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Soil Mapping and Classification using Remote Sensing and GIS in Sullia Taluk, DK, Karnataka, India

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ABSTRACT: The developing area like Dakshina Kannada it is important to build the agricultural development. Current agriculture requires accurate information on various landuse and agro-climatic parameters like soil, rainfall, temperature, water resources etc. The district can be divided into two agro-climatic regions as coastal region and Malnad region. Here an attempt made to mapping of soil at Sulliatuluk. Geographically the taluk is considered as Malanad Region. It is bounded by Puttur taluk to the North and to the East and Mangalore taluk to the West. The study carried by using hardcopy maps available from the KRSRAC and updated by IRS P6 LISS III data and field check.

KEYWORDS: Soil mapping, remote sensing, GIS, IRS P6 and Sulliatuluk.

I. INTRODUCTION

In agricultural point of view, knowing the soil type and its classification is very important aspect. Mapping and assessment of soils is the process of estimation of a particular type of land for specific purposes in order to identify the suitability of cropping pattern and to build the agricultural development. Soil is the base for every production system and knowledge on their properties, extent and spatial distribution at watershed level is extremely important for developing land use (Sarkar et al. 2006). More than ninety percent of world's food production is dependent on soil (Venkataratnam&Manchanda 1997). Soil resource inventory provides an insight into the potentialities and limitation of soil for its effective exploitation. In soil mapping we can go through inventory of different soils, their type and nature, and distribution of extent. It also provides information in terms of land form, terraces, vegetation as well as characteristics of soils which can be utilized for the planning and development. An intimate knowledge of the kind of soils their spatial distribution is a prerequisite in developing rational land use plan for agriculture, forestry, irrigation, drainage etc. Standard soil survey helps to gather information about soil in a systematic manner regarding their genesis, extent, potentiality, limitations and to predict their behaviour for specific purpose and classify them. Satellite remote sensing and GIS techniques are being effectively used in recent times in determining the quantitative description of the terrain features and geomorphological mapping (Reddy and Maji 2003).

The selected study area was Sulliatuluk in Dakshina Kannada District of Karnataka State of India. It is located between latitude 12° 29' 29" N and 12° 43' 25" N and longitude 75° 21' 08" E and 75° 33' 21" E. Sulliatuluk occupies area 847.23 km². The study area is characterized by heavy precipitation due to the influence of Western Ghats, receives an average annual rainfall of ~3900 mm. The physiography of the area shows an undulating topography. The elevated portion of this region is flat-topped and owing to the lateritic caps. Humidity of the area is 67 % and small variation in temperature range between 15 °C to 35 °C.

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II. RELATED WORK

Use of satellite remote sensing for soil survey and mapping have been also received appreciation in India, and based on the potential of remote sensing techniques it can map at regional scale and multiphased approach consisting of image interpretation, field survey, soil analysis, classification, cartography and printing (Velayutham 1999). In soil survey digital image processing and mapping was initiated of National Remote Sensing Agency and Regional Remote Sensing Service Centres and work carried out by Venkatratnam (1980); Kudrat et al (1990) and Karale (1992). Multispectral satellite data are being used for mapping soil upto family association level (1:50,000). The methodology in most of the cases involves visual interpretation (Biswas 1987; Karale et al. 1981). However, computer aided digital image processing technique has also been used for mapping soil (Epema 1986; Korolyuk & Sheherbenko 1994; Kudrat et al. 1990) and advocated to be a potential tool (Kudrat et al. 1992; Lee et al. 1988). The properties of soils that govern their spectral reflectance are colour, texture, structure, mineralogy, organic matter, free carbonates, salinity, moisture and the oxides/hydroxides of iron and manganese. Several workers (Karale 1992; Kudrat & Saha 1993; Kudrat et al. 1990; Sehgal 1995) have concluded that the technology of remote sensing provides better efficiency than the conventional soil survey methods (USDA 1951) at the reconnaissance (1:50,000) and detailed (1:10,000) scale of mapping. Soil mapping needs identification of a number of elements. The dynamic inter-relationship between physiography and soils is utilized while deriving information on soils from satellite data (Kudrat et al., 1992). In the interpretation of satellite image for soil mapping proper identification of land type, drainage pattern and drainage condition, vegetation, land use, slope and relief is very essential (Dwivedi, 2001).

