

## **A GEOGRAPHICAL STUDY OF LANDUSE PATTERN IN PUDUKKOTTAI DISTRICT USING SPATIAL INFORMATION TECHNOLOGY**

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### **Abstract**

The study of land use distribution with multispectral imageries which give information about the land use development within study area. To analyses the land use / land cover. Remote sensing technology reduces cost and time to a great extent with better accuracy to that of conventional surveying. Land degradation is a central challenge to sustainable development. The latter has been defined as development that “meets the needs of the present without promising the ability of future generations to meet their own needs”. Land use planning helps to create and maintain vital communities with close-knit neighborhoods, a sustainable economy, protected natural systems, and an efficient public infrastructure. Balancing transportation and other land use needs through coordinated planning efforts help communities realize their visions.

**Key words:** land use, Land degradation, biodiversity, Natural vegetations.

## Introduction

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

Land use and land cover change has become a central component in current strategies for managing natural resources and monitoring environmental changes. The advancement in the concept of vegetation mapping has greatly increased research on land use land cover change thus providing an accurate evaluation of the spread and health of the world's forest, grassland, and agricultural resources has become an important priority.

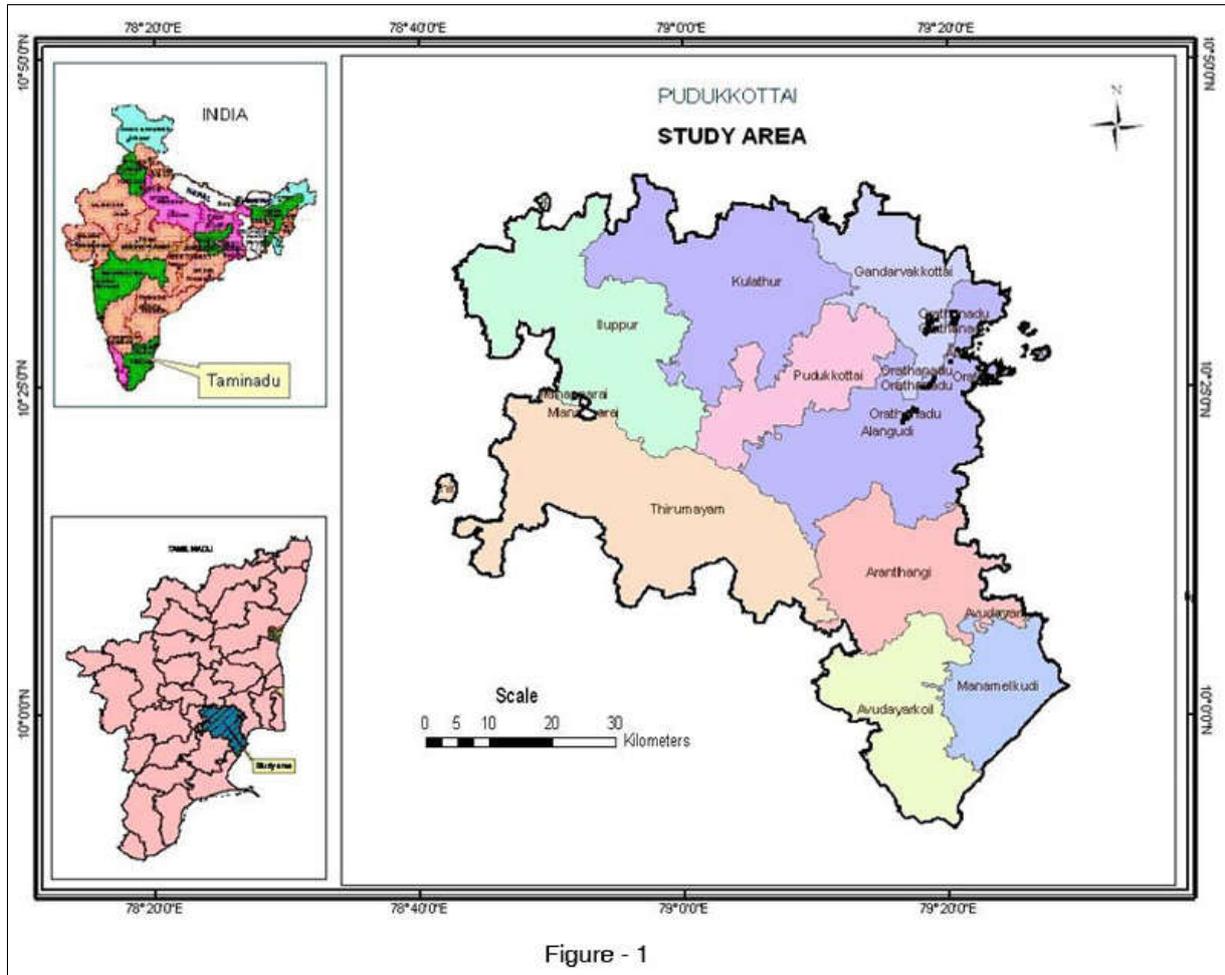
Remote Sensing (RS) and Geographic Information System (GIS) are now providing new tools for advanced ecosystem management. The collection of remotely sensed data facilitates the synoptic analyses of Earth - system function, patterning, and change at local, regional and global scales over time; such data also provide an

