



Lithological Studies and Types of Soils Along Coastal Area of Kanyakumari to Colachel Coastal Belt, South Tamil Nadu, India

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ABSTRACT

Soil types of an area are more important, since soil is the main criteria in agricultural production and in recharge of groundwater. Different types of soils are derived from a wide range of geological formations. Knowledge about type of soils, its extent and occurrence is of primary importance for agricultural planning to maximize production and for groundwater recharge. The soils of the district from Kanyakumari to Colachel coastal belt can be classified into red loams, red lateritic soil and pale reddish. They are derived from lateralization of gneisses. The soils derived from gneisses are mostly brownish. Thickness of soils in mountains is almost negligible, whereas in the valleys they are around 2m thick. The lateritic type of soil occurs in blocks of Rajakkamangalam. The mixed type of red and alluvial soil occurs in Agastheeswaram block. The coastal sand occurs in the western side of the district. The coastal alluvium sand is of high fertility. Generally, the soils are highly acidic in the coastal area. This is mainly due to heavy rainfall and heavy leaching of basic rock in hilly areas.

INTRODUCTION

The geographical extent of Kanyakumari district is 1671.84 sq. km. Considering the total geographical area of Tamil Nadu State, it is 1.5%. A study area of 350 sq. km from Kanyakumari to Colachel has been considered for analysis of the types of soils. The coastal area is situated between latitude 8°05'30"-8°34'30" and longitude 77°06'30"-77°35'00". As per physiographical aspect the coastal region contains hilly regions representing Western Ghat mountains, coastal region and undulating regions.

Hilly regions represent Western Ghat mountains: The north of north western side of the district is completely occupied by Western Ghat mountains with maximum elevation of 1658m (Mahendragiri peak).

Coastal region: The coastal region is a narrow strip of plain region along the coast with a width of 1 to 2.5 km. The coastline has narrow stretches of beach and sand dunes. The area adjoining the coast is characterized by laterite cappings.

Undulating region: The whole area is generally undulated with ups and downs slopping towards different directions. All major rivers originate from the Western Ghats and flow towards southeast. River Tamirabarani has a vast catchment area and the two important reservoirs viz., Petchiparai and Perunjani have been constructed across its flow tract. Nearly 300 days flow of water has been noticed in this river because of the contribution by both northeast and southwest monsoon rains. The water from these two reservoirs is not directly let into the river but taken out through channels to distant places for irrigation purposes, so that this forms a network of channel system, a quite different

drainage system, when compared with other districts. The river confluence is seen near Thengapattinam. It runs a distance of 40km from its origin of 1600m height above MSL in the Western Ghats.

River Pazhayar originates at an altitude of 1300m in the Mahendragiri hills and the river water is taken away through channels for irrigation. The River is benefited by both SW-NE monsoons. It completes its 20km journey before joining the Arabian sea. Its creek can be seen near Manakudi, 12km south of Nagercoil. River Valliyar originates at an altitude of 950m at Vallimalai hills and has a very limited irrigation system. Period of flow of water in this river is for 6 months. The river joins the Arabian sea near Manavalakurichi. The length of the river is nearly 29km. The general flow trend is mainly southwards for all these rivers.

Out of the total geographical area of 1,67,184 hectares, forestland account for 54,155 hectares representing 32.4% of the total area.

RESULTS AND DISCUSSION

Methodology: Types of soils in the study area are red soil, lateritic soil, clayey soil, river alluvium and coastal alluvium (Fig. 1). The north of northwestern side is completely occupied by Western Ghat mountains. The coastal region is a narrow strip of plain region along the coast with a width of 1km to 2.5km. The coastline has narrow stretches of beaches and sand dunes. The rear adjoining the coast is characterized by laterite capping.

The whole area is generally undulated with ups and downs slopping towards different directions. All major rivers originate from the Western Ghats and flow towards southeast. Wind velocity generally reach maximum in July-August indicating the setting of monsoon over the district. The maximum wind speed of 17.74 km/hr is recorded during August, and the minimum of 5.53km/hr during

