RS and GIS based Assessment of Land Utilization Pattern in Pochampalli Taluk, Tamil Nadu

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Abstract— Assessment of land utilization pattern is fundamental for managing and protection of natural resources of a region and the information on the existing landuse is one of the key pre-requisites for suggesting optimum use of a terrain. The use of Remote Sensing (RS) and Geographic Information System (GIS) can be helpful for quick and efficient landuse mappingthat provides the essential data necessary to undertake the inventory of a land. The present paper focuses on the assessment of land utilization pattern in the Pochampalli taluk of Krishnagiri district, Tamil Nadu. The study area geographically lies between 78o 13' & 78o 29' E longitudes and 12o 15' & 12o 28' N latitudes. The areal extent of the study area is about 1153 sq km.IRS LISS image acquired during the year 2015 was subjected to supervised clustering analysis and resulted output was validated with field inputs. Further, secondary data was used for change detection analysis. The results show that there has been a drastic decline in forest cover and increase in agricultural and horticultural land in the study area. The study clearly indicates that the major livelihood generationis through cropping.

Key words: Remote Sensing, GIS, Supervised Classification, Landuse/landcover, Sustainable Land Utilization

I. INTRODUCTION

Studies have shown that there remain only few landscapes on the Earth that is still in theirnatural state. Due to anthropogenic activities, the Earth surface is being significantly altered insome manner and man's presence on the Earth and his use of land has had a profound effectupon the natural environment thus resulting into an observable pattern in the landuse/landcover over time.

The terms landuse and landcover are not technically synonymous. There are different definitions of and landuseandlandcoveramong researchers. Although the terms landuse and landcover are often used interchangeably, their actual meanings are quite distinct. Landuse refers to human activities that take place on the earth's surface. Landcover refers to the natural physical properties of a land surface. Land is becoming a scarce resource due to immense agricultural and demographic pressure. Landuse/landcover change research is critical to improve our understanding of human interaction with the environment and provide a scientific foundation for sustainability, vulnerability and resilience of land systems and their use.

Landuse involves the management and modificationof natural environment into built environment such as fields, pastures, and settlements. It has also been defined as "the arrangements, activities and inputs people undertake in a certain land cover type to produce, change or maintain it". Land use practices vary considerably across the world. Landuse and Landcover mapping is of great significance in scientific, research, planning and management. Regional land use pattern reflects the character of interaction between man and environment and influence to the mankind's basic economic activities. Due to Advancement in satellite sensors, their analysis techniques are making Remote Sensing (RS) systems fruitful, realistic and attractive for use in research and management of natural resources. Landuse map is a valuable tool for agricultural and natural resources studies.

Remotely sensed satellite images provide a synoptic overview of the terrain or earth in a very short time span. This leads to quick and truthful representation of the real world in the best possible way. Remote Sensing provides land resource data in the digital form &in different bands of the electromagnetic spectrum. Availability data in different bands makes it very useful & easy way for delineation of landuse/ landcover classes.

RS and GIS based landuse/landcover mapping has been carried out by many researchers (Mas, 1999; Berlanga and Ruiz 2002; Martinuzzi et al. 2007; Mundia and Murayama2009; Uma and Mahalingam 2011; Kotoky et al., 2012; Pukhan et al. 2013). The main objective of the present study is generate the feature clusters for various landuse/lancover categories through supervised classification of IRS LISS IV image and to quantify the landuse pattern in the Ponchampallitaluk of Tamil Nadu.

II. STUDY AREA

Pochampallitaluk is the eastern taluk of Krishnagiri district in Tamil Nadu. It geographically lies between 78o 13' & 78o 29' E longitudes and 12o 15' & 12o 28' N latitudes. The areal extent of the study area is about 1153 sq km. The study area map is shown in Fig. 1.

