Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2021; 10(1): 1556-1561
Received: 18-11-2020
Accepted: 23-12-2020

Rajendra Hegde
ICAR-National Bureau of Soil Survey and Land Use Planning, Regional Centre Hebbal, Bangalore, Karnataka, India

MB Mahendra Kumar
ICAR-National Bureau of Soil Survey and Land Use Planning, Regional Centre Hebbal, Bangalore, Karnataka, India

KV Seema
ICAR-National Bureau of Soil Survey and Land Use Planning, Regional Centre Hebbal, Bangalore, Karnataka, India

KV Niranjana
ICAR-National Bureau of Soil Survey and Land Use Planning, Regional Centre Hebbal, Bangalore, Karnataka, India

BA Dhanorkar
ICAR-National Bureau of Soil Survey and Land Use Planning, Regional Centre Hebbal, Bangalore, Karnataka, India

Corresponding Author:
MB Mahendra Kumar
ICAR-National Bureau of Soil Survey and Land Use Planning, Regional Centre Hebbal, Bangalore, Karnataka, India

Study of land use mapping of Devarahalli microwatershed with geospatial technology

Rajendra Hegde, MB Mahendra Kumar, KV Seema, KV Niranjana and BA Dhanorkar

Abstract
The study was reveals to identify the changes of land use/land cover of the Devarahalli microwatershed of Gundlupet taluk, Chamarajanagar district, Karnataka. The study was undertaken with the use of remote sensing and GIS for delineating and planning. For land use mapping the standard procedure has been used and finally with the help of geospatial technology (ArcGIS10.2.2 software version) the mapping was done. Land classification was done and it was showed that, majority of the area in the microwatershed was covered by agricultural land (89.40%) followed by forest (5.05%), water body (3.06%) and built up (2.44%) land. This classification and the land use map will be beneficial to the policy makers, farmers, NGO's and field agricultural officers for planning and development of this watershed. Also rainwater harvesting techniques can be provided after estimating the runoff potential and accordingly rainwater conservation structures can be planned.

Keywords: Land use/land cover, GIS, agricultural, forest, water body, built up

Introduction
Land is becoming a scarce resource due to immense agricultural and demographic pressure. Hence, information on land use/land cover and possibilities for their optimal use is essential for the selection, planning and implementation of land use schemes to meet the increasing demands for basic human needs and welfare. This information also assists in monitoring the dynamics of land use resulting out of changing demands of increasing population. According to Dimyati *et al*. (1996) [1] land use/cover is two separate terminologies which are often used interchangeably. Land use refers to the way in which land has been used by humans and their habitat, usually with accent on the functional role of land for economic activities (agriculture, urban development, grazing, logging and mining). While land cover refers to the physical characteristics of earth's surface, captured in the distribution of vegetation, water, soil and other physical features of the land, including those created solely by human activities (cropland, forests, wetlands, pasture, roads and settlements). The land use/land cover pattern of a region is an outcome of natural and socio-economic factors and their utilization by man in time and space. Information on land use/land cover and possibilities for their optimal use is essential for the selection, planning and implementation of land use schemes to meet the increasing demands for basic human needs and welfare. This information also assists in monitoring the dynamics of land use resulting out of changing demands of increasing population (Rawat and Manish Kumar, 2015) [9]. Changes in land cover by land use do not necessarily imply degradation of the land. However, many shifting land use patterns driven by a variety of social causes, result in land cover changes that affects biodiversity, water and radiation budgets, trace gas emissions and other processes that come together to affect climate and biosphere (Riebsame *et al*., 1994) [10]. Land use/land cover change detection is very essential for better understanding of landscape dynamic during a known period of time having sustainable management. Land use/cover changes is a widespread and accelerating process, mainly driven by natural phenomena and anthropogenic activities, which in turn drive changes that would impact natural ecosystem (Ruiz Luna and Berlanga Robles, 2003[11]; Turner and Ruscher, 2004) [12]. Understanding landscape patterns, changes and interactions between human activities and natural phenomenon are essential for proper land management and decision improvement. Reliable and timely information on the available natural resources is very much essential to formulate a comprehensive land and water plan for sustainable development. The land, water, minerals and biomass resources are currently under tremendous pressure in the context of highly competing and often conflicting demands of an ever expanding population. Consequently over exploitation and mismanagement of resources are exerting detrimental impact on environment. Now days, rainwater harvesting becomes