important link between intensive, localized ecological research and regional, national and international conservation and management of biological diversity (Wilkie and Finn, 1996) .

Land use affects land cover and changes in land cover affect land use. A change in either however is not necessarily the product of the other. 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, Meyer, and Turner, 1994).

### **Study Area and Location**

Pudukkottai district is one of the smallest districts in Tamil Nadu with an area of 4663 Sq. kms. and a total population of 1327148 persons living in 767 villages and eight towns as on 2001. The district lies between latitudes 9.50'30" N and 10.44' and longitudes 78.25-5"E and 79.16'13. It has borders with Thiruchirrapalli in the north, Thanjavur in the north-east and with Sivaganga and Ramanathapuram Districts in the south. The district is divided at present into seven taluks, viz., Kulathur, Thirumayam, Alangudi, Arantangi, Pudukkottai, Gandarvakottai and Avudaiyarkoil. (Figure -1)



The Pudukkottai municipality maintains 122.84 km (76.33 mi) of roads. The city has 4.16 km (2.58 mi) concrete roads, 9.78 km (6.08 mi) WBM roads, 6 km (3.7 mi) gravel roads, 2.5 km (1.6 mi) foot paths and 100.4 km (62.4 mi) bituminous road. A total of 19.908 km (12.370 mi) of state highways is maintained by the State Highways Department and national highways by the National Highways Department.

### Problems in Land Use/Land Cover

The problem in analyzing the land use/Land cover is to Procedures for identifying land use from various types of remote sensor imagery, Classification and categorization and Mapping land use traits. Land degradation is a central challenge

to sustainable development. The latter has been defined as development that “meets the needs of the present without compromising the ability of future generations to meet their own needs” This was accepted as a common goal at the UN Conference on Environment and Development (UNCED) in 1991.

At the global scale, key problems threatening natural resources and the sustainability of life support systems are (1) soil degradation, (2) the availability of water and (3) the loss of biodiversity. These occur in virtually all socio – cultural and economic context Worldwide. However, there are great differences in the abilities of countries to cope with the problem of land degradation. Problems of land degradation exist in many parts of the world. The following natural resources may be affected. (!) Soils: about one third of the world’s agricultural land has been damaged, mostly by soil loss caused by water erosion. (2) Water: problems of quality and quantity, as well as spatial and temporal interdependence (highland-lowland effect). (3) Natural vegetations: Problem of quality, quantity and biodiversity. (4) Wildlife: Problems of protected areas, wildlife corridors, controlled hunting and poaching.

### **Objectives**

The main objective is to demarcate and to classify the land use pattern, and defining the Visual interpretation techniques and defining the methodology.

- **To prepare the general land use map for Pudukottai District.**
- **To evaluate the land use/land cover resources in Pudukottai District.**

### **Methodology and Analysis for the Study**

As mentioned in the aim using the visual image interpretation technique in GIS environment does the interpretation of land use/land cover analysis. This paper elaborately explains the methodology for the study.

### Data Product used

The different data source, materials, instruments and software's are used for Land use/Land cover analysis. The multi spectral data of IRS P6 imagery is used. Satellite Digital data acquired by IRS P6 acquired on April, 2015 has used as primary data for this study. The earth-observing instrument onboard this spacecraft is Enhanced IRS P6 Image with Four bands such as visible, near-IR, spectral regions at a spatial resolution of 23.5m.