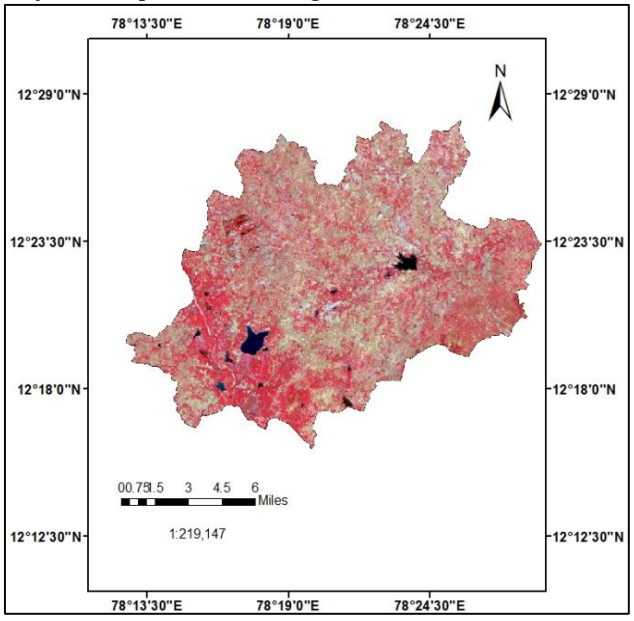

Fig. 1: Study Area Map

The area receives the rain under the influence of both southwest and northeast monsoons. The normal annual rainfall over the district varies from about 750 to about 900 mm. The climate is comparatively more pleasant due to general dryness of atmosphere and appreciable drop in temperature in the monsoon season. The year may be divided into four seasons namely dry season from January to March, summer season April and May, southwest monsoon season from June to Sept. and northeast monsoon season from October to December. During summer season (April to May) the maximum temperature is about 37°C, and the mean daily minimum temperature of about 25°C in the plains. There is a gradual decrease of both day and night temperatures from June onwards till December, when the mean daily maximum temperature is about 30°C and the mean daily min. is about 19°C in plains. The prominent geomorphic units identified in the study area are structural hills and denudational land forms like buried pediments in the plains and inselbergs and plateaus represented by conical hills aligned with major lineaments.Soils have been classified into Black soil, mixed soil, red loamy soil, gravelly and sandy soils. Vast stretches of loam soils and black soils occur in the study area.

Lithologically the study area is underlained by Archaean crystalline formations with Recent alluvial deposits of limited areal extent and thickness along the courses of major rivers (Plate-II). The occurrence and movement of ground water are controlled by various factors such as physiography, climate, geology and structural features. Weathered and fractured crystalline rocks constitute the important aquifer systems in the district. Ground water generally occurs under phreatic conditions in the weathered mantle and under semi-confined conditions in the fractured zones at deeper levels. The thickness of weathered zones in the district ranges from less than a meter to more than 15 m.

III. METHODOLOGY

The methodology essentially includes preparation of a base map using Survey of India Topographical (SOI) Map on 1:50,000 scale,georeferencing of the IRS LISS IV satellite image (acquired in February, 2015), co-registering the image with the SOI Topographical Map using UTM Projection and WGS 84 datum, supervised classification and clustering of landuse/landcovertypes, quantification of features in GIS domain and subsequent delineation of land utilization pattern and finally the ground truth verification of the resulted product.The schematic methodology adopted in the study is shown in Fig. 2.The secondary on landuse/landcover collected for the periods 2005 and 2015 from the Krishnagi District Statistical Office were also used in the study point out major changes occurred in the recent past..