imperative to meet the inadequacy of water supply. There are six key factors which must be considered while selecting rainwater harvesting sites *viz*. Climate (rainfall), hydrology (rainfall–run-off relationship and intermittent watercourses), topography (land slope), agronomy (crop characteristics), soil (texture, structure and depth) and socio-economic condition (population density, work force, people's priority, people's experience with rainwater harvesting, land tenure, water laws, accessibility and related costs) (FAO, 2003) [3]. Emerging geospatial technologies such as Remote Sensing (RS) and Geographic Information System (GIS) have been found to be effective tools for delineating rainwater harvesting potential zones and selecting sites for RWH structures and play a vital role in the planning and management of water resources (Jha and Peiffer, 2006) [4]. An analysis of land use and land cover changes is fundamental for the understanding of numerous social, economic and environmental problems and can be carried out rapidly, using either cartographic or census data (Pelorosso *et al*., 2009) [7]. Multi-temporal analysis of land, with the support of Geographic Information System (GIS) and historical document, is a very important tool for monitoring landscape diversity and for investigating changes in vegetation and landscape structure. Among others, land use change influences in particular the local water balance (Fohrer *et al*., 2002) [2]. The impact of land use change on the annual water balance was relatively small due to compensating effects in a complex catchment, and the decrease of forest due to a grassland bonus amplifies the peak flow rate and thus increases the risk of flooding. Analyzing land use changes generally requires an integrated approach that considers multiple disciplines, data sources and methodological constructs (Morgan *et al*., 2014) [6]. Considering these facts, the study has been taken up to create a land use mapping of Devarahalli microwatershed with Geospatial techniques.

Material and Methods

The Devarahalli microwatershed is located in the southern part of south Karnataka in Gundlupet Taluk, Chamarajanagar District, Karnataka State (Fig 1). It lies between 11^0 43'' and 11^0 45'' north latitudes and 76^0 36'' and 76^0 39'' east longitudes and covers an area of 614 ha. It surrounded Honnegaudanahalli village in the northwest, Hangala village in the southeast, Hangala Hosahalli in the northeast and Kallipura village in the southwest side. Major rock formations observed in the microwatershed are granite gneiss. The elevation ranges from 855 to 905 m above MSL. The climate is semiarid and categorized as drought- prone with an average annual rainfall of 734 mm and mean maximum temperature of 30^0C to 42°C. Length of growing period (LGP) ranges from 120 to 150 days. In this study Image processing and visual interpretation techniques are carried out to land use/land cover classification by using digital data and standard false colour composite (FCC) satellite image. The classification is adopted to prepare land use and land cover map. Standard False Color Composite (FCC) for satellite image LISS IV is used for mapping land use land cover. The methodology followed was on-screen digitization using visual image interpretation elements like tone, texture, size, shape, pattern, association using ArcGIS10.2.2 software version. Fig 2 shows the schematic diagram of the methodology followed.

a) Field surveys

Field surveys were conducted within the study areas to determine the major types of land use and land cover. This data is used in two aspects of the mapping of land use and land cover. Firstly it will aid in land use and land cover classification, by associating the ground features of a specific type of land use and land cover with the relevant imaging and spectral characteristics. Secondly, ground data will be used for accuracy assessment of the developed land use and land cover maps before final mapping.

b) Digitization

Digitization is a process of converting information into a digital format. In this format, information is organized into discrete units of data that can be separately addressed (usually in multiple bit groups called bytes) shown in Fig 3 (Land use / Land cover map digitization. The LU/LC map were digitized in ArcGIS 10.2.2 Add the World view imagery and shapefile).

c) Attributes

Geo-processing tools are used to create and build a land use dataset from satellite data. The tool import the land use feature classes into the file Geodatabase and add the appropriate fields to these feature classes. The tools can also processes advanced logistics attribute from data vendors and model them as restrictions and attribute parameters in the land use dataset. Attribute data helps to perform spatial queries and analysis. When information in Geodatabase or database changes, attributes can be updated had shown in Fig 4 & 5 (open the attribute tables-click-option-add field-add the attribute name).

