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RESEARCH ARTICLE

PREPARATION OF PHYSICO-CHEMICAL CHARACTERSTIC OF SOILMAP USING REMOTE SENSING AND GIS: A CASE STUDY OF KODAIKANAL TALUK, DINDIGUL DISTRICT, TAMIL NADU

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ABSTRACT

Soil is the loose (unconsolidated) mineral or organic matter on the surface of the earth's crust that is capable of supporting plant growth. Soil is a major component of land system which provides a medium for plant growth. The present study deals with the "preparation of soil map in Kodaikanal Taluk, Dindigul District, Tamil Nadu". The soil characterization was carried out for parameters like pH, electrical conductivity, etc. Based on the visual interpretation and contour information from SOI (Survey of India) toposheets, a physiographic map was prepared; broadly three physiographic units were identified. Taxonomically soils were classified under Inceptisols, Alfisols, Vertisols and Entisols. Spatial distribution of soils under varied physiographic settings is mapped. Based on the morphological, physical and chemical properties of soils and related information, the soils have been classified into various soil various irrigation type, this information is very helpful in evaluation of the land and to suggest appropriate alternate land use practices.

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INTRODUCTION

The quality of the soil is a function of its morphological, morophometric, physical and chemical characteristics. These characteristics are expressed a taxonomic class as depicted on soil map with location reference. Soil mapping of the region is intended to serve as a crucial input for preparing an integrated plan for sustainable development of the area. Soil surveys provide desired information on nature, location, extent and physio-chemical characteristics along with their spatial distribution. Earlier, soil surveys have been carried out using topographic maps and cadastral maps as data base. The development of aerial photo interpretation technique in late sixties in India substantially augmented the efficacy of soil mapping programme. Salinity and sodicity are separate and unique descriptions of the impact of soluble salts in soil and water. Sodicity represents the relative predominance of exchangeable sodium compared to other exchangeable cations, chiefly calcium, magnesium, potassium, hydrogen and aluminums and is expressed as ESP (exchangeable sodium percentage).

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The sodium adsorption ratio, SAR, is another expression of sodicity that refers to the ratio of adsorbed sodium and the sum of calcium and magnesium. Soil salinity is a characteristic of soils relating to their content of water -soluble salts and expressed mostly as ECe (electrical conductivity of paste extract) and is measured as dS m−1 (Charmanand Murphy, 2000). The inter-relation of all these soil parameters is important for the Interpretation of their measures (van de Graaff and Patterson, 2001).

The impact of salinity on agriculture is now being felt in irrigated areas in which soil -and waterborne salts are accumulating during repeated cycles of water use. Non saline soils could easily be damaged and degraded by secondary salinization through irrigation with water from the Blue Nile, White Nileand River Nile (Abdalla 1986~ Mustafa 1986). These problems will become more serious as increasing population leads to more intensive use of land and water, and as presently unused or marginally used resources are pressed into service. The entire physical and biological systems involved in saline agriculture must be understood and carefully managed if increased production is to be achieved without exacerbating the existing problems.