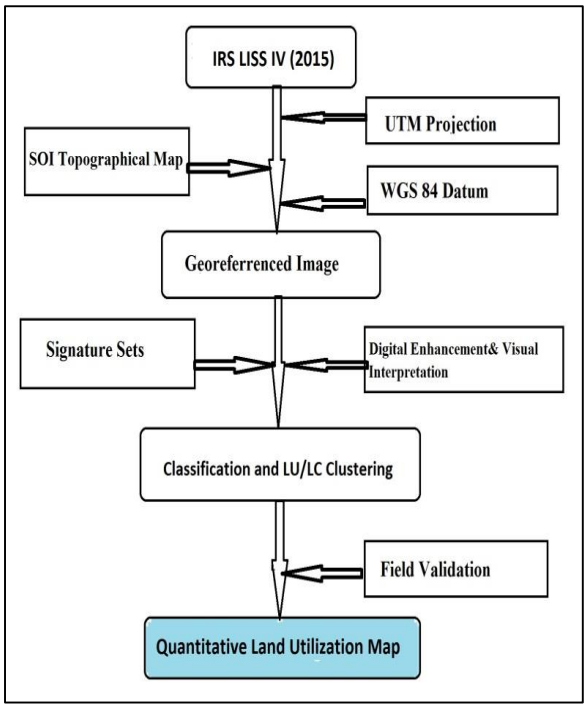

Fig. 2: Methodology Flow Chart

IV. RESULTS AND DISCUSSION

The Pochampalli taluk totally covers an area of about1153 sq km. The results show that 15.7% of the total area is under forest vegetation in which the degraded forest constitutes more than 50%. Forests are mainly distributed in south-west and eastern parts of the study area. Agricultural and horticultural land comprises of 34.7% of the total area. Crop lands and currents fallows are spread almost equally throughout the taluk. Appreciable numbers of tanks are observed in the study area except for the northern parts. Nine percent of the study area is covered by built-up land whereas habitat with vegetation category occupies 8.6%. Some portions of the study area are well dissected and the gullied land occupies 9.5% of the total area. Wasteland is 10.3% which includes both barren/rocky waste and sandy waste. The scrub land is 5.1%. The landuse/landcover map of the study area is given Fig. 3. The area under each and percentage distribution are presented in Table 1 and Fig. 4.

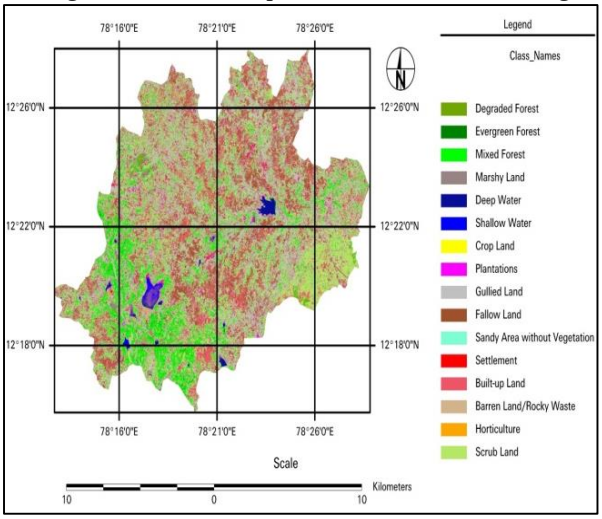

Fig. 3: Landuse/landcover Map of the Study Area

LU/LC Category	Area in sq km	Area in Percentage
Degraded Forest	94.18	8.2
Evergreen Forest	37.5	3.3
Mixed Forest	48	4.2
Marshy Land	16.53	1.4
Deep Water	40.45	3.5
Shallow Water	13.35	1.2
Crop Land	123.2	10.7
Plantations	57.33	5.0
Gullied Land	109.77	9.5
Fallow Land	120.45	10.4
Sandy Area without Vegetation	21.85	1.9
Habitat with Vegetation	98.87	8.6
Built-up Land	103.23	9.0
Barren Land/Rocky Waste	108.31	9.4
Horticulture	101.58	8.8
Scrub Land	58.77	5.1
TOTAL	1153.37	100.0

