overall, and Kappa (Khat/K) statistics.

Keywords: Land use/Land Cover; GIS; and remote sensing

Introduction

Rapid urban development and increasing land-use changes due to increasing population and economic growth in selected landscapes are being witnessed of late in India and other developing countries. The measurement and monitoring of these land-use changes are crucial to understanding land use cover dynamics over different spatial and temporal time scales for effective land management. Today, with rapid urbanization and industrialization, there is increasing pressure on

land, water, and the environment, particularly in the big metropolitan cities. Urban sprawl may be defined as the scattering of new development on isolated tracts, separated from other areas by vacant land. Land cover (LC) is defined as the features that are present on the earth's surface. Land cover (LC) is defined as the features that are present on the earth's surface (Sabzar Ahmad Kuchay and Ramachandra T.V). Land use refers to the human-induced changes for agricultural, industrial, residential, or recreational purposes (Ramachandra

and Bharath, 2012; Sabzar *et al.* 2016). Land cover changes refer to conversion and modification of vegetation, changes in biodiversity, soil quality, runoff, erosion, sedimentation, and land productivity (Sabzar *et al.* 2016). The terms land use and land cover are not synonymous and the literature draws attention to their use and cover change. Land cover is the biophysical state of the earth's surface differences so that they are used properly in studies of land and immediate subsurface (Turner *et al.* 1995). The present study area witnessed rapid development and growth during the past few decades in terms of urbanization, population growth, expansion of city area, industrialization, and population increase substantially.

Study Area

The Mandya Taluk lies between North latitude $12^{\circ} 44' 42.6''$ to $12^{\circ} 25' 50.7''$ and East longitudes $76^{\circ} 42' 05.6''$ to $77^{\circ} 0' 22.9''$ falling in the survey of India degree sheet Nos -57 H and 57D. The total geographical area of the Taluk is 705 km². The taluk is divided into one town and 175 villages distributed around the Mandya city. The soils in Mandya taluk are thin gravelly and underlain with marram zone containing weathered rock. The soils are highly leached and poor in bases. The taluk enjoys a sub-tropical climate with temperatures ranging between 160 and 350 C. April is the hottest month and with the onset of southwest monsoon in June, the temperature drops considerably. December is the coldest month. The rainfall is generally uniform in the district except in the western sector where it is slightly higher.

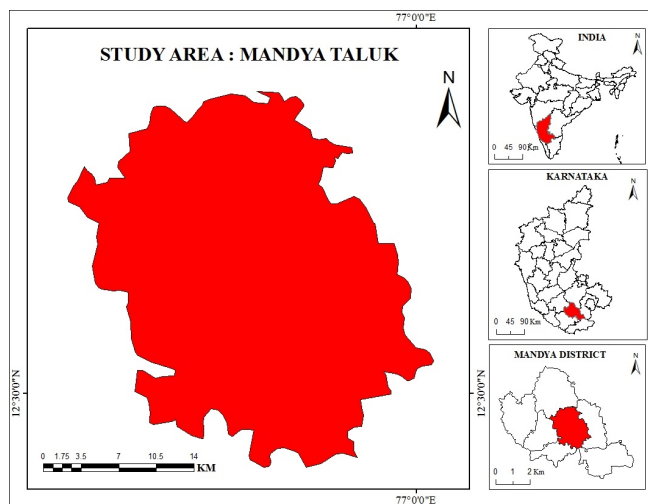


Fig. 1. Location map of Mandya Taluk

Objective

- To Analyse the Land use /Land Cover Changes in Mandya Taluk.

Research Method

The Mandy taluk images (years 1995, 2005, and 2018) of the study area were then classified using a Maximum likelihood algorithm, nonparametric parallelepiped classifier in ERDAS Imagine software. The training data collected from various training sites are applied to the entire image during image classification processes. Multi-spectral pixels of the study area were classified and mapped into four broad land cover classes i.e., (1) Waterbody (2) Open space (3) Agriculture area, and (4) Urban or built-up land. The accuracy of the classified map was assessed by randomly taking 50 points by using Google Earth software on the reference image. The accuracy assessment was computed using user, producer, overall, and Kappa (Khat/K) statistics. Finally, the resultant classified images were vectored using the raster to vector conversion tool with Arc GIS software.