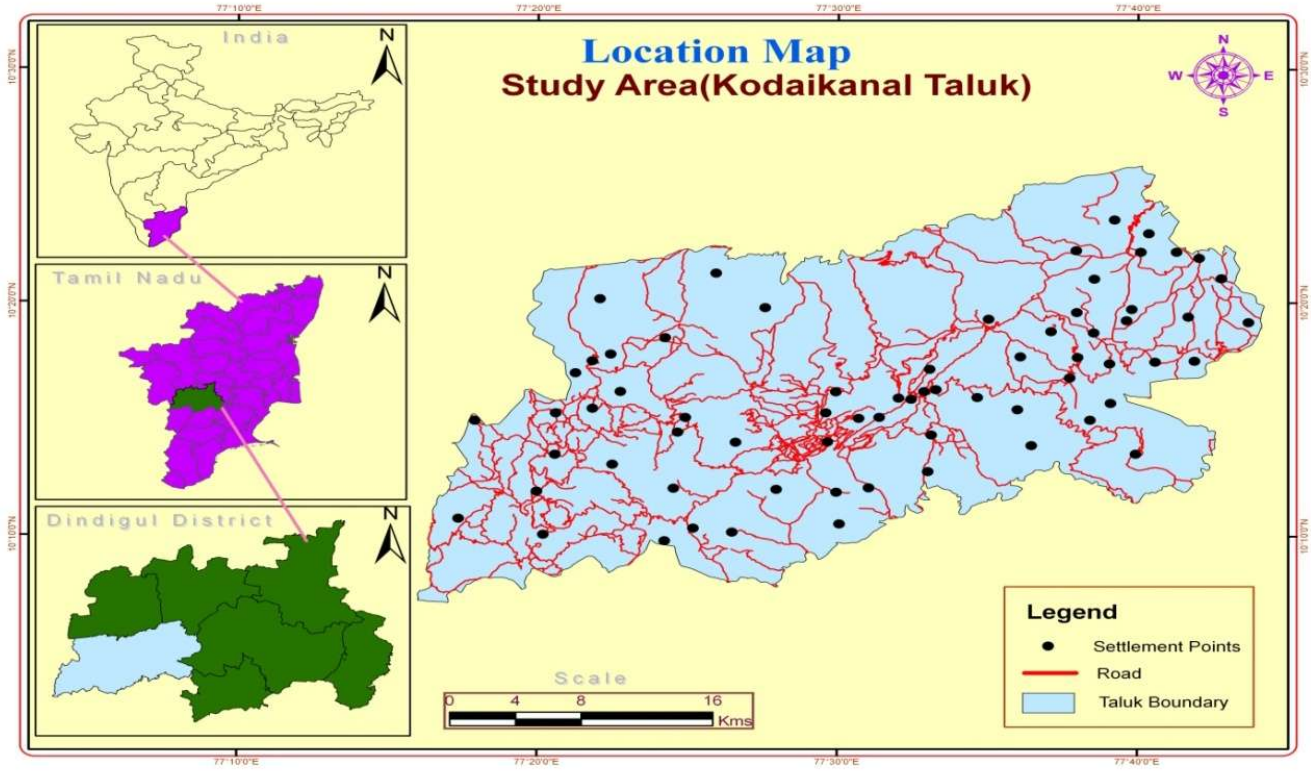
Study Area

The Palani hills is situated in eastward spur of western Ghats with a maximum east west length of 65 kms and north south width of 49kms.Total area of Palani hills is about 2068sq.km in which Kodaikanal Taluk occupies a major part of Palani hills with 1050sq.km. Latitude10◦13‘N, Longititude 77 ◦ 32‘E. The altitude ranges from 380m to 2502m and its slope varies gentle to very steep. Geology is mainly consisting of charnockites. Figure 1).

Objectives

The objectives of the current study are as follows

- To create spatial digital database consisting of Identification, characterization and classification of the soils of the study area usingIRS P6 LISS IV geocoded false color composite (FCC) Satellite data and SOI top sheets.
- To generate attribute data base consisting of statistical details of each of the above thematic layer and ground data on ARC/INFO GIS platform.



Study area administratively located in south direction of Palani Taluk, west direction of Dindigul Taluk, east direction of Udumalpet Taluk and north east part of Kerala State. The temperature of quasitemperate, with summer (April-May) temperatures touching 24°C maximum, 13°C minimum. Winter December-January) ,temperatures hover between 16°C maximum and 7°C minimum. Rainfall is well distributed throughout the year, with an average precipitation of 1300 mm. annually. Annual mean maximum and minimum temperatures are 21.5c and 8.75c respectively.

Population of Kodaikanal taluk is 100645 (as per 2001 census). The climate of Kodaikanal is very unique, with a temperate fall, winter, and spring and a mild summer. Kodaikanal also receives a large amount of rainfall every year, making it an ideal environment for cultivation. Therefore, many varieties of fruits and vegetables are grown in the Kodaikanal region, many of which can only be grown here including: peaches, pears, grapes, plums, guava, jackfruit, hill banana, passion fruit, cauliflower, potatoes, garlic, carrots, and coffee. Many other varieties of plants inhabit the area including blue gum, eucalyptus, pine, walnuts and other fruit trees which are used for cultivation.

- To extract and understand the Soil characteristics of the study area for effective management of Soil Resources for future development.
- Different soil samples strategies were applied depending on satellite image interpretation and morphological and differences physical properties (colour, texture, structure...etc).
- To perform soil limitatins for sustainesd used under irrigation map analysis and delineate suitable zones for cultivation.

