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Interpretation of soil resources using remote sensing and GIS in Thanjavur district, Tamil Nadu, India

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ABSTRACT

Mapping of physiographic units and the sediments/soils of an area can give useful information for land use planning. Remote sensing technique plays an important role in the mapping of soil, physiographic units and other land resources. In this present study, Thanjavur district, Tamil Nadu has been choosen to prepare physiographic units and soil maps by using IRS-P6 satellite imagery, (Scale 1:50,000). This study reveals that the mapping of different soil/sediment types and physiographic units can be effectively and the land suitability can be inferred.

Key words: Physiographic units, Soil productivity, Crops grown, Remote sensing and GIS.

INTRODUCTION

In view of soil resources mapping, the study area of Thanjavur district Tamil nadu has been interpreted. The Remote sensing Technique is a major tool interpreting the land resources and that can be used for a Thanjavur area like this kind of soil mapping. The major physiographic features such as alluvial and sandy plains, undulating pediplan, upland and natural vegetation, coastal plain areas or low lying lands of the study area have been interpreted. There are many previous investigation such as Ahuja R.L[1], Kumar, Ashok and Sanjay Kumar Srivastava [3], Fabos J.G.[4], Fitz and Patrick.E.A [5], Lillesand, Keieper[6], Saha and S.K.Singh [7] and many other soil resources related of the previous investigation.

The main objectives are:
1) Mapping of different physiographic units with the help of IRS-P6 satellite imagery
2) Interpretations of soil types for each physiographic unit using satellite imageries
3) Correlation of land suitability and soil types and colours.
4) Analyse the Soil productivity
5) Analysis of Crops grown.

STUDY AREA

The area under investigation lies in between the Long. 78° 45' 50'' E to 79° 35' 55'' E and Lat. 10° 10' 0'' N to 11° 10' 6'' N. Thanjavur is a Rapid industrialization and urbanization has resulted. The study of land is mainly for agricultural region. The city is connected by land, and air transportation. Thanjavur district lies as the East coast of Tamil Nadu. It extends to an area of 3396.57 sq kms. The district is bounded on the north by the cuddalore on which separate it from Perambalur district and on the East it is bounded by the Thiruvarur and Nagapattinam and on the south by the Palk Strait and west by Pudukkottai and Tiruchirappalli district. The district can be divided into 3 main divisions and 12 deltaic regions. Totally in my study area 8 taluks, 12 blocks. The details are given in figure 1.

Geologically the study area can be broadly devided into four geological zones viz. 1. The western and sourthern zones from a laterite country. The laterties/latertic soil occur places at places over the crystalline rocks viz. migmatite genisses and also sedimentary formations comprising fossil ferrous sandy calcareous clay and limestone of upper age and cretaceous age and grits, ferruginous sandstone gravel of mio-pliocene age. 2. The fluvial deposits (flood plains) of Cauveri and Agniyar rivers. 3. The fluvio marine deltaic sediments. 4. The coastal sediments of marine/Aeolian regions fringing the Palk Strait.