III. METHODOLOGY

The present study involves application of remote sensing and GIS in identification, interpretation, classification and mapping of soil. The elements which are of major importance for soil survey are land type, vegetation, land use, slope and relief. Here in Sullialuk mapping of soil have been done using hardcopy soil map collected from KRSRAC and which is updated by IRS P6 LISS III data and field check. A soil map generated through visual interpretation of satellite images at 1: 50,000 scale is given in Fig 2. Visual interpretation is based on shape, size, tone, shadow, texture, pattern, site and association. Fieldwork was carried out to collect ground information of the study area. A rapid reconnaissance survey of the study area was undertaken prior to detailed field checking to understand the broad landforms, land use and their relationship with soils

IV. RESULT AND DISCUSSION

Remote sensing and GIS is the technology of acquisition and interpretation of data about the terrestrial objects without direct contact with it and processes in the form of photographs, imageries and beyond the range of human vision and photographic sensitivity. Visual interpretation is based on shape, size, tone, shadow, texture, pattern, site and association. This has the advantage of being relatively simple and inexpensive. Soil mapping needs identification of a number of elements. The elements which are of major importance for soil survey are land type, vegetation, land use, slope and relief. Mapping of the study area was carried out mainly based on map collected from KRSRAC Map. Here the Karnataka state soil map, figure 1.

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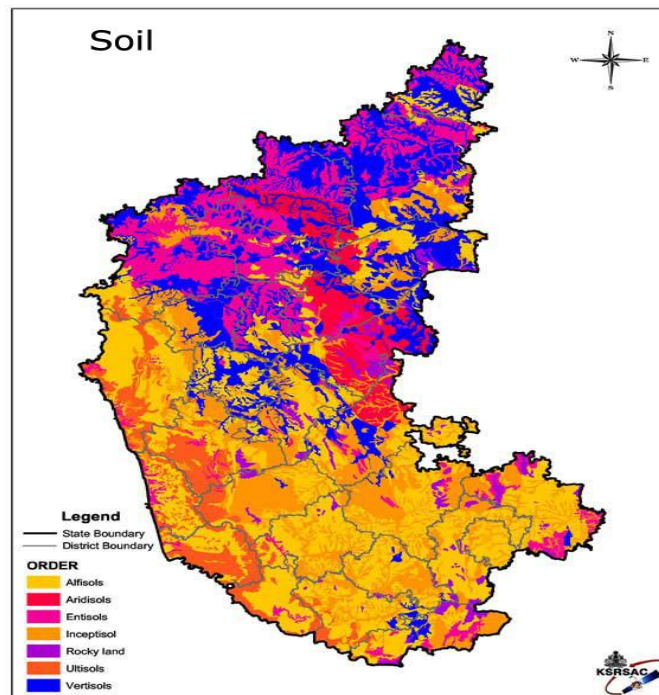


Fig 1. Soil Map of Karnataka From KRSAC

V. SOIL CLASSIFICATION

The soils identified in the study area have been classified based on United States Department of Agriculture (USDA, 1975) taxonomic scheme. According to this scheme five order have been identified Viz., Alfisols, Inceptisols, Entisols, Mollisols and Ultisols followed by six sub orders viz., Ustalfs, Orthents, Humults, Ustults, Ustepts and Ustolls and eleven great groups viz., Argiustolls, Dysrustepts, Haplohumults, Haplustalfs, Haplustepts, Haplustolls, Haplustults, Paleuhumults, Paleustalfs, Paleustults and Ustorthents and fourteen sub groups viz., AquicHaplustepts, HumicDysrustepts, Lithic Dysrustepts, Lithic Haplustolls, Lithic Ustorthents, TypicArgiustolls, TypicHaplohumults, TypicHaplustalfs, TypicHaplustults, TypicPaleustults, TypicPaleustalfs, TypicUstorthents, UsticHaplohumults and UsticPaleuhumults. Soil is the residual product of physical disintegration and chemical decomposition of the underlying rocks, which reflects the geomorphic history of the area. The chief factors influencing the formation of the soils are: rock material, climate, slope of the land and time. The porosity and permeability of soil influences the groundwater potential and quality of water in an area. The study area comprises of five types of soils Viz., clayey skeletal, fine, fine loamy, loamy and loamy skeletal. Soil classification order has been mapped in the figure 2 and full classifications have been listed in the table 1.