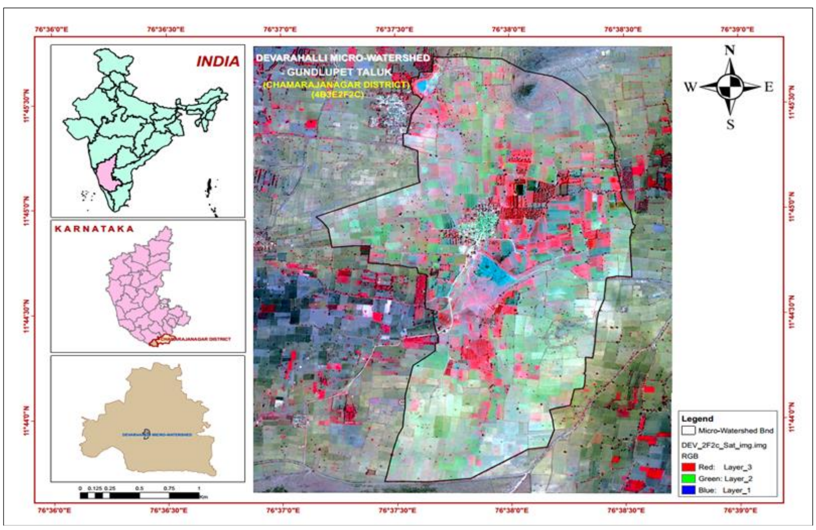

Fig 1: Location map of Devarahalli microwatershed

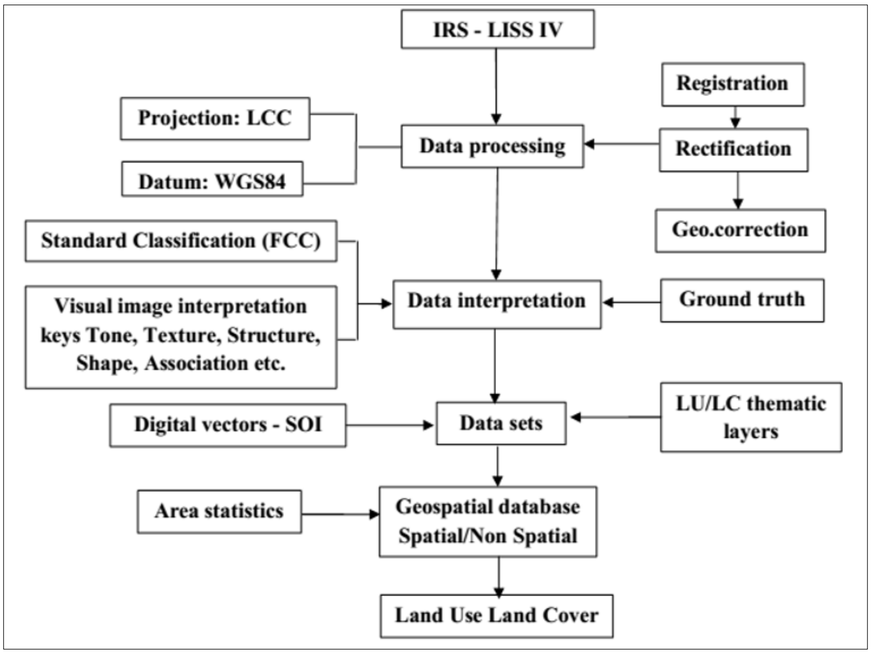

Fig 2: Flow chart of Land Use Land Cover mapping of Devarahalli microwatershed