LOCATION MAP OF THE STUDY AREA

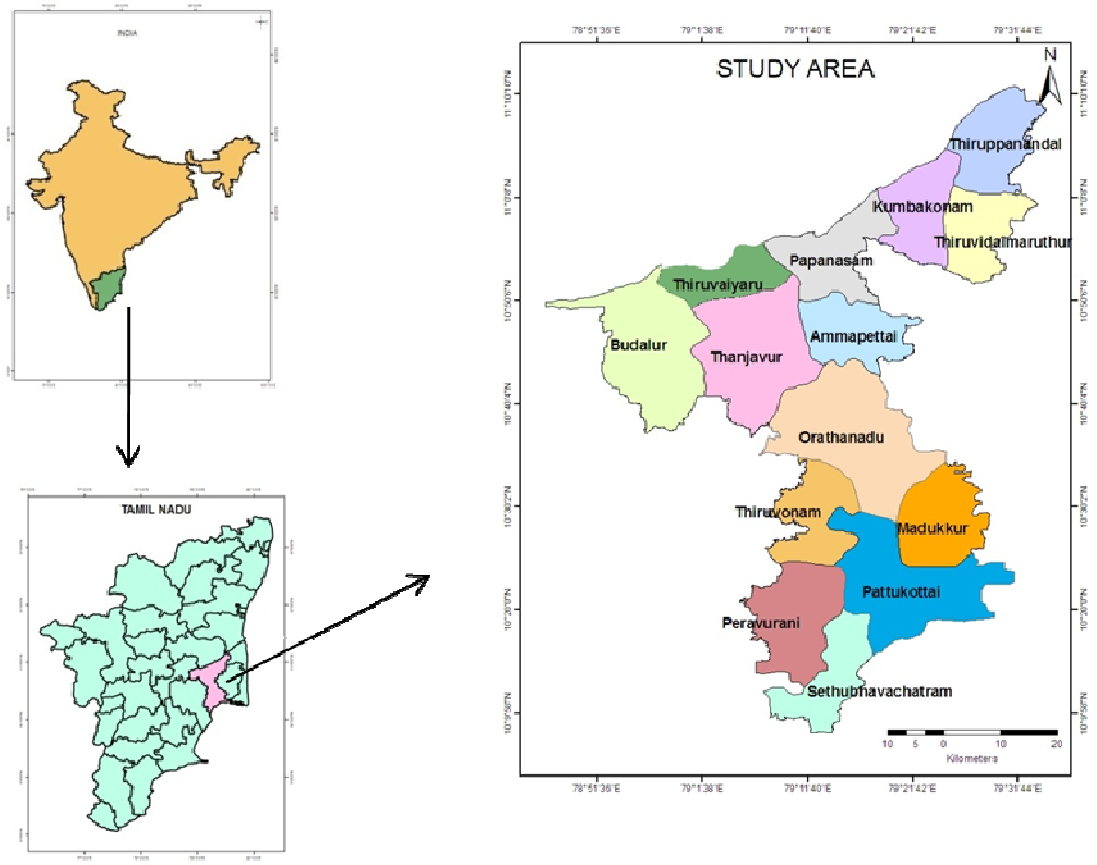

Figure.1 Location Map of the study area

Thanjavur is placed in a plain land in nature. It is a region which is full of alluvial soil. The general slope of this region is from West to East. It is the big urban centers for the surrounding rural areas and small towns are developed. The town acts as a service centre notably for agriculture economy to the entire East and South of the district. The town is divided in to 36 wards for administrative purpose. The area is bounded by revenue villages. Thanjavur district is well connected in all directions with major cities by national highways.

The town is located in the centre of the Cauvery delta, about 320 kilometers from the state capital Chennai and 56 kilometers from Tiruchirapalli. Some of the nearby towns are Kumbakonam (40km), Pattukkottai (45), Mannargudi (37km), Pudukkottai (55km), Tiruvarur (58km), Peravurani (80) and Nagappainam (84km). The municipality has an area of about 36km^2. The township and its exterior suburbs extend for an area of about 100km^2. The town has an elevation of 57 meters above mean sea level. It is drained by the rivers Vadavar and vennar in the north.