MATERIALS AND METHODS

- Selection of suitable satellite data.
- Collection of Survey of India Topsheets pertaining to the study area
- Interpretation of satellite data for preparation of Soil map.
- Field validation.
- Finalization the Soilmap.
- Digital conversion through GIS.

Physiography

The detailed physiographic unit's interpretation has been done from the IRS-P6 satellite imagery. Such major physiographic units were interpreted on the basis of tone, texture, pattern, size and association references with drainage, relief, slope, etc. The further interpretation of soil mapping over this area has been done by using liss-III imageries which classification of soil types and land use patterns of the different physiographic units. Using the topographic map of Survey of India, the physiographical maps of the study area has been prepared in the scale 1:50,000 and it could be superimposed on the enhanced IRS-P6 satellite image in the same scale by using the optical instrument "PROCOM".

ANALYSIS AND DISCUSSION

The Taluk is totally 32 soil series. The soils names are called for the village's name. The Taluk mainly for Eighteen soil Texture of founded into the area. The geological formation the major area is occupied by the Ridge type structural Hills. The soil Texture and soil series maps given the details are Figure 2 and 3. Thus the visual interpretation technique helps in minimizing reconnaissance survey for locating and plotting soil boundaries thereby reducing about 60 to 70 per cent of field work as compared to the conventional soil survey; Karale (1992) was also of the same opinion. In the traditional system, plotting of soil boundaries is directly related to the skills of the soil surveyor and the traversing plan,

