Research Article

CLASSIFICATION OF LAND USE AND LAND COVER IN HANUR WATERSHED AREA, KOLLEGAL TALUK, CHAMARAJNAGAR DISTRICT, KARNATAKA STATE, INDIA, USING REMOTE SENSING AND GIS

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ARTICLE INFO

ABSTRACT

The Earth's natural resources play an important role in the production and development of the whole world. The reasonable development and protection of land resource have become the key issues for economic growth. The accuracy and timely updation of land use/land cover classes are of great significance in these studies. Land use and land cover are two major factors for assessment. Land use refers to human activities like agriculture & various uses which are carried on land, while land cover refers to natural vegetation such as forest, water bodies and rock/soil, artificial cover and other zones resulting due to land transformations. Although land use is generally inferred based on the cover, yet both are closely related and interchangeable. The present study is an attempt to classify the land use/land cover (LU/LC) of the study area using Geocoded FCC bands 2, 3 and 4, of IRS 1C and 1D (LISS 111+ PAN merged) on 1:50,000 scale and Survey of India Toposheets as reference.

INTRODUCTION

The terms land use and land covers are often used interchangeably, but both of them have their own unique characteristics. Land cover–refers to the surface cover elements of Earth's Surface, as represented by natural segments like vegetation, water, soil, impervious surface and other physical features of the land. Identification of land cover establishes the baseline information for activities like thematic mapping and change detection analysis. Land use–refers to the activity, economic purpose, intended use, and/or management strategy placed on the land cover type(s) by humans or land managers. Changes in intent or management practice, likewise, constitute land use change. When used together, the phrase Land Use / Land Cover generally refers to the categorization or classification of human activities and natural elements on the landscape within a specific time frame. Land cover is the physical material at the surface of the earth. Land use is the description of how people utilize the land for the socio-economic activity. Urban and agricultural land uses are two of the most commonly recognized high-level classes of use. At any one point or place, there may be a multiple and alternative land uses, the specification of which may have a greater dimension. Hence, Land use is the activity for which land is used by the man. Remote Sensing data and interpretation and Geographical Information System (GIS) provide efficient methods for analysis of land use and land cover aspects and tools for Land Use Land Cover planning and modelling. Satellite Remote Sensing data is usually the most accurate and up-to-date information useful for any geospatial analysis.

Study Area

Kollagal taluk is one of the largest taluks in Chamarajnagar district and also largest taluk in Karnataka state. The study area lies between $77^0 5^1$ to $77^0 30^1$ East longitude $11^0 45^1$ to $12^0 15^1$ North latitude **(Map 1).**with total aerial extent of 1025 sq kms falls in the survey of india (SOI) toposheets no 57H/4, 57H/7, 57H/8, 58E/1 and 58E/5. Kollegal is well known for its silk industry. It is also called as silk city which attracts traders from all over the state. The area is accessible by good road network. It is connected by two national highways NH 209 which starts from Bengaluru-Dindukal via Coimbatore, Kollegal and NH 212 which starts from Kollegal to Calicut/Kozhikode, via T.Narasipura, Mysuru the nearest railway station is Chamarjanagar.