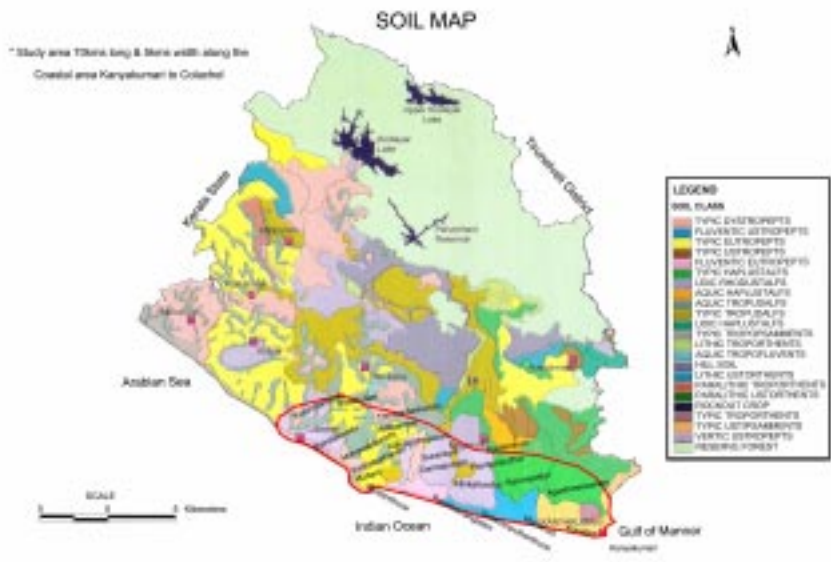


Fig.1. Soil details-Kanyakumari-Colachel coastal area.

Table 1: Soil categorization.

Sl. No	Category	Differentiation characters
1.	Order	Soil forming process as indicated by the presence or absence of major diagnostic horizons.
2.	Sub-Order	Sub-divisions of Order according to presence or absence of properties associated with wetness, soil moisture, parent materials and vegetation effect.
3.	Group	Sub-divisions of Sub-Orders according to similar kind arrangement and degree of expression of horizons base status, soil temperature and moisture regime.
4.	Sub-Group	Integration to other great groups, Sub-Orders and Orders.
5.	Family	Properties important for plant growth, broad soil textural, mineralogical and soil temperature class.
6.	Series	Kind and arrangement of horizons, colour, texture, consistency regarding chemical and mineralogical properties of horizons.

December. Humidity in the area is generally high during May (95%), whereas low during February (45%). Types of soils in the coastal area from Kanyakumari to Colachel are categorized and given in Table 1.

Under new system of classification, 10 soil Orders namely, Entisols, Inceptisols, Alfisols, Ultisols, Axisols, Vertisols, Mollisols, Spodosols, Histosols and Aridisols are recognized. Out of them only three soil Orders occur in Kanyakumari district from Kanyakumari to Colachel coastal area. Important soil subgroups that occur in Kanyakumari district are discussed here. Table 2 shows different soil Orders falling in the district along the coastal belt.

The lithological strata of soils in bore holes drilled in the coastal area are shown in Fig. 2. Analysing the lithological details of bore holes in the study area, at Kanyakumari 0-0.5m is top soil, 0.5-9.5m is leptinite and 9.5-34m is leptinite weathered, at Kottaram 0-1.5m is top soil, 1.5-4.5m is gneiss highly weathered and 4.5-18m is gneiss weathered, and at Colachel 0-7m is top soil, 7-10m is sand, 10-12m is clay, 12-17m is sandstone and 17-19m is clay. Other soil subgroups like lithic ustorthents (Luot), typic ustropepts (Tutp) and udic haplustalf (Uhsf), etc. are present only in small area extent.

Vertical soil strata: Soils of Kanyakumari district are mapped based on All India Soil and Land Use Survey Organization and the USDA (1978) soil survey manuals by Soil Survey and Land Use Organization, Palayamkottai. Along the coastal area the normal availability of soils are laterite, weathered rock, clay, sand and sandstone up to a depth of 60m below MSL (Fig. 3).

Under new system of soil classification, 10 soil Orders namely Entisols, Inceptisols, Alfisols, Ultisols, Axisols, Vertisols, Mollisols, Spodosols, Histosols and Aridisols are recognized. Out of them only three soil Orders occur in Kanyakumari district. Important soil subgroups that occur in Kanyakumari district are discussed here. Table 3 shows the different soil orders falling in the district between Kanyakumari and Colachel coastal area. Other soil subgroups like lithic ustorthents (Luot), typic ustropepts (Tutp) and udic haplustalf (Uhsf), etc. have only a small area extent.

CONCLUSION

Types of soil in the study area is red soil, lateritic soil, clayey soil, river alluvium and coastal alluvium. The north of north western side is completely occupied by western ghat mountains. The coastal region is a narrow strip of plain region along the coast with a width of 1 km to 2.5 km. The coastline has narrow stretches of beaches and sand dunes. The rear adjoining the coast is characterized by laterite capping. The whole area is generally undulated with ups and downs slopping

Table 2: Major types of soils from Kanyakumari to Colachel coastal belt.