Table 1: Landuse/landcover Details

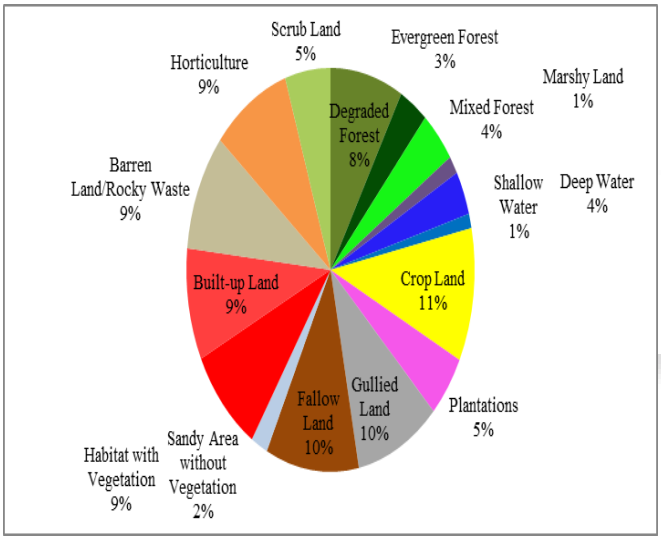

Fig. 4: Percentage Distribution of each Landuse/landcover Category

Comparison of the secondary data collected on the landuse/landcover for the years 2005 and 2015 clearly indicates that there is a drastic decrease in forest cover over the period of 10 years(Fig. 5). The decrease is significant in Kondireddipatti, Pannandur, Kottaipatti and Peddappampati villages. The reduction of the forest is mainly due to their conversion into agricultural and non-agricultural purposes. On the other hand, area under agriculture and horticulture is significantly increased (Fig. 6). This could be due to stable rainfall, implementation of artificial water harvesting practice and installation of bore wells and dug wells in the study area. However, in the villages like Marappanayakanpatti, Rengampatti and Kondireddipatti, cultivable wastelands are prominent due to water scarcity in these regions.

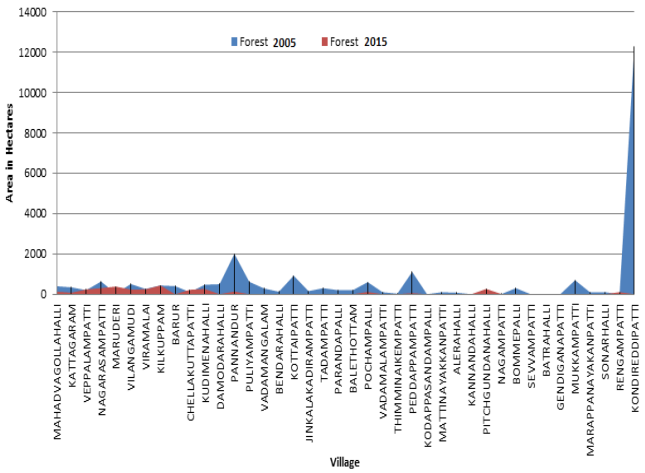

Fig. 5: Comparison between the Forest Cover in 2005 and 2015

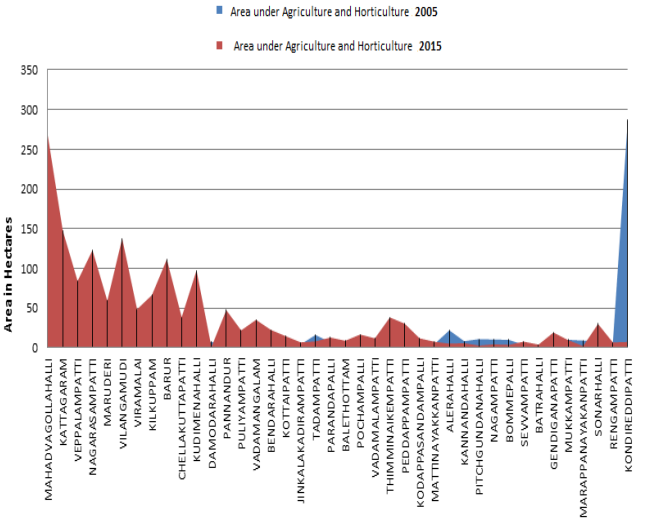

Fig. 6: Comparison between the Agricultural & Horticultural Land in 2005 and 2015

Plate 1: A Horticultural Crop in the Study Area

V. CONCLUSION

The study concludes that the main livelihood options in PochampalliTaluk of Krishnagiri district are agriculture and horticulture. There was a drastic decline in forest cover and increase in agriculturaland horticultural landin the recent past as evidenced in the study. Presently about 35% of the total area is under agriculture and horticulture. Increased bore wells and dug wells and practicing of rainwater harvesting have increased the availability of water for

cropping. The study also highlights the significance of Remote Sensing& GIS as efficient and economical means of landuse mapping for quick and reliable assessment.

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