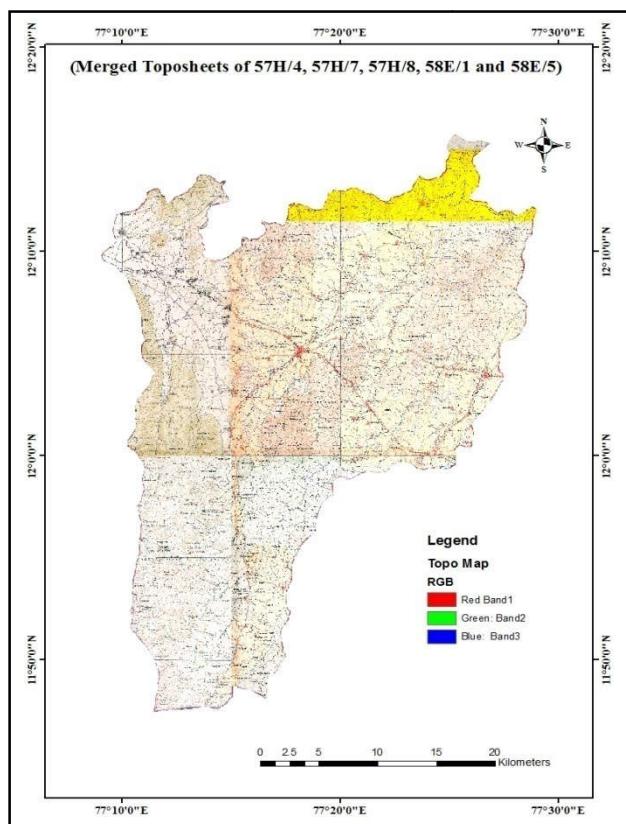*Corresponding author:* **Siddaraju K**
Department of Studies in Earth Science, Manasagangotri, Mysuru, 570006 Karnataka, India
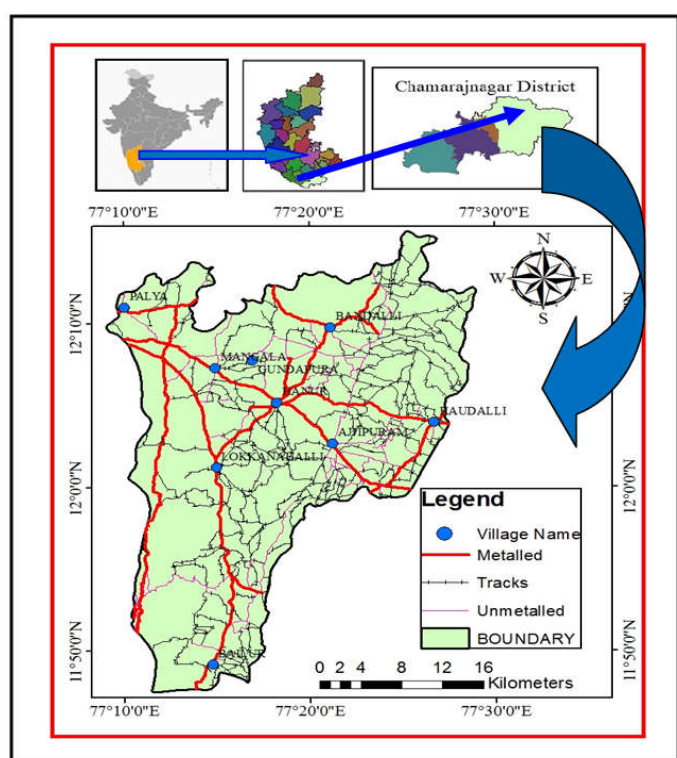
Map 1 Location of Hanur Watershed

METHODOLOGY AND MATERIALS

The survey of India Top sheets 57H/4, 57H/7, 57H/8; 58E/1 and 58E/5 (Source SOI) have been used as base maps.

Map 2 Topo Map of the Hanur Watershed (1: 50,000 Scale)

The land use(Lu) and land cover (Lc) map of the study area, digitized using satellite images of Indian Remote Sensing (IRS)1C and 1D PAN+LISS-III (year: 2005 with resolution of 26 mtrs) were overlaid on SOI toposheets, on 1:50,000 scale, constructed through visual interpretation and using Arc Map (V 10.21) and Eradas Imagine 9.2 software's. The identification of various land use land cover pattern have been based on the variation in tone, texture, shape, and association patterns.

Land Use and Land Cover Classes

Agricultural land

It comes under land use category, it may be defined broadly as land used primarily for production of food and fiber for human needs. It also include horticultural/plantations, under irrigated & rain-fed conditions. In this study area, out of 1025 sq kms 435.41 sq kms (42.4869 %) comes under this category,(Table 1) and (Map.2), including croplands, fallow lands and Plantations

Table 1 Lu/Lc classification of Hanur watershed (in sq kms)

