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Landuse pattern in Perambalur district using spatial information technology

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ABSTRACT

land use/land cover is required to central all scientific studies that aims to understand the terrestrial dynamics and is required to local to global scale to aid planning while safe guarding the environmental concerns. It is well known that land use/land cover have great impact on the economic and social development of the region. Remote sensing is an effective and economic means o collect the data and to monitor the changes occurring in land use categories. Knowledge of the present distribution and area of such agricultural, recreational, and urban lands, as well as information on their changing proportions, is needed by legislators, planners, and State and local governmental officials to determine better land use policy, to project transportation and utility demand, to identify future development pressure points and areas, and to implement effective plans for regional development. The aim of this study is to analyze the Land use Land cover for Perambalur District using the remote sensing, to evaluate the agricultural resource using GIS and GPS technology.

Key words: Land use, landforms, biosphere, biodiversity, land degradation.

INTRODUCTION

Land cover refers to the natural vegetative cover types that characterize a particular area. These are generally a reflection of the local climate and landforms, though they too can be altered by human actions. The change in the biosphere and bio-geochemical cycles are driven by the heterogeneous changes in land use. Information on the existing land use/ land cover, its spatial distribution and changes are essential pre-requisite for planning. Thus land use planning and land management strategies hold key for development of any region. The study of land use is necessary for proper utilization of land resources of a region.

Although the terms “land cover (LC)” and “land use (LU)” are sometimes used interchangeably, they are actually different. Simply put, land cover is what covers the surface of the earth and land use describes how the land is used. Examples of land cover classes include: water, snow, grassland, deciduous forest, and bare soil. Land use examples include: wildlife management area, agricultural land, urban, recreation area etc. Two land parcels may have similar land cover, but different land use. For instance, A golf course and an office building are both commercial land uses. The former would have a land cover of grass, while the latter would be considered to the type of feature present on the earth surface. The land cover types are Relief, Water Bodies etc..,

Land use is generally refers to the human activity associated with a specific piece of land. The land use types are agriculture land, settlements, plantation etc.., and the term landuse is used to indicate the particular purpose for which piece of land is utilized. The landuse pattern of a region is by and large determined by the nature and general layout of physical as well as cultural elements. Primarily the physical factors like climate, topography and soils set the broad limits upon the capabilities of the land. Subsequently the human factors like length of occupation of

the area, density of population, social and economic factors and technological levels of the people, determine to an appreciable degree the extent to which the physical capabilities of the land are utilized (Dubey and Negi,1968). A study of land use therefore is of prime concern for a geographer. A number of attempts have been made to classify land use. In India a nine-fold classification is adopted. Among the different types of land use, agricultural use is the most significant.

There is no one ideal classification of land use and land cover, and it is unlikely that one could ever be developed. There are different perspectives in the classification process, and the process itself tends to be subjective, even when an objective numerical approach is used. There is, in fact, no logical reason to expect that one detailed inventory should be adequate for more than a short time, since land use and land cover patterns change in keeping with demands for natural resources. Each classification is made to suit the needs of the user. In order to address the issues associated with classification like class definitions, multiple land uses on a single land parcel, minimum representable area and to standardize the LULC information that could be generated using remote sensing data. Anderson (1971) developed some criteria for classification systems.

• The minimum level of interpretation accuracy in the identification of land use and land cover categories from remote sensor data should be at least 85 percent
• The accuracy of interpretation for the several categories should be about equal
• Repeatable or repetitive results should be obtainable from one interpreter to another and from one time of sensing to another
• The classification system should be applicable over extensive areas
• The categorization should permit vegetation and other types of land cover to be used as surrogates for activity
• The classification system should be suitable for use with remote sensor data obtained at different times of the year
• Effective use of subcategories that can be obtained from ground surveys or from the use of larger scale or enhanced remote sensor data should be possible
• Aggregation of categories must be possible
• Comparison with future land use data should be possible
• Multiple uses of land should be recognized when possible

Accordingly, he proposed a multilevel land use and land cover classification system, wherein LULC information at Levels I and II would generally be of interest to users who desire data on a nationwide, interstate, or statewide basis. More detailed land use and land cover data such as those categorized at Levels III and IV usually will be used more frequently by those who need and generate local information at the intrastate, regional or municipal level. It was intended that these latter levels of categorization would be developed by the user groups themselves, so that their specific needs might be satisfied by the categories they introduced into the structure. The system satisfied the three major attributes of the classification process (1) it gave names to categories by simply using accepted terminology; (2) it was amenable to further refinement on the basis of more extended and varied use and (3) it allowed inductive generalizations to be made. At the more generalized levels it met the principal objective of providing a land use and land cover classification system for use in land use planning and management activities.