Results and Discussion

Agriculture Area

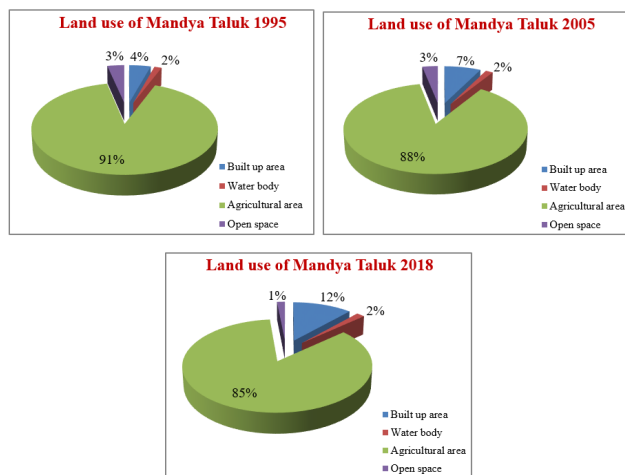
Agriculture Area is the main part of this area. This area coverage of the Irrigated and non-irrigated or other agricultural lands, it is a rain-fed area. Agricultural land we classified into two divisions. One is Irrigated land and the other one is non-irrigated land or other agricultural lands. The irrigated land is located in mainly the Cauvery river basin area Shimsha river basin area. The irrigated facility land is available in this area for cultivation. The area available for Agriculture land is 636.173 km² in the year 1995. After 1995 year the Agriculture land is decreased. In the year 2005, the Agriculture land is 613.236 km² available for Agriculture. After the 2005 year, Agriculture land is decreased. In the year 2016, the Agriculture land is 579.920 km² available for Agriculture. The mainly this type of land is visible in Shimsha river basin system. 636.173 km² area has Agriculture land. This land has from 1995 to up to present it is decreased. This area of 579.920 km² has been covered in 82.168 % of the total area.

Built-Up Area

The land use category in the Mandya taluk is the main category of the taluk. In the year 1995, the built-up or urban land is 35.234 km². This much area was used for urban and settlement purposes. The mainly Mandya city is the best development in the entire taluk. After 2005 the urban land is increased. The satellite imagery shows the changes in inbuilt and urban land. In the year 1995 is 35.234 km². After this year in the 2005 year, this land is 59.764 km² are used for urban and development purpose. After this year in the 2018 year, this land is 103.728 km² are used for urban and development purposes. The modernization and urbanization is the main intention of increase by the built-up land and settlements.

Table 1. Land use status and change of Mandya Taluk during 1995 to 2018.

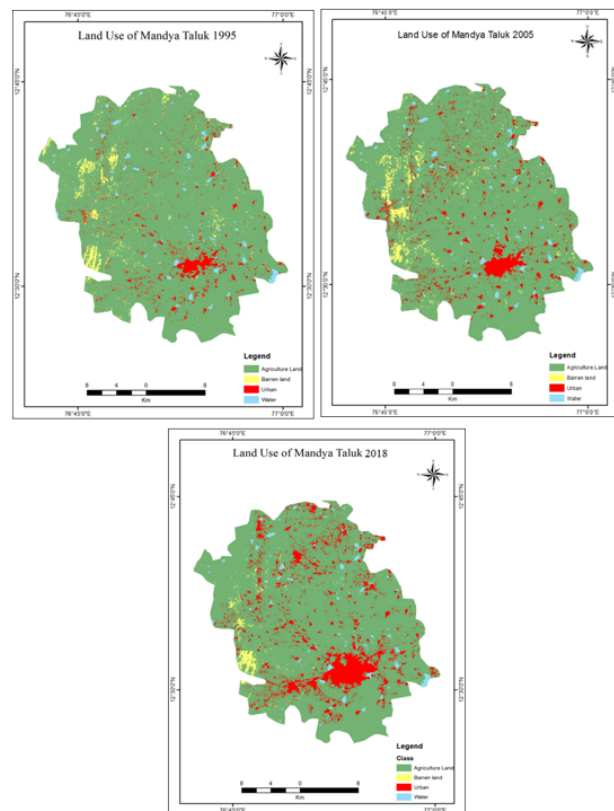
Land use category	1995		2005		2018	
	Km	%	Km	%	Km	%
Built up area	30.6	4.3	52.5	7.4	82.3	11.6
Water body	10.5	1.5	10.8	1.5	11.7	1.7
Agricultural area	641.4	90.8	621.1	87.9	601.8	85.2
Open space	24.0	3.4	22.3	3.2	10.9	1.5
Total	706.6	100.0	706.6	100.0	706.6	100.0

**Fig. 2.** Land use of Mandya Taluk 1995 to 2018

The settlement is showing from the Mysore to Bangalore main state highway road is improved area of the taluk. From the starting Mandya is depending upon the Mysore for the all economical activities and after the years it is improved in the agriculture field.