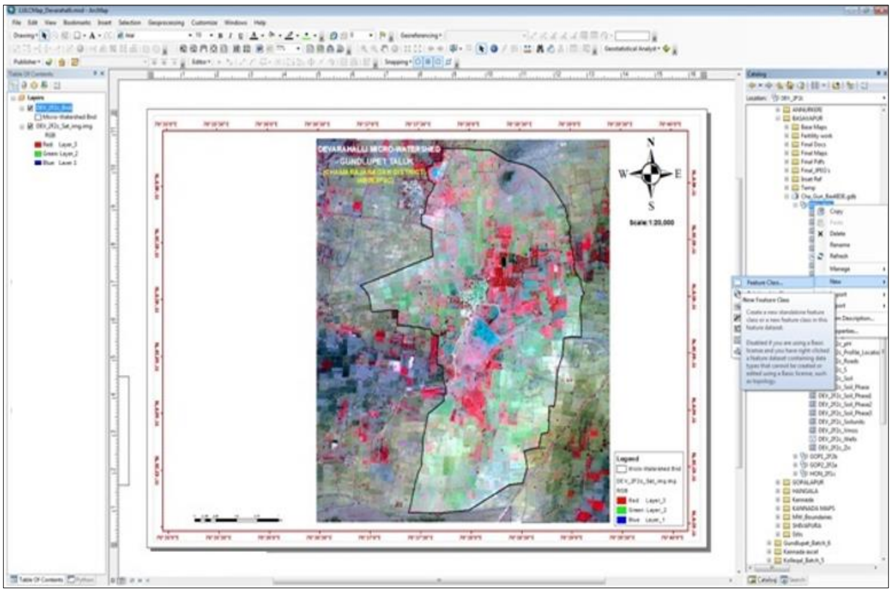

Fig 3: Screen shot of Land use/Land cover map digitization

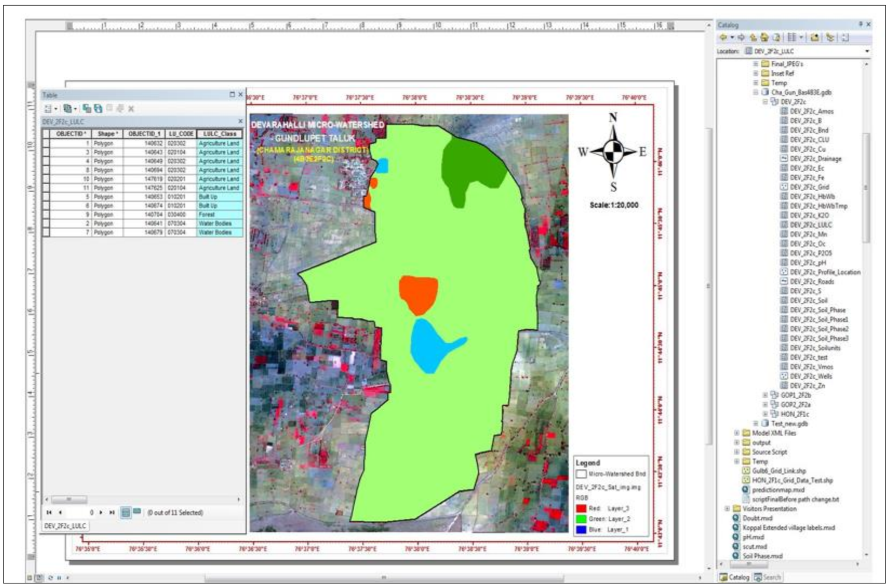

Fig 4: Screenshot of adding the attribute information and add the label feature Devarahalli microwatershed