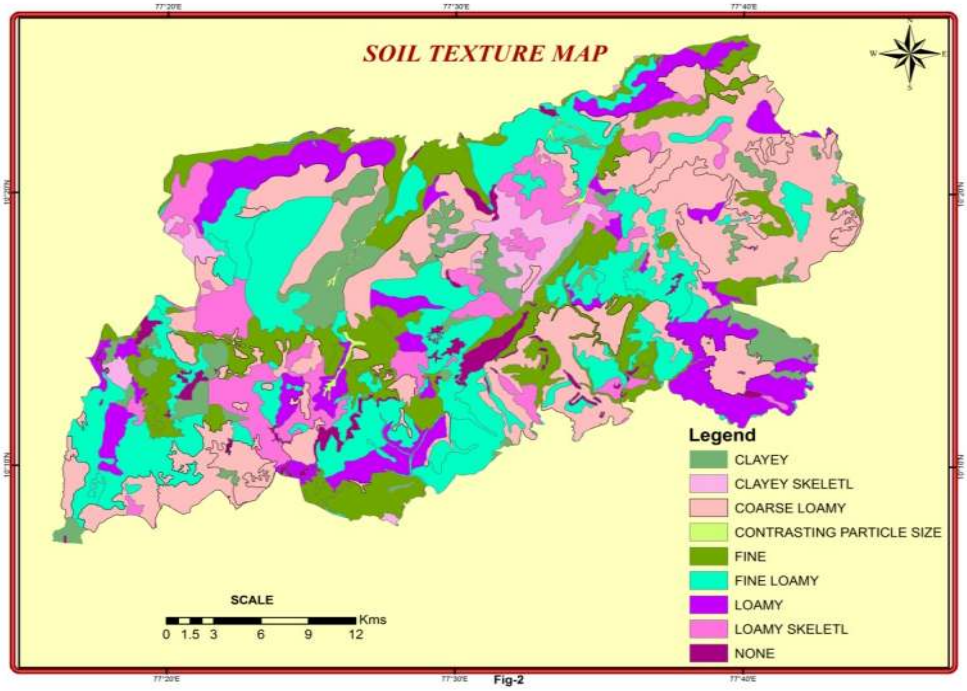


Fig-2

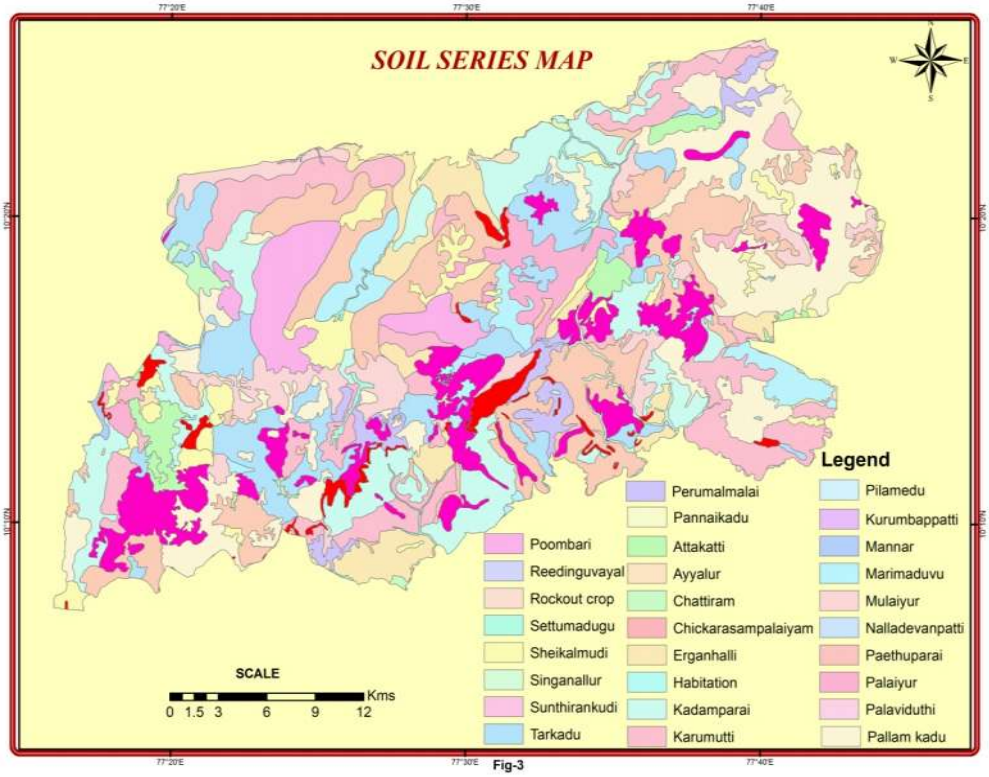


Fig-3

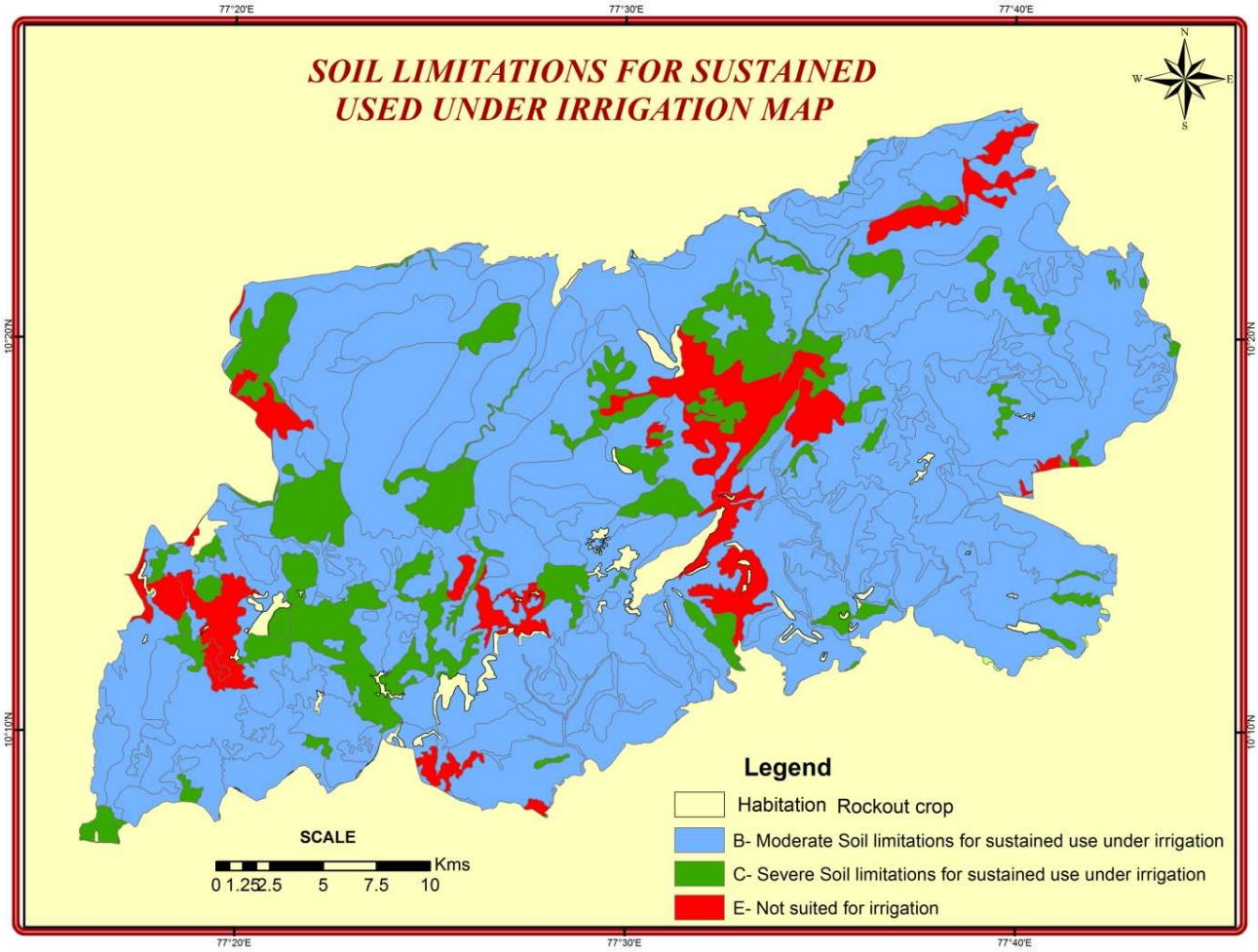


Fig. 4.

Soil Limitations for sustained used under Irrigation table in Kodaikanal Taluk

Soil Limitations for sustained used under Irrigation Map	Aera in Sq.Kms
A- None to slight limitations for sustained use under irrigation	0.20
B- Moderate Soil limitations for sustained use under irrigation	969.92
C- Severe Soil limitations for sustained use under irrigation	64.80
E- Not suited for irrigation	10.73
Habitation Rock out crop	4.35

where as visual interpretation of satellite data provides accurate soil boundaries which reduces the time and cost involved in survey and mapping. The results showed that the satellite data in conjunction with limited field studies provided details of soil features that were not always recorded even in ground surveys through reconnaissance and semi-detailed intensities. Similar opinion was expressed by Karale *et al*. (1991) in Tamil Nadu.

The physiographic units observed while delineating the satellite data have a sort of relationship with the soil formations, which was ascertained during the field visit, which confirms that the physiographic condition has a direct bearing on the soil formation of the terrain which is in tune with the studies of Goyal *et al.*(1988) in Haryana. The soils of Kodaiakanal Taluk sandy loam to sandy clay loam and clay loam to clayey soils in the study area.

Taxonomically these soils belong to soil orders Vertisols, Alfisols, Entisols and Inceptisols. Similar observations were made in the study conducted by Labrandero and Palou (1978) in central Spain. The soils in general are free from salinity or alkalinity. The soil pH ranges from 5.90 to 7.80 in most areas, but pH of 4.6 to 8.60 is noticed in study area good drainage conditions.

The electrical conductivity varies from 0.01 to 1.7 dSm-1 indicating that these soils are normal The CEC values vary from 3.78 to 22.93 C mol/kg of soil depending on the sandyclayloam content.Based on the study of soil profiles for its horizon wise physico-chemical properties along with field traversing, three soil suitable classes namely C- Severe Soil limitations for sustained use under irrigation B- Moderate Soil

limitations for sustained use under irrigation, E-Not suited for irrigation Fig-4 (Table 1).

Conclusion

Remote sensing has grown as a potential alternate source for natural resources database generation and their management within the shortest time. The synoptic view and its repetitive coverage helps in inventory of natural resources and generating reliable and accurate database quickly when compared to the conventional systems. The information that is generated upon integration with the attribute data in a Geographic Information System provides information on composite resource units. The major part of this study area is covered by the Moderate Soil limitations for sustained use under irrigation. The area is permanently of the forest Plantation. Mainly this area soil resources and climates are suitable for very good condition. So the Forest production is very high. Recently some forest areas are transformed to settlements. The study highlight is mainly for the soil types and land use patterns. The soils are suitable for *irrigation* activities. The soil is mainly for 3 types of irrigation. So the irrigation activities are well developed and suitable for climate of the study area.

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