Open space

Open space is an island of limited ability to support life and in which less than one-third of the area has vegetation or other covers. Mandya taluk land use category. In 2005 year, this land is 21.796 km² no use for any cultivation and development purpose. After the year 2018 year, this land is 11.843 km² no use for any cultivation and development purpose. Previous years this kind of land is available in huge quantity, after then it is decreased. Because it is converted to agricultural land use and urban area. The 2018 year this land is 11.843 km² is non-user of any purpose. When neither the former nor the future use can be discerned and the area is obviously in a state of land-use transition, it is considered to be Open space, to avoid inferential errors.

**Fig. 3.** Land use of Mandya Taluk 1995 to 2018

Water Bodies

The water body is very important in this study. Water is a very important thing in the biophysical world. Mandya taluk has several water resources. It is mainly depending on the Shimsha river and they meet the water requirements of the taluk. The delineation of water areas depends on the scale of data presentation and the scale and resolution characteristics of the remote sensor data used for interpretation of land use and land cover.

Change Detection

Change detection is a process that measures how the attributes of a particular area have changed between two or more periods. Change detection often involves comparing aerial photographs or satellite imagery of the area taken at different times. Change detection has been widely used to assess shifting cultivation, deforestation, urban growth, the impact of natural disasters like Tsunamis, earthquakes, and use/land cover changes, etc. In this step the change between the multi-temporal land use/land cover found and the matrix of change detection was built.

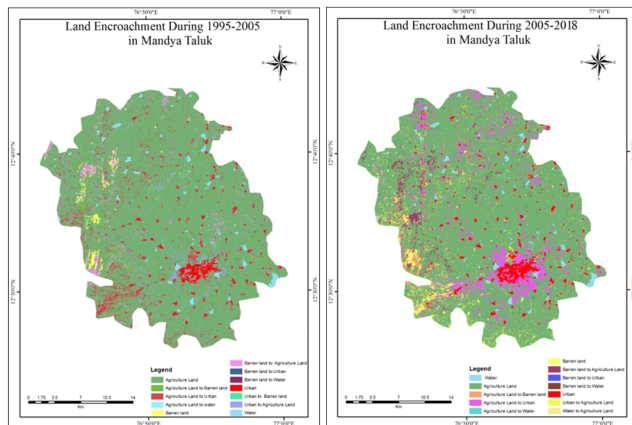


Fig. 4. Land use Changes in Mandya Taluk 1995-2005 and 2005-18

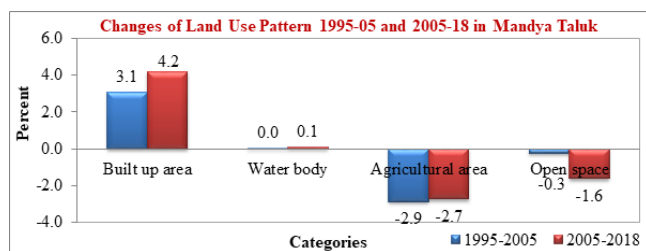


Fig. 5. Changes of Land use pattern 1995-05 and 2005-18 in Mandya Taluk

Conclusion

The land cover analysis of Mandya revealed an increase in the built-up area from 30.6 sq. km in 1995 to 52.5 sq. km in 2005 and 82.3 sq. km in 2018 with a slight increase in water bodies from 10.5 sq. km in 1995 to 11.7 sq. km in 2018. The agricultural area covers the maximum area of the taluk and also with substantial decrease of area from 641.4 sq. km (90.8%) in 2005 to 621.1 sq. km (87.9%) in 2005 to 601.8 sq. km (85.2%) in 2018. Moreover, the open space is also seen to be declined from 24 sq. km in 1995 to 22.3 sq. km in 2005 and 10.9 sq. km in 2018 respectively. Whereas, it can be seen that only 1.5 % of the total area in the taluk is covered by open space. The reason for the decreasing trend of agricultural area and open space is because of the increasing area of the built-up area due to urban sprawl and expansion of the town area

in the last three decades. The Present study uses the RS and GIS approach which is one of the most prominent technology at present for Spatio-temporal analysis which is not possible through other conventional mapping techniques.

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