Soil Subgroup with map symbol	Common name	Local name
1. Typic Dystropepts, Tdtp	Slightly developed, low fertile, deep brown soils in high rainfall area	
2. Fluventic Ustropept, Futp	Very weakly developed, deep, stratified, brown soils.	Vandal, Valarman
3. Typic Entropepts, Tetp	Slightly developed, highly fertile, deep, brown soils in high rainfall area.	
4. Typic Ustopepts, Tutp	Slightly developed, deep brown soil	Aasal Valarman
5. Fluventic Entropepts Fetp	Very weakly developed, deep, stratified brown soils in high rainfall Zone	
ORDER: ALFISOL		
Sub-Order: Ustalfs		
6. Typic Haplustalfs, Thsf	Moderately developed deep, calcareous brown soils	Sukkan Paalseval
7. Udic Rhodustalfs, Ursf	Moderately developed deep, noncalcareous red soils	Asal Seval
8. Aquic Haplustalfsx, Ahsf	Moderately developed deep, ill drained brown soils	Machacha Paalseval
9. Aquic Tropudalfs, Atdf	Moderately developed deep, ill drained brown soils in high rainfall zone	
10. Typic Tropudalfs, Ttdf	Moderately developed deep, brown soils in high rainfall zone	
11. Udic Rhodudalfs, Urdf	Moderately developed, deep noncalcareous red soils in high rainfall zone	
ORDER: MENTISAL		
Sub-Order Summents		
12. Typic Tropopsments, Ttpt	Pedogenically young coastal sandy soil in high rainfall zone	
ORDER: ENTISAL		
13. Lithic Troporthents, Ltot	Pedogenically eroded, shallow soils in high rainfall zone	

Table 3: Soil categorization.

Sl. No	Category	Differentiation characters
1.	Order	Soil forming process as indicated by the presence on absence of major diagnostic horizons.
2.	Sub-Order	Sub-divisions of Order according to presence or absence of properties associated with wetness, soil moisture, parent materials and vegetation effect.
3.	Group	Sub-divisions of Sub-Orders according to similar kind arrangement and degree of expression of horizons bass status, soil temperature and moisture regime.
4.	Sub-Group	Integration to other great groups, Sub-Orders and Orders.
5.	Family	Properties important for plant growth, broad soil textural, mineralogical and soil temperature class.
6.	Series	Kind and arrangement of horizons, colour, texture, consistency regarding chemical and mineralogical properties of horizons.

towards different directions. All major rivers originate from the Western Ghats and flow towards southeast. Wind velocity generally reach maximum in July-August indicating the setting of monsoon over the district. The maximum wind speed of 17.74 km/hr is recorded during August, and the minimum of 5.53km/hr during December. Humidity in the area is generally high during May (95%) whereas the minimum during February (45%). The basement of the study area consists of charnockite, granite gneiss, leptinite, leptinite gneiss, peninsular gneiss, laterite, warkalai sandstone, variegated clay, river alluvium, etc. The study of structural and tectonic history indicates several episodes of deformation, which caused repeated folds, faults, joints and fracture systems. The basement rocks are overlain by red soil, lateritic soil, clayey soil, river alluvium and coastal alluvium, black, red and red sandy soils of thickness ranging from 1 m to 1.5 m in most places. The area is underlain by the