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]

Land cover can be altered by forces other than anthropogenic. Natural events such as weather, flooding, fire, climate fluctuations, and ecosystem dynamics may also initiate modifications upon land cover. Globally, land cover today is altered principally by direct human use: by agriculture and livestock raising, forest harvesting and management and urban and suburban construction and development. There are also incidental impacts on land cover from other human activities such as forest and lakes damaged by acid rain from fossil fuel combustion and crops near cities damaged by troposphere ozone resulting from automobile exhaust [Meyer, 1995]

A remote sensing device records response which is based on many characteristics of the land surface, including natural and artificial cover. An interpreter uses the element of tone, texture, pattern, shape, size, shadow, site and association to derive information about land cover.Digital change detection is the process of determining and/or

describing changes in land-cover and land-use properties based on co-registered multi temporal remote sensing data. The basic premise in using remote sensing data for change detection is that the process can identify change between two (or more) dates that is uncharacteristic of normal variation. To be effective, change detection approaches must maximize inter-date variance in both spectral and spatial domains (i.e. using vegetation indices and texture variables). Numerous researchers have addressed the problem of accurately monitoring land-cover and land-use change in a wide variety of environments with a high degree of success (Muchoney and Haack, 1994; Singh, 1989; Chan et al., 2001).

Remote sensing is a science and art of obtaining Information about an object, area or phenomenon through an analysis of the data acquired by a device which is not in contact with the object, area or phenomenon under investigation. Remote sensing is an information gathering tools. Remotely Sensed data are used for various studies and development, repetitive scanning of an area at affixed interval of time through satellite based sensor as provided invaluable information for updating the natural resources. The land use/land cover can be identified in the remotely sensed image using visual interpretation techniques. The visual interpretation techniques such as tone, texture, color, pattern, size shape and association.

The USGS has derived the Land use/land Cover system for use with remote sensing data for built up, agricultural land, waste land, forest land water wet land barren land ,water bodies etc., The land use classification has totally seven stages.

The GIS technology provides as to analysis the spatial and non spatial data. The GIS technology maximize the planning and decision making, provides efficient means of data distribution and handling, the GIS is help to integrate the information from many source.

- Improves mapping, improves accuracy, more effective thematic mapping and reduces storage cost.
- Greater efficiency in information retrieval.
- Faster and more extensive access to the types of geographical information.
- Improved analysis.

Study Area Descriptions

Composite Perambalur District came in to existence after trifurcation of Tiruchirappalli district with effect from 30.09.1995 as per G.O MS. No 913 Revenue / Y3 dated 30.09.1995. In the Government Orders G.O (Ms)No. 656, Revenue, Dated. 29.12.2000 and G.O (Ms)No. 657, Revenue, Dated. 29.12.2000, the Government ordered Perambalur District to be bifurcated into two Districts, Perambalur District with headquarters at Perambalur and Ariyalur District with headquarters at Ariyalur. Subsequently, in the Government orders G.O (Ms)No. 167, Revenue, Dated. 19.4.2002, and G.O (Ms)No. 168, Revenue, Dated. 19.4.2002 , Government ordered that the above two districts be merged into one as Perambalur District with headquarters at Perambalur.

In the Government Order G.O (Ms) NO. 683 Dated. 19.11.2007 Government passed orders that Perambalur District be reorganised and bifurcated again into two districts Perambalur and Ariyalur, out of which Perambalur district with Headquarters at Perambalur consists of one Revenue Division of Perambalur and three Taluks of Perambalur, Kunnam and Veppanthattai. It is bounded on the North by Cuddalore and Salem Districts, South by Tiruchirappalli, East by Ariyalur District, West by Tiruchirappalli and Salem Districts. Perambalur District is centrally located in TamilNadu and is 267 K.M away, in southern direction, from Chennai. The District has an area of 3691 Sq.Km. spread between 10.54’ and 11.30’ degree Northern latitude and 78.40’ and 79.30’ degree of the Eastern longitude. (Fig – 1).