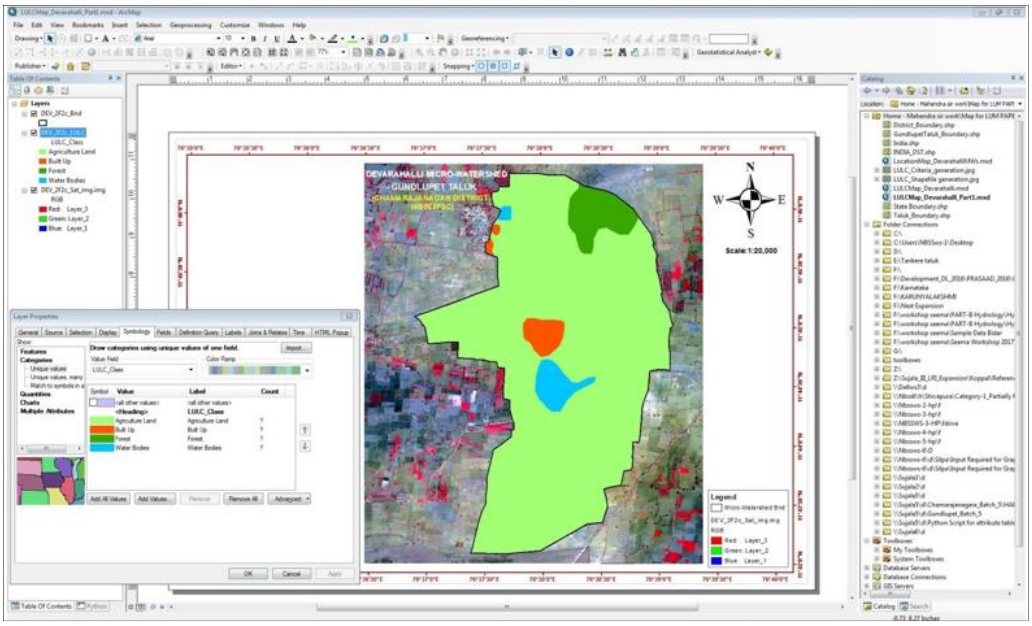

Fig 5: Screenshot of adding symbol and colour to every LULC classes of Devarahalli microwatershed

Results and Discussion

The good comprehensive development and management of the Devarahalli microwatershed is needed to have proper information on land use and land cover and the driving forces that affect the natural resources and also it is used as a primary input data source. IRS LISS-IV data of 1:50000 scales were visually interpreted for delineation of LU/LC categories of the study area. The classification levels of various LU/LC based on visual interpretation, supervised classification in the study area includes agricultural land, built-up land, forest and water bodies have been identified. The final map of land use/ land cover was generated by visual interpretation by using false colour composite satellite image from Landsat IRS-LISS IV and along with field verifications.

The registration and digitization of the watershed was done using ArcGIS10.2.2 software version to create land use coverage. The area and per cent distribution of land use/land cover classes of Devarahalli microwatershed were shown in Table 1. The land use/land cover map of Devarahalli microwatershed area were shown in Fig 6 and 7.

Table 1: Land use and land cover classification

S. No	Land Use/Land Cover classes	Area (ha)	Percentage (%)
1	Agricultural Land	549.52	89.40%
2	Built up	14.98	2.44%
3	Forest	31.06	5.05%
4	Water bodies	18.82	3.06%
	Total	614.38	100