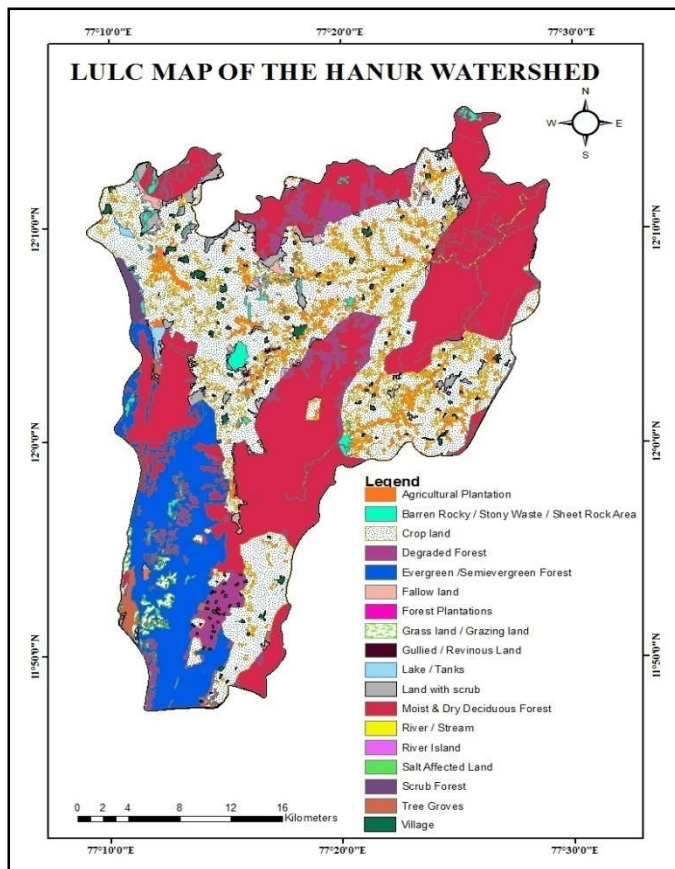| Slno	Description of LULC	area in sq kms
1	Village	9.8
2	Tree Groves	8.2
3	Scrub Forest	4.9
4	Salt Affected Land	1.7
5	River Island	0.02
6	River / Stream	4
7	Moist & Dry Deciduous Forest	338.7
8	Land with scrub	25.8
9	Lake / Tanks	2.99
10	Gullied / Revinous Land	1
11	Grass land / Grazing land	6
12	Forest Plantations	0.54
13	Fallow land	5.9
14	Evergreen /Semievergreen Forest	122.8
15	Degraded Forest	48.55
16	Crop land	400.7
17	Barren Rocky / Stony Waste / Sheet Rock Area	14.4
18	Agricultural Plantation	28.8
	TOTAL	1024.8
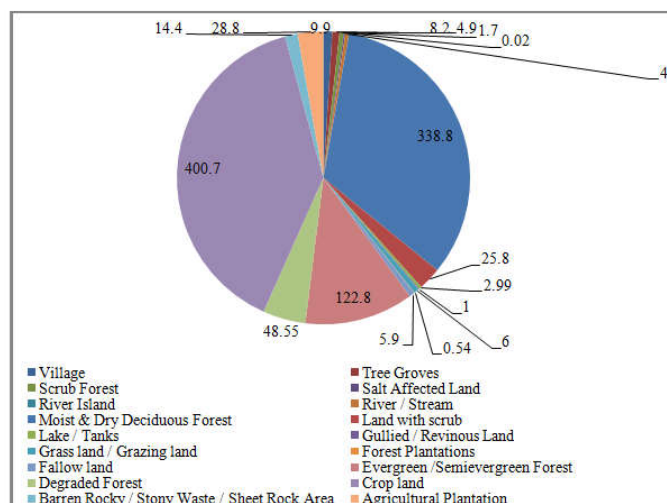
Fig 1 Pie chart represents Lu/Lc of Hanur watershed

Map 3 Land use Land cover of Hanur Watershed (Level 2 classification)

Croplands

Cropland includes areas used for the production of adapted crops for harvest. Two subcategories of cropland are recognized as: cultivated and non-cultivated. Out of 435.41 sq kms of the total agricultural area, cropping land covers an area of 400.7sq Kms.

Plantations

It is a large scale farming practice. It includes crops like coconut, sugar cane and banana. Out of 435.41 sq kms of aggriculture land plantation covers almost 28.8 sq kms.

Fallow land

It is an agricultural system with an alternation between a cropping period of several years and a fallow period, (Ruthenberg, 1980). In another terms these are the lands, which are taken up for cultivation but are temporarily allowed to rest, un-cropped for one or more season, but not less than one year. In the study area Out of 435.41 sq kms it covers 5.9 sq kms.

Built up land

Built-up Land is comprised of areas of intensive use of human necessity. Included in this category are cities, towns, villages, strip developments along highways, transportation, power, and communications facilities, and areas such as those occupied by mills, shopping centers, industrial and commercial complexes, and institutions. Built up land covers an area of 9.9 sq kms out of 1024.81 sq kms (0.966%) (Table .1) and (map .2)

Forest

A forest may be defined as a biologically significant dominated by trees and other woody vegetation. Satellite data has been used in demarcation of different forest types and density classes with reliable accuracy through Visual Image Interpretation as well as Digital Image Processing techniques (Map.2 and Table.1).

Evergreen/semi evergreen forest

This term as such describes the phenology of perennial plants that are never entirely without green foliage (Ford-Robertson, 1971). This category comprises of tall trees, which are predominantly remain green throughout the year. It includes both coniferous and tropical broadleaved evergreen species. Semi- evergreen is a forest type that includes a combination of evergreen and deciduous species with the former dominating the canopy cover. . In the study area, out of 515 sq kms of total forest area, 122.8 sq kms comes under this category

Moist and Dry deciduous forest

The suitable temperature conditions and moderate rainfall help to have moist deciduous forests. The trees have broad trunks, are tall and have branching trunks and roots to hold them firmly to the ground. Some of the taller trees shed their leaves in the dry season. There is a layer of shorter trees and evergreen shrubs in the undergrowth. These forests are dominated by sal and teak, along with mango, bamboo, and rose wood. Dry decidious forest is characterized by tall trees. They drop their leaves during the dry winter and spring months. In the study area, majority of the North – Eastern parts covers this type forest area. Out of 515 sq kms, 338.7 sq kms covers this category.