### Landuse/Landcover Classification

The term land use refers to 'how the land is being used by human beings. Land cover defined as the biophysical materials found on the land. The best way to insure land utility information derived from remote sensor data is useful in many applications to organize it according to a standard land use/ land cover classification system especially "Modified USGS land use/ land cover classification system", proposed by Geological Survey Department, USA. The knowledge of land use and land cover is important for many planning and management activities concerned with the surface of the earth.

**Table -1 Land use Classification scheme for the present study**

LEVEL - I	LEVEL – II	LEVEL – II I
1. Built up	1.1 Built up land	
	Transport 1.2 Roadways	1.2.1 Major roads 1.2.2 Other Roads
2. Water bodies	2.1 River 2.2 Tank 2.3 Canal	2.2.1 Tank with water 2.2.2 Tank bed vegetation 2.2.3 Dry tank bed
3.Agricultural land	3.1 Crop land 3.2 Fallow land 3.3 Plantation	
4.Natural Vegetation	4.1 Open Scrub	
5.Waste land	5.1 Relief 5.2 Structural Hill	

### **GIS Technology in Map Making**

In this map making GIS technology has vital role like importing, geometric correction, registration, new vector layer creation, digitization, attribute id creation area estimation and querying etc. The process of conversion of analog data like toposheets, administrative maps and village boundary maps into digital data using computer is known as scanning. This helps to convert coordinate data into raster format in GIS analysis. It is the primary step among the all processes, and they are Geometric correction and radiometric correction. The process of converting a new image into specified map projection. The procedure involves the selection of distinguishable Ground Control Points (GCPs) in an image such as road intersections, river and stream intersection, etc., these points are assigned with the appropriate reference information such as latitude/longitude or UTM co-ordinates. According to the selected study the number of vector layers were created to demarcate all spatial resources present in the study area with its area of extent and distribution. Vector layer creation is based on three features they are: Point, Line and Polygon from the rectified toposheets and image. Vector layers like point, line, polygon features represent to the real world environment are created by digitizing process. This helps to convert raster layer into vector layer. To create various thematic maps for focusing study area information, spatial resources expressed with its corresponding attribute and its id for making queries each vector layers created with its spatial and non spatial attributes.

The uniqueness of GIS software is able to calculate the area of extent in a particular feature present on the image. The interpreted land use / land cover features area can be estimated using Arc GIS 9.0 software. In Arc view GIS, the area of particular features whole land use can estimate by using the scripts. Every land use and land cover and its area of extent are estimated.

### **LANDUSE/LAND COVER ANALYSIS:**

Land use analysis is classified based on the Visual Image Interpretation techniques, and USGS land use classification method. Land use / Land cover include both natural and cultural features. These are delineated by modified USGS

classification system. A multi level system as being designed to untainted different degrees of information on resources up to level III for each land parcels from IRS P6 imagery. The level I and II classifications are specifically interest to express resource information on national wide and state wide basics. It is indented that level III and IV are focused more details for local or village wide basis (Figure 2).