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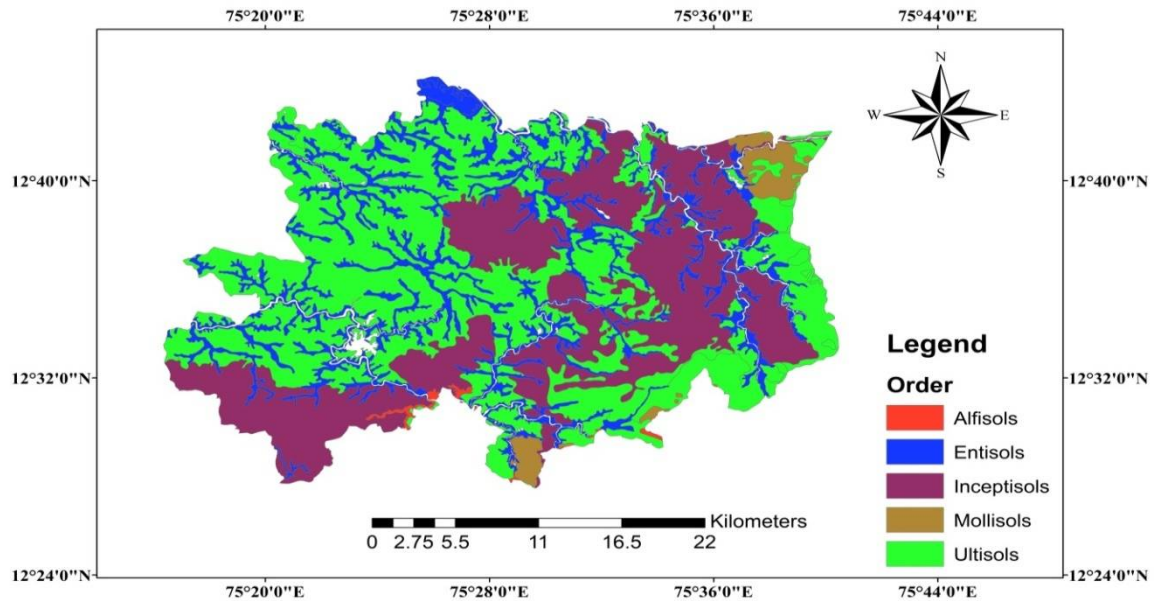


Fig. 2 Soil Map of Sulliatuluk

Table: Soil classification of SulliaTaluk

Order	Sub-Order	Great Group	Sub- Group	Family Texture	Soil Taxonomy
Alfisols	Ustalfs	Haplustalfs	TypicHaplustalfs	Clay skeletal	Mixed
		Paleustalfs	TypicPaleustalfs	Clay skeletal	Mixed
Inceptisols	Ustepts	Haplustepts	AquicHaplustepts	Fine loamy	Mixed
		Dystrustepts	Lithic Dystrustepts	Loamy skeletal	Kaolinitic
			HumicDystrustepts	Fine Loamy	Mixed
Entisols	Orthents	Ustorthents	TypicUstorthents	Fine loamy	Mixed
			Lithic Ustorthents	Loamy skeletal	Mixed
Mollisols	Ustolls	Argiustolls	TypicArgiustolls	Fine loamy	Mixed
		Haplustolls	Lithic Haplustolls	Loamy	Mixed
Ultisols	Humults	Haplohumults	TypicHaplohumults	Fine	Kaolinitic
			UsticHaplohumults	Loamy skeletal	Mixed
		Paleuhumults	UsticPaleuhumults	Fine	Kaolinitic
	Ustults	Haplustults	TypicHaplustults	Fine	Kaolinitic
TypicPaleustults		Paleustults	Typicpaleustults	Fine	Kaolinitic

Alfisols: Developed under forest vegetation. Characterized by occurrence of an argillic horizon without mollic or spodic horizons. Alfisols are distinguished from the more highly weathered Ultisols by having higher content of basic cations. The dominant pedogenic process is translocation of clay. It is eluviated from upper profile to deeper positions by drainage water. Movement of clay particles is stopped by evapotranspiration, clogging of pores by translocated clay

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or flocculation, as by Ca²⁺ or Mg²⁺. Alfisols are productive soils but somewhat less fertile and more acidic than Mollisols

Entisols: Development limited by any of several causes such as wetness whereby saturation inhibits horizon development, dryness with little water movement and sparse vegetation, deposition that continually buries the developing profile, erosion at a rate nearly equal to downward profile development and parent material that is highly resistant to weathering or lack of time for development.

Inceptisols: From inception cambichorizon usually presents. Causes for limited development are the same as with Entisols but there has been greater development.

Mollisols: Fertile, grassland soils with a mollicepedon. Melanization or darkening by accumulation of organic matter is the dominant pedogenic process. Organic matter added at surface and in subsurface by dense mat of roots.

Ultisols: Term from ultimate development. Similar to Alfisols, these developed under forest vegetation and contain an argillic horizon. However, Ultisols are more weathered than Alfisols and have a lower content of basic cations. Accordingly, Ultisols are also less fertile.

VI. CONCLUSION

The study of soil surveys reveals that the formation of soils dependent on their nature of parent material, topography and time affected in the physiographic units. The present study represents the satellite remote sensing data is a valuable tool for physiographic analysis and GIS is of potential use in mapping of soils in their total perspective and to generate map for end users. Digital remote sensing and use of Geographic Information System (GIS) are yet to gain momentum in addressing the various issues in soil survey. In the study area most of the regions are ultisols represents more weathered during the paedogenesis and less fertile soil.

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