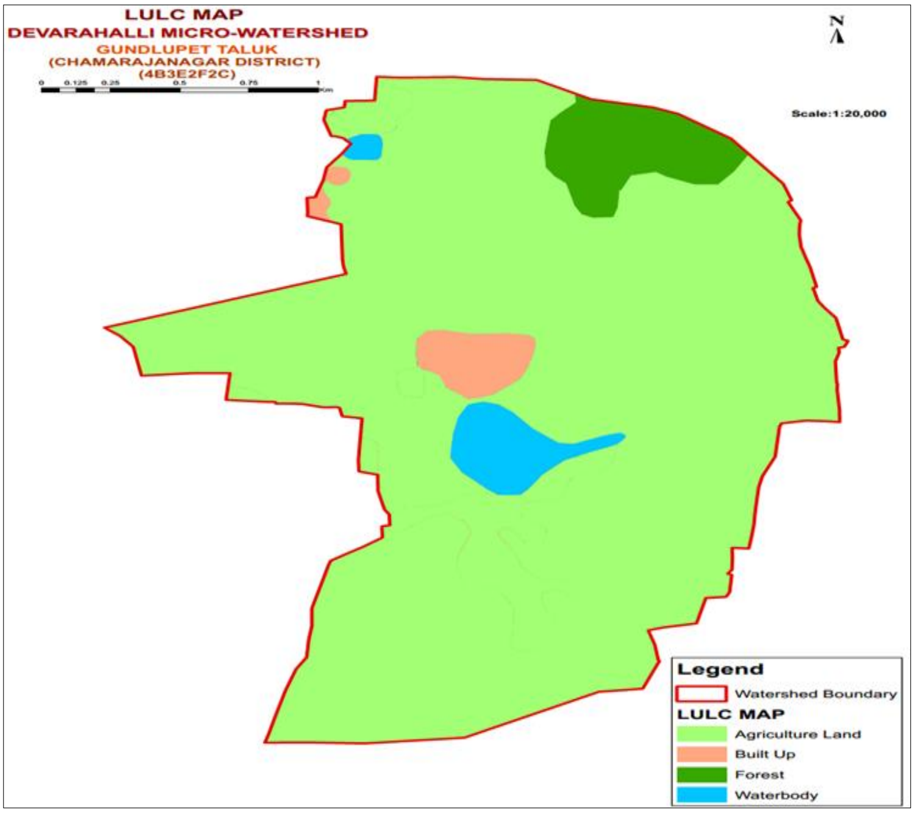

Fig 6: Land use and land cover map of Devarahalli microwatershed

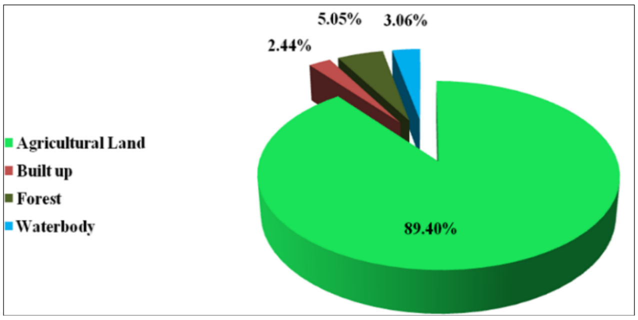

Fig 7: Pie-chart of Land use/Land cover classification of Devarahalli microwatershed

Agricultural Land

Agricultural land is described as land devoted to agriculture, the systematic and controlled use of other forms of life particularly the rearing of livestock and production of crops to produce food for humans. It is thus generally synonymous with farmland or cropland, as well as pasture or rangeland. All ecosystems modified or created by man specifically to grow or raise biological products for human consumption or use. This includes cropland, pasture, orchards, groves, vineyards, nurseries, ornamental horticultural areas, and confined feeding areas. In the study area, agricultural land includes mostly crop lands.

The cropland includes areas used for the production of adapted crops for harvest. The cultivated cropland comprises land in close grown crops and also other cultivated cropland (i.e hay land or pastureland that is in a rotation with close grown crops). The crops can be either kharif or rabi or kharif-rabi seasons. In this study, the cropland occupies an extent of about 549.52 ha (89.40%). Dryland cultivation is the dominant land use category in the study area. Majorly sorghum, redgram, maize, horse gram, cotton and other horticultural (onion, beans, marigold, custard apple, lime, amla, sapota, guava, jackfruit etc.) crops are growing in this watershed. Similar results were also found by Mahender Reddy *et al*. (2017) [5].

Built up

Built up area is a human settlement with a high population density and infrastructure of built environment. Urban areas are created through urbanization and are categorized by urban morphology as cities, towns and suburbs. In urbanism, the term contrasts to rural areas such as villages and hamlets; in urban sociology it contrasts with natural environment. The creation of urban areas during the urban revolution led to the creation of human civilization with modern urban planning, which along with other human activities such as exploitation of natural resources led to a human impact on the environment. Rural built-up lands are the main sub categories identified under this category. The rural area is characterized by built-up areas are smaller in size, mainly associated with agriculture and allied sectors and non-commercial activities. Most of the people are involved in the primary activity of agriculture. In this study the built up area occupies an area of about 14.98 ha (2.44%). This may be due to the gradual conversion of cultivable area into built-up area or human developmental area as the population increased significantly (Praveen Kumar Mallupattu and Jayarama Reddy Sreenivasula Reddy, 2013) [8].

Forest

It is an area of land dominated by different types and species of trees. The, incorporating factors such as tree density, tree height, land use, legal standing and ecological function. According to Food and Agriculture Organization forest as land spanning more than 0.5 ha with trees higher than 5 m and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use. Forests are the dominant terrestrial ecosystem of earth and are distributed around the globe. The largest part of the forest (45 percent) is found in the tropical domain, followed by the boreal, temperate and subtropical domains. The study revealed that, forest area occupies in an area of about 31.06 ha (5.05%) was due to afforestation, conversion of forest lands into urban areas and other development activities (Praveen Kumar Mallupattu and Jayarama Reddy Sreenivasula Reddy, 2013) [8]. Similar findings were noticed by Mahender Reddy *et al*. (2017) [5].