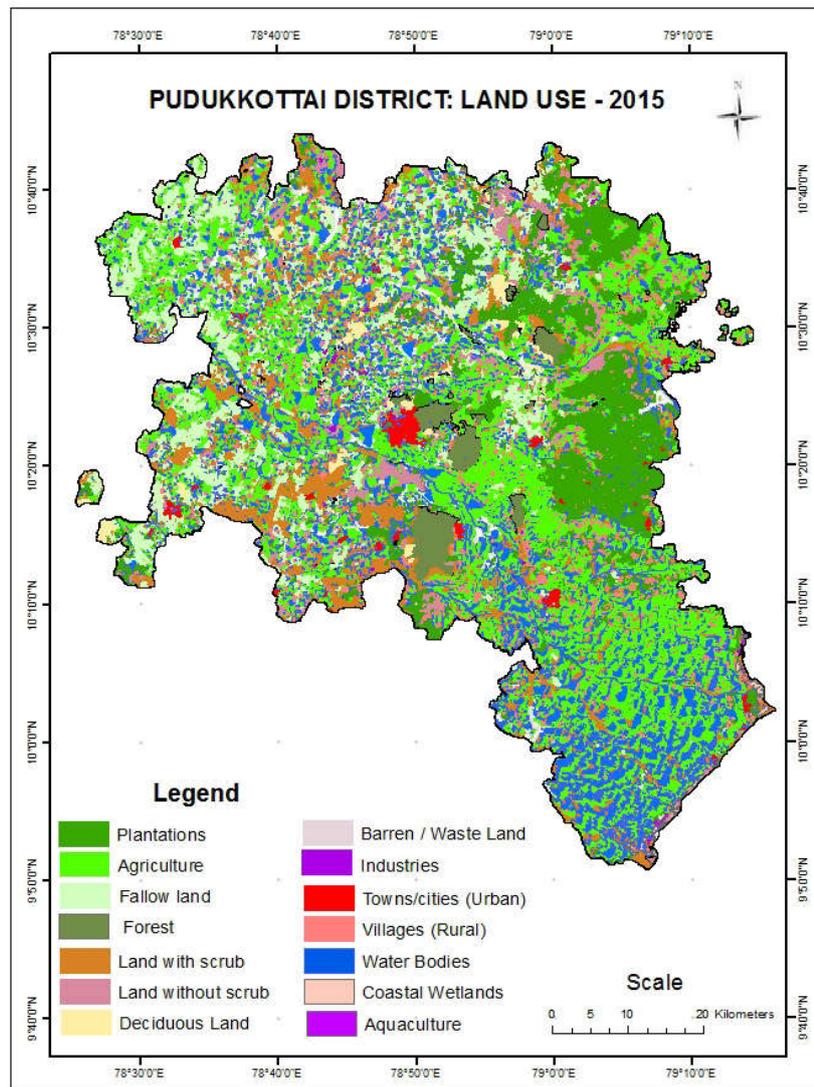


Figure -2

**Table-2 Detailed accounts of these Land Use / Land Cover classes**

Landuse	Area In Percentage
Plantations	7.42
Agriculture	23.58
Fellow Land	8.68
Forest	16.1
Land with scrub	6.11
Land without scrub	1.58
Deciduous land	7.38
Barren/Waste land	0.41
Industries	0.75
Town/cities (Urban)	4.95
Villages (Rural)	6.15
Water Bodies	15.23
Coastal wetlands	1.34
Aquaculture	0.32

The study has shown the major land use/land cover types in figure 2. The land use categories were built-up lands, agricultural lands, forests, waste lands and water bodies. The agricultural land has predominant in the present study; the agriculture land is well distributed throughout the District. Agriculture is the main occupation of the people. The agriculture land includes crop land 23.58%, Plantation 7.42%, Fallow land 8.68% and The forests occupy about 16.1 % of the total land use land cover of the District. The forest categories include deciduous forest, evergreen forest and degraded. There forest is indentified to the hill slopes of the blocks of Ponamaravathy, Thiruvankulam. Land with scrub 6.11% and land without scrub covers 1.58% in the district.

The Barren /waste land has occupied around 0.41 % of the total land use and land cover of the District. The waste land includes scrub land and other waste lands. Industries 0.75% and the water body category include rivers, streams, tanks and reservoirs. River Agniyar, River Vellar River Pambar, and River Kovalar are the major non perennial rivers flowing here. The tanks were found well distributed throughout the District. It covers 15.23% and Aquaculture 0.32% of the district. The town/cities

occupies 4.95 and villages (Rural) land use 6.15 % of the total land use/land cover in Pudukkottai District.

## Conclusion

Land degradation is a central challenge to sustainable development. The latter has been defined as development that “meets the needs of the present without compromising the ability of future generations to meet their own needs” Natural resources can potentially be used in a sustainable way if appropriate land management technology, regional planning and the policy framework complement one another in a purposeful way, in accordance with the principles and concepts of sustainable land management (SLM). At the center of this thinking are the concept of “ecosystem balance”, and especially the questions of irreversibility of ecologic (and socio-economic) processes, resilience of ecosystems, and the spatial and temporal scales to be considered at the landscape level. It is here that the relevance of geo-information to SLM can be seen. Sustainable land management has been defined as “a system of technologies and/or planning that aims to integrate ecological with socio-economic and political principles in the management of land for agricultural and other purposes to achieve intra- and intergenerational equity”

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