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Site suitability assessment for residential areas in south Chennai region using remote sensing and GIS techniques

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ABSTRACT

The estimation of land suitability of Chennai southern area is presented. The total area of the study area is 108.69 sq. km, out of which settlement area was found to be 5.51 sq. km and the forest cover is about 16.34 sq. km. Water bodies 12.21 sq. km and the Barren or unclassified land covered 74.63 sq. km. The total percentage of water bodies, forest, settlements and barren lands covers about 11.23, 15.03, 5.07and 68.67 respectively. These studies revels that the southern part of Chennai is best for land-use suitability as compare to northern part. From the study it is clearly identified that 45.6% percent of the study areas come under restricted area (water bodies and forest areas are considered as restricted area in the study), 31.8% of moderate suitability areas and moderate high suitability of about 22 %. The overall suitability map indicated that most of the area is coming under restricted area and only moderate suitability areas can be properly used for residential areas development.

KEY WORDS: GIS, Slope, LULC, Drainage.

1. INTRODUCTION

Urban planning is the process of influencing, scheming or straight changes in the use of land overtime and space in an urban area. Site suitability analysis (SSA) is used in recognize the most appropriate spatial pattern for future land uses according to specify requirements, preferences, or predictors of some action. Typically suitability analysis is studied for various aspects like planning and landscape assessment (Miller, 1998), selecting the best site for the public and private sector amenities (Church, 2002), environmental impact estimation (Moreno and Seigel, 1988) and tourist infrastructures (Abomeh, 2013 and Gomaa Dawod, 2013). SSA also provides important reference for planning, management, implementation and evaluation. Therefore there is needed to get better land use planning strategies. Now-a-day geographic information system is widely used by various authors such as in planning and management (Brail and Klosterman, 2001; Collins, 2001), urban regional environmental planning and management (Janssen and Rietveld, 1990), habitant analysis for animal and plant species (Ereira Duckstein, 1993). Chrisman, 1998, studied Land-use suitability analysis is more than a GIS-based procedure even if it involves participatory approaches. According to Longley, 1999, GIS is considering as the science behind the systems. Sieber, 2003, has studied that the progression of the high powered micro computing hard baton the lowering of the costs of desktop GIS software have popularized GIS. Consequently suitability involves in identifying the most excellent location for a new housing development, a new road or pipeline, or a retail store, which reduce the time and enhance the accuracy. Therefore the study is undertaken to use help of ArcGIS 9.2 spatial analyst techniques in evaluating the suitable areas around the southern Chennai regions for the growth of residential areas. The aim of the study is to estimate the site suitability assessment for residential area in southern Chennai region using remote sensing and GIS techniques, by considering the following objectives

- To prepare base maps for the study area.
- To classify and prepare various land use classes such as existing built-up areas, open space area, geology, vegetation cover, water bodies, road networking, drainage etc.
- To prepare the ground water level map in the study area.
- To prepare the soil type map in the study area.
- To prepare of various maps such as slope maps and aspect from DEM data.
- To prepare overall weighting map and to assess the suitability areas.

2. METHODOLOGY

For the present study, the available data sets like SOI toposheet, LANDSAT satellite data were collected for years namely 1970 and 2009 respectively. LANDSAT image have been taken from Global Land Cover Facility (GLCF), a NASA funded member of the Earth Science Information Partnership at the University of Maryland. The GLF develops and distribute remotely sensed satellite data and products are available free of cost by the GLCF. Visual interpolation techniques were adopted to classify the pixels in the images into different classes such, water bodies, settlements, road network, rail lines, and barren land. The base map was geo-referenced and was projected to standard projection called the Universal Transverse Mercator (UTM) projection with the zone 44N by using Quantum GIS (QGIS) software. The satellite data which was downloaded composed of seven bands and the standard band combination was carried out for the generation of false composite colour (FCC) image. The satellite images

were subset by using clip analysis for the limitation of the study area. Therefore all the pixels within the study area are classified into various classes or themes. The generalized flowchart adopted for the present study.

Study Area: The study area considered for the present work is a part of South Chennai in Kanchipuram district of Tamil Nadu state. The study area covers 10869 hectors area and located between N 12^0 831' to N 12^0 900' Latitude and E 80^0 129' to E 80^0 184' Longitude. It has an average elevation of 83.2 meters. The soil samples were collected from the study area by using shovel and tillers. The soil samples were collected from the depth of about 30cm and then locations were collected by using GPS. The latitude and longitude were given. A total of 9 samples were collected from different places in the study area. The samples are transported to our college department laboratory, Bharath University and air dried and was used in determination of the soil texture. The detailed of the soil percentage were calculated.

3. RESULT AND DISCUSSION

Preparation of various thematic maps: The total area of the study area is 108.69 sq. km out of which settlement area was found to be 5.51 sq. km and the forest cover is about 16.34 sq. km. Water bodies 12.21 sq. km and the Barren or unclassified land covered 74.63 sq. km. Thematic maps for cost, water level, drainage, slope, aspect, drainage density and road density were prepared. The Ground Water Levels were collected in the field by measuring the water table from the open wells. The cost of the land values are collected from the local person and by using the IDW method the ground water levels and the cost map of the study area are prepared. From the ground water level is more in the southern part and the cost of land is high in the northern part of the study area. Land cover is the physical material at the surface of the earth. Land covers include grass, asphalt, trees, bare ground, water, etc. Soil is the mixture of minerals, organic matter, gases, liquids, and myriad organisms that together support plant life.

Suitability Map: The process of weighting involves emphasizing the contribution of some aspects of a phenomenon to a final effect or result, giving them more weight in the analysis. To obtain a suitability map the multi criteria analysis was used by using the standard nine-point weighing and given. The suitability map was obtained by given proper weightage, from the study it is clearly identified that 45.6% percent of the study areas come under restricted area (water bodies and forest areas are considered as restricted area in the study), 31.8% of moderate suitability areas and moderate high suitability of about 22 %. The overall suitability map indicated that most of the area is coming under restricted area and only moderate suitability areas can be properly used for residential areas development.

4. CONCLUSION

The estimation of land suitability of Chennai southern area is presented. The total area of the study area is 108.69 sq. km, out of which settlement area was found to be 5.51 sq. km and the forest cover is about 16.34 sq. km. Water bodies 12.21 sq. km and the Barren or unclassified land covered 74.63 sq. km. The total percentage of water bodies, forest, settlements and barren lands covers about 11.23, 15.03, 5.07and 68.67 respectively. These studies revels that the southern part of Chennai is best for land-use suitability as compare to northern part. From the study it is clearly identified that 45.6% percent of the study areas come under restricted area (water bodies and forest areas are considered as restricted area in the study), 31.8% of moderate suitability areas and moderate high suitability of about 22 %. The overall suitability map indicated that most of the area is coming under restricted area and only moderate suitability areas can be properly used for residential areas development.

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