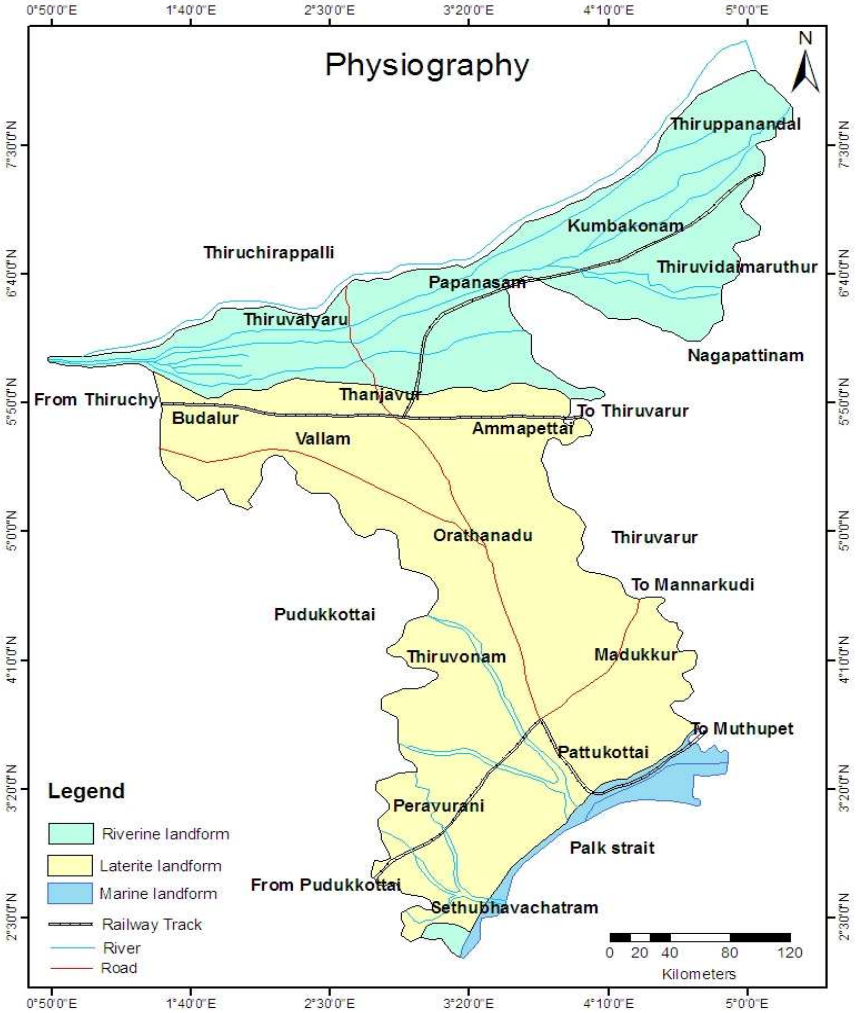

Figure: 2 Physiographic maps

Physiography

The detailed physiographic unit's interpretation has been done from the IRS-P6 satellite imagery and it show as figure 6. 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 liss3 imageries which classification of soil types and land use patterns of the different physiographic units.

DATA AND METHODOLOGY

For this study, the main sources of spatial and non spatial datas are used. The direct field checking with reference to soil types and crop pattern cultivations of this area are alighting the study. Totally this area toposheets are 14 by 58N/1, N/2, N/3, N/4, N/5, N/6, N/7, N/8, N/9, N/11, 58J/13, J/14, 58M/8, M/12. Mainly in this Papers prepared by Remote sensing and GIS techniques are used. Remote sensing data IRS-P6 (Path 102 Row 66 NRSA) satellite imagery, panchromatic aerial photograph 1980 and the topographic maps are 1:50,000 scales are used.

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". The Black and white aerial photographs of the study area were interpreted for soil types and correlated with imagery interpretations by using the instrument "Optical Reflecting Projector".

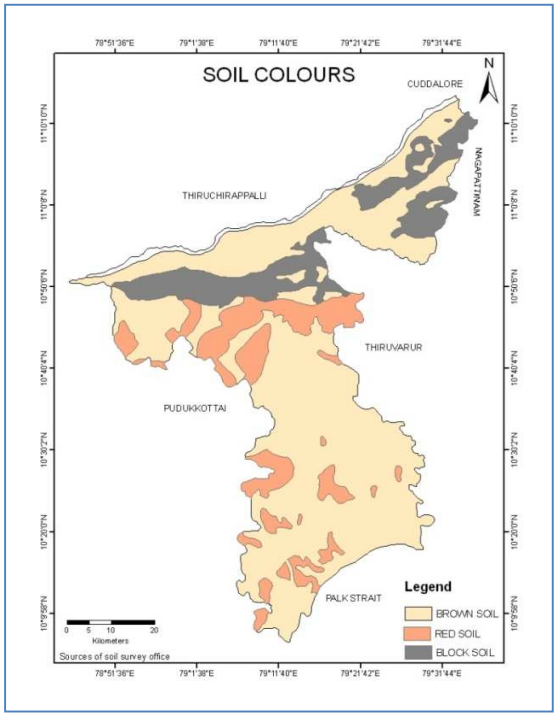

Figure: 3 Soil colors

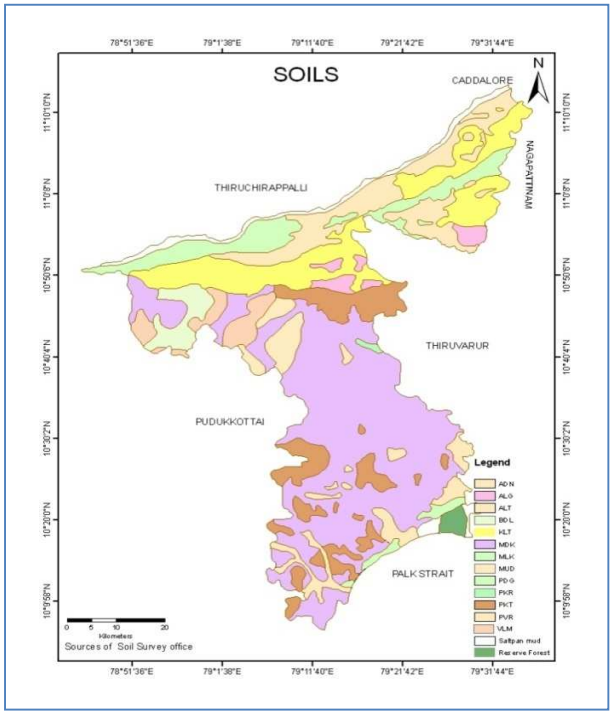

Figure: 4 Soil Types

ANALYSIS AND DISCUSSION

Soil colour and soil types

The geological formation of Thanjavur Dt is made up of cretaceous Tertiary and Alluvial deposits and the major area is occupied by the Alluvial and Tertiary deposits. The district is