Water bodies

A water body is any significant accumulation of water, generally on a planet's surface. The term most often refers to oceans, seas and lakes, but it includes smaller pools of water such as ponds, wetlands, or more rarely puddles. A body of water does not have to be still or contained; rivers, streams, canals and other geographical features where water moves from one place to another are also considered bodies of water. Most are naturally occurring geographical features, but some are artificial. There are types that can be either most reservoirs are created by engineering dams, but some natural lakes are used as reservoirs. Similarly, most harbors are naturally occurring bays, but some harbors have been created through construction. In this study, the identified water bodies such as small tanks and natural ponds and their distribution in an area of about 18.82 ha (3.06%). The available water body in the microwatershed may helpful to facilitate daily water requirement for the increasing population and it play a vital role in the areas ecology, economy, transportation and general health of the system.

Conclusion

The generated land use map by using geospatial technology represents most of the area in the microwatershed was covered by Agricultural land in an area of about 549.52 ha (89.40%) followed by forest of 31.06 ha (5.05%), water body of 18.82 ha (3.06%) and finally built up of 14.58 ha (2.44%). This study is more important for knowing the land use and land cover area in the microwatershed. This study visibly shows the important effect of population, ecological and its growth activities on land use changes. This study proves that integrated effort of Geospatial technology is very most effective methods for land use mapping with development, planning and management. The important of land use mapping of microwatershed is most useful for environmental management groups, policymakers and for public to better understand the surrounding. Also based on the LULC pattern the runoff generation can be estimated with provision of rainwater harvesting structures.

References

1. Dimyati M, Mizuno K, Kitamura T. An analysis of land use/cover change using the combination of MSS Landsat and land use map: a case study in Yogyakarta, Indonesia. International Journal of Remote Sensing 1996;17:931-944.
2. Fohrer N, Moller D, Steiner N. An Interdisciplinary modelling approach to evaluate the effects of land use

change. Physics and Chemistry of the Earth 2002;27:655-662.
3. Food and Agriculture Organization. Training course on water harvesting land and water digital media series: CD-ROM no 26. Rome: Food and Agriculture Organization of the United Nations (FAO) 2003.
4. Jha M, Peiffer S. Applications of remote sensing and GIS technologies in ground-water hydrology: past, present and future. Bayreuth: Bay CEER; 3201 pp. Water Resource Management 2006;21(2):427-467.
5. Mahender Reddy D, Patode RS, Nagdeve MB, Satpute GU, Pande CB. Land use mapping of the Warkhed microwatershed with geo-spatial technology. Contemporary Research in India 2017;7(3):403-409.
6. Morgan Mutoko C, Chris A, Shisanya Lars Hein. Fostering technological transition to sustainable land management through stakeholder collaboration in the western highlands of Kenya. Land Use Policy 2014;41:110-120.
7. Pelorosso R, Leone A, Boccia L. Land cover and land use change in the Italian central Apennines: A comparison of assessment methods. Applied Geography 2009;29:35-48.
8. Praveen Kumar Mallupattu, Jayarama Reddy, Sreenivasula Reddy. Analysis of land use/land cover changes using remote sensing data and GIS at an urban area, Tirupati, India. The scientific world Journal 2013, 1-6.
9. Rawat JS, Manish Kumar. Monitoring land use/cover change using remote sensing and GIS techniques: A case study of Hawalbagh block, district Almora, Uttarkhand, India. The Egyptian Journal of Remote sensing and space sciences 2015;18:77-84.
10. Riebsame WE, Meyer WB, Turner BL. Modeling land use and cover as part of global environmental change. Climate Change 1994;28:45-64.
11. Ruiz Luna A, Berlanga Robles CA. Land use, land cover changes and costal lagoon surface reduction associated with urban growth in northwest Mexico. Land Ecology 2003;18:159-171.
12. Turner MG, Ruscher CL. Change in landscape patterns in Georgia, USA. Land Ecology 2004;1(4):251-421.