Degraded forest

This type of forest is noticed in south eastern and north eastern parts of the study area it covers an area of 48.55 sq kms.

Grass land /Grazing land

These are the areas of natural grass grown along with other vegetation, predominantly grass-like plants (Monocots) and non-grass-like herbs (except Lantana species which are to be classified as scrub).It includes natural/semi-natural grass/ grazing lands of Alpine/Sub-Alpine or temperate or subtropical or tropical zones, desertic areas and manmade grasslands. In the study area it covers only little part 6.1 sq kms (Table.1) and (map.3)

Waste lands

Wastelands are degraded lands that lack their life sustaining potential as a result of inherent or imposed disabilities such as by location, environment, chemical and physical properties of the soil or financial or management constraints (CSIR, 1990). It includes area affected by water logging, ravine, sheet and gully erosion, riverine lands, shifting cultivation, salinity, wind erosion, extreme moisture deficiency etc. Due to complete loss of top soil these degraded lands are ecologically unstable and are unsuitable for cultivation. In the study area, it covers 43.1 sq kms (Table.1) and (Map.3)

Water bodies

Udutorehalla reservoir

There are no perennial rivers flowing in the study area. However, the important seasonal river is Udutorehalla. The

Udutorehalla stream is (a tributary of Cauvery river) the Uduthorehalla dam construction of a storage reservoir across Uduthorehalla, near Ajjipura village in Kollegal taluk. This earthen dam measures about 1.560 kms long and 41.30 mts height with gross storage capacity of 26.19 Million cubic meters and live storage capacity of 22.01 Million cubic meters. Two canals are proposed on either side to irrigate an area of 6,275 hectares.

Gundal reservoir

The Gundal reservoir constructed across the Gundal stream, a major stream flowing in Kollegal taluk and tributary to the river Cauvery with a saddle spillway on the right side along the Sallgeguda hill ranges. The total length of the dam is 1,220 meters and the height of the dam above river bed level is 30 meters which has a gross storage capacity of 23 million cubic meters. The catchment area of the dam site is 93 sq. Kms, with an estimated average yield of 50.9 million cubic meters at the dam site. With an estimated average yield of 50.9 million cubic meters at the dam site. This project was started in 1970 and completed in 1980.

Photo 1 Crop Land near Doddaindavadi (Paddy)

Photo 2 Bannana and coconut Plantation near Budabalu Village

Photo 3 Tank in Hanur MM hills road

Photo 4 Forest near Ramapura of study area

Photo 5 Wasteland Near Cowdahalli

Photo 6 Forest plantation Near Hanur road

RESULTS AND DISCUSSION

LU/LC map is digitized using satellite images that were overlaid on SOI toposheets on 1:50,000 scale. The major land features identified in the study area are Forest (515 Km^2 50%), Agricultural (435.5 Km^2 42.5%) and wastelands (43 km^2 4%) the Permanent features such as National & State Highways, Temples, Tanks, Power lines, Hills and other features in categorization of LU/LC patterns (NRSA, 1995) are digitized.

The present study area Land use/land cover classes are Built-up land (Villages and towns and industries etc.,), forest (evergreen/semi evergreen, moist and dry deciduous, degraded and scrub etc.,), agricultural land (crop land, agricultural plantation and fallow land), wastelands (water logging, revinous land, salt affected land and barren rocky / stony waste etc.,) and water bodies (reservoirs, rivers / streams, lake/tanks and canals etc.,) Built up land (9.9 km^2 0.9%) less than one percent. In the study area

CONCLUSION

Land use land cover features are dynamic in nature and keeps on changing with time and its demand for human society. The accuracy and timely update of land use/land cover classification are be of great significance to global change. Land use and land cover are two ways of observing Earth's surface. Land use refers to man activities like agriculture & various uses. Remote Sensing data and techniques and Geographical Information System (GIS) provide efficient methods for analysis of land use and land cover aspects and tools for Land Use Land Cover planning and modelling. Satellite Remote Sensing data is usually the most accurate and up-to-date. Lu/Lc classes of the study area are noticed in, agricultural land (crop land, fallow land, plantation), built-up land forest (evergreen/semi evergreen, moist/dry deciduous, degraded), Grassland, waste land and water bodies (rivers, stream and reservoirs) the major part of the study area covers the forest land 50%, agricultural land covers around 42.5%, wasteland 4%, built up land less than one percent. In the study area, agricultural activities on dry lands are mainly dependent of rainwater; while irrigated land depend both on groundwater and rain water.

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