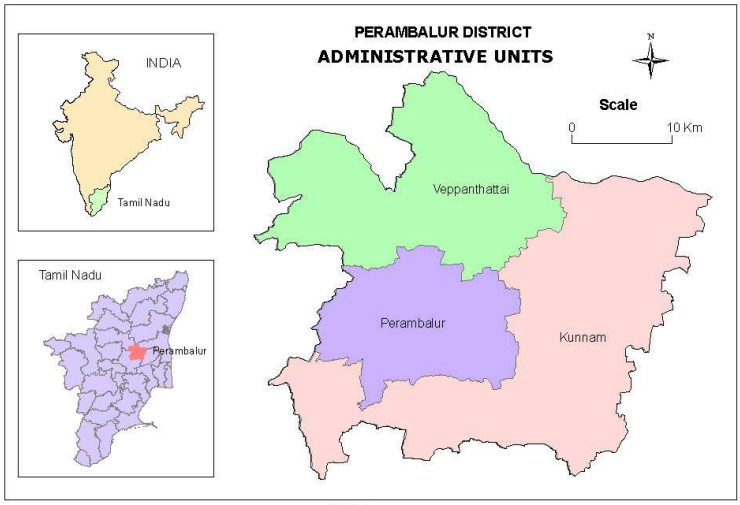

Figure - 1

It is an inland district without coastal line. The District has Vellar River in the North and it has well marked natural divisions. The Pachamalai hill situated on the North boundary of Perambalur is the most important hill in the district.

Problem statement

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.

(1) 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.

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.

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 Perambalur District.*
- *To evaluate the land use/land cover utilization of resources in Perambalur District.*

MATERIALS AND METHODS

The aim of this study is to analyze the Land use Land cover for Perambalur District using the remote sensing, to evaluate the agricultural resource using GIS and GPS technology Remote sensing technology reduces cost and time to a great extent with better accuracy to that of conventional surveying. 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.

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 toposheet, 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 extend 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.

RESULTS AND DISCUSSION

Land use/ land cover defined as the presence of surface features in parcel of land in an area. 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 1D 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.

In this study area, each resource is mapped at level III with the help of substantial amount of supplemental information extracted from high resolution, medium scale satellite image in addition, details from topo sheets, statistical department data and by field verification.

In the perambalur district the overall landuse where classified and the result where given in Sq.hec and the total area where calculated and get the percentage for the selected landuse in the study area. The major lands of study area used for agricultural activities. This land use further classified into cultivable land, plantation, fallow etc. Crop cultivation lands are identified by it square to rectangle shape reddish tone. They are mostly presented in the central northern and agricultural land is also found in the southern region near the river bed. Plantation also appear in dark reddish tone with medium to course in texture. It is found on the North western region of the study area. In the north western region near the reserved forest there is less vegetation found in this area and central region of study area have less agriculture activities due to accumulation of open scrub and less availability of water. Plantation comprises coconut trees, Banana. In this study area, plantation generally distributed along tank beds. Along the agricultural lands, light greenish yellow to yellowish blue color represent of fallow lands. It is distributed among the entire agricultural land.