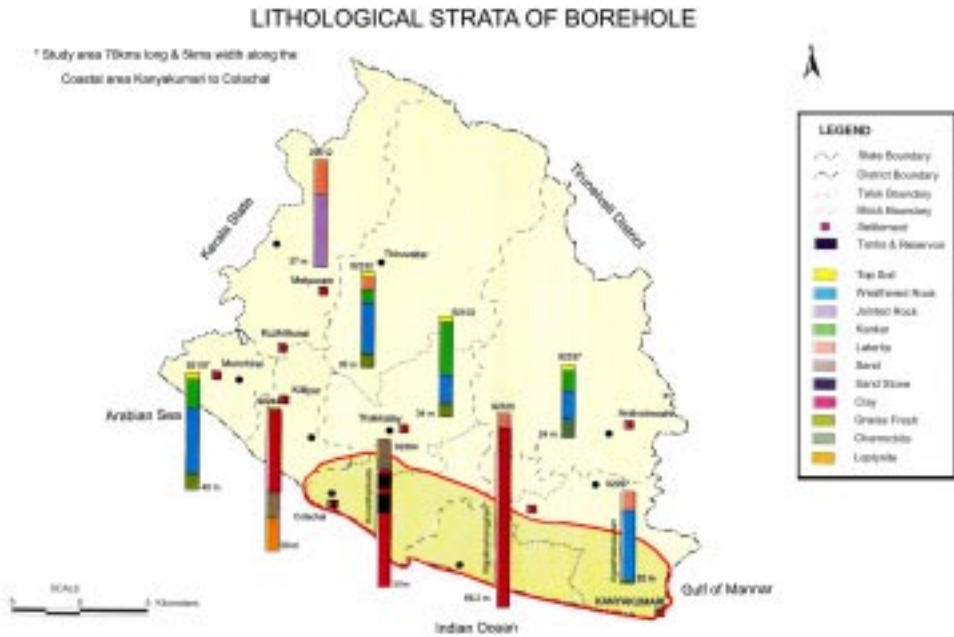


Fig. 2: Lithological soil strata.

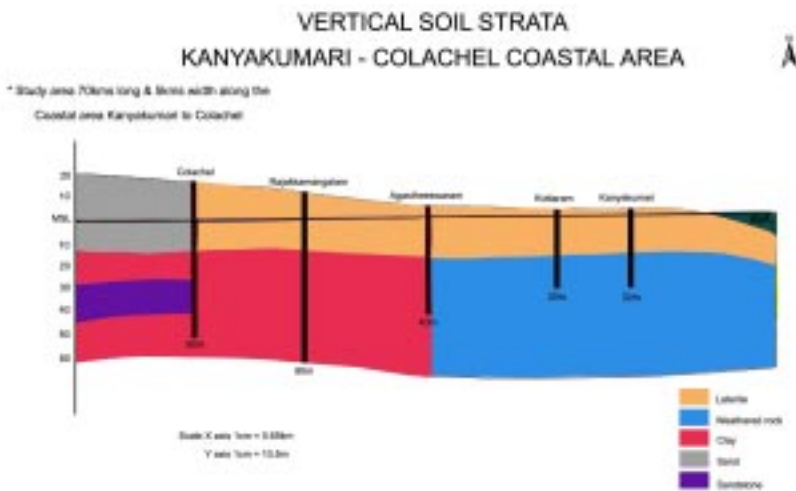


Fig. 3: Vertical soil strata.

peninsular gneissic terrain of India. Sediments of miocene were also deposited and identified as the warkalai sandstones. Also, the sands of recent origin are noticed along the coast. Peninsular gneisses occupy the largest area in the study places. The general trend of the strike of the area is N-NW to S-SE. Garnetiferous sillimanite, graphite gneisse and garnetbiotite gneiss are the two major groups identified in this area. The charnockite group of rocks is well exposed around Rajakkamangalam

area. The warkalai beds of tertiary age are exposed as the cappings, south-west region near the coast. Sub-recent origin of calcareous limestone is noticed near Kanyakumari. Lateral deposits or bay deposits of sand, zircon, rutile, illemanite and garnet are very common phenomena along the entire sea coast of Kanyakumari. Near Manavalakurichi monazite are deposited. The trend of foliation in gneisses is N-20 W-S30 E with steep dips on the eastern side. The peculiar deposition of feldspathic granites over a large portion of this area is suggestive of the fact that rocks have been sharply folded isoclinally causing repetition of bands. The trend of folds is aligned in NW-SE direction. Subsequently, this might have been subjected to cross folding. Also coastal sand is seen in the entire coastal belt of Kanyakumari coastal area. Borehole lithology records reveal that the thickness of alluvial deposits is more in bajada and valley fills (about 10-15 m). Weathered and fractured zones are areas for ground-water occurrence. Intensity of weathering is not uniform in space and depth. It is considerably higher in gneissic rocks than in charnockite. Weathered zone thickness of the study area generally ranges from 10 m to 35 m below ground level. The groundwater of the area occurs under unconfined conditions. Rainfall infiltration and seepage of water from surface water bodies are responsible for ground-water actuation. Most of the wells used for irrigation are shallow and partially penetrating because once a considerable depth of water column is reached, farmers stop further deepening of wells. Hydrographs indicate that the groundwater table tends to rise during October and December to reach peak and starts receding from February onwards to the end of August to September. However, a slight raising trend is seen during July because of southwest monsoon rain.

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