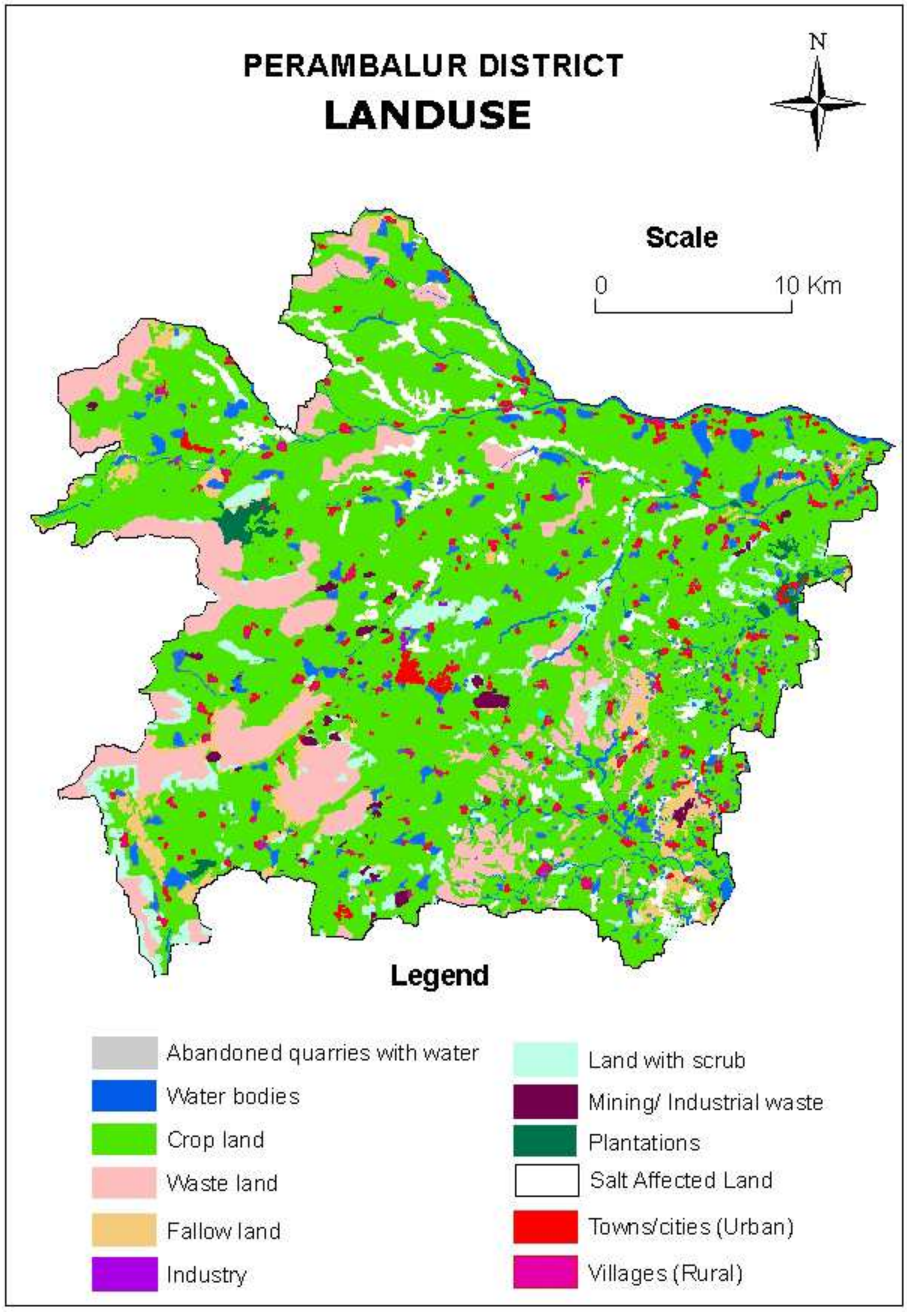
PERAMBALUR DISTRICT
LANDUSE
N
Scale
0
10 Km
Legend
Abandoned quarries with water
Water bodies
Crop land
Waste land
Fallow land
Industry
Land with scrub
Mining/ Industrial waste
Plantations
Salt Affected Land
Towns/cities (Urban)
Villages (Rural)

Figure - 2

In Figure – 2 shows the landuse in perambalur district, the abandoned quarries with water is shown in gray color, the water bodies in blue color the major land covers in cropped land in green color, waste land in pink color, land with scrub is shown in cyan, plantation in dark green, salt affected land in white, town and cities where shown in red color, villages shown in magenta.

Table: 1 Landuse in Perambalur District

Land use	Area in Sq.hec	Area in Percentage
Abandoned quarries with water	45019.83	0.000868
Water bodies	137189052.6	2.646297
Croped land	4133157597	79.72622
Waste land	509019332.7	9.818688
Fallow land	94136684.98	1.815842
Industries	797017.95	0.015374
Land with scrub	92943282.99	1.792822
Maining / Industrial waste	490405.65	0.00946
Plantations	120026223	2.315236
Salt affected land	54356782.04	1.048511
Town/Cities (urban)	4369101.77	0.084277
Villages (Rural)	37658175.26	0.726404

In the table 1 shows the dominant landuse is cropped area in nearly 80%,and followed by the cropped land wasted land nearly 10% percent, water bodies 2.6%, plantation 2.3%, and the rest of 5% of the landuse that are town, villages, salt affected land and mining and industrial waste, Industries etc,.

CONCLUSION

The overall quality of the total reserves including the marginal grade limestone is much better than the minimum specifications for cement manufacture. The entire reserves of 531 million tonnes appear to be amenable to economically viable exploitation. The reserves of about 120 million tonnes of high grade limestone with an average CaO content of 49.53% in the Niniyur deposits are of great significance. The high grade limestone from the Niniyur deposits can be used for “sweetening” and grade control. Most of the known deposits have been under exploitation for a few decades. The chances of locating substantial additional tonnages in these deposits and also the chances of discovering new deposits cannot be rated as very high. Hence, judicious exploitation of the known resources is of paramount importance from the point of view of sustaining the existing cement industry and future expansion of the industry. A detailed analysis of interactions among spatial units, among actor categories, and between spatial units and actor categories is the most important step of the assessment stage. Changes over time, such as degradation processes, land use changes, ownership changes, etc, play an essential role.

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 is 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 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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