totally 13 soil series. The soils names are called for the village's name. The district mainly for thirteen soil series of founded into the area. Mainly the soil colors are three. There are Red, Brown, and Block. The soil color and soil series maps given the details are Figure 2&3 and the table 1.

Soil productivity.

The productivity rating of the soils taking into consideration the important soil properties such as depth, base saturation, texture and structure, organic matter content, mineral reserve and soil moisture. Five productivity classes were recognized by him. This method was adapted to work out the productivity rating of the soils of the district. Mostly this area is full of paddy cultivated of the area. The details are given in table 2 &3 and the figures are 5&6.

Soil colours (Table 1)

SOIL COLOUR	SOIL SERIES	EXTENT(ha)	PERCENTAGE
Red	Pattukkottai, Mudukulam, Budalur&Vallam	62,184	19.30
Black	Kalathur	51,449	15.97
Brown	Padugai, Melkadu, Adhanur, Peravurani, Madukkur, Alathur, Kallivayal & Alangudi	2,08,613	64.73

Productivity ratings for the soils. (Table-2)

Ratings	Productivity classes	Soil series	Extent(ha)	% to total
0 -7	Extremely poor (EP)	Kallivayal and Melkadu	5,527	1.72
8 -19	Poor (P)	Vallam, Alathur and Peravurani	31,828	9.88
20 -34	Average (A)	Kalathur, Alangudi, Budalur, Mudukulam, Pattukottai, Madukkur and Adhanur	2,48,429	77.09
35 -64	Good (G)	Padugai	36,467	11.31
65 - 100	Excellent (E)	-	-	-

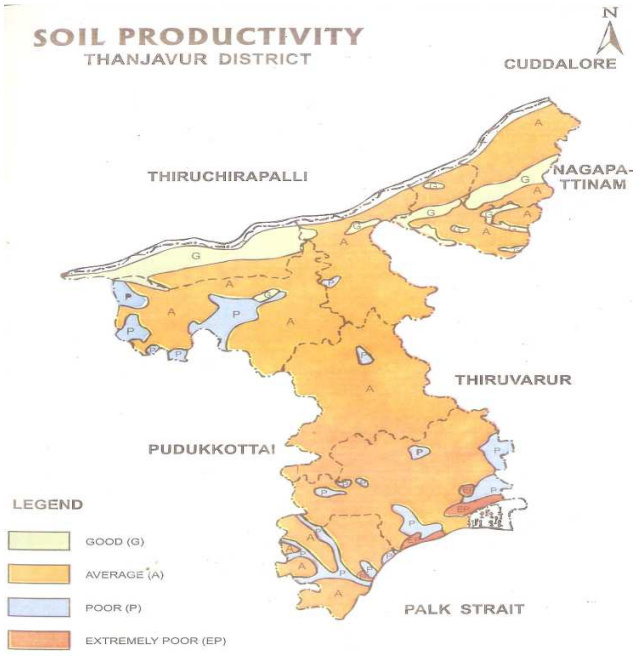

Figure: 5 Soil Productivity map

CROPS CROWN (Table: 3)

S.NO	CROPS GROWN		MAP SYMBOL	SOIL SERIES
	IRRIGATED	RAINFED		
1.	Tobacco, Gingelly&vegetables	Groundnut&Casuarina	1	Melkadu
2.	Banana, sugarcane, paddy, vegetables&flowers	Groundnut, Gingelly&Eucalyptus	3	Padugai
3.	Paddy&pulses	-	4	Kallivayal&peravurani
4.	Paddy, sugarcane&Millets	-	5	Alathur
5.	Groundnut, Gingelly, paddy, Millets&Chillies	Groundnut	6	Budalur&Madukkur
6.	Groundnut, Gingelly, vegetables&Chillies	Groundnut, coconut, Fruit trees, Eucalyptus&casuarina	7	pattukkottai
7.	Coconut, Flowers&vegetables	Groundnut, Millets, Fruit trees	8	Mudukulam
8.	-	Groundnut, Millets, Cashew, Encalyptus	9	vallam
9.	Paddy, sugarcane&cotton	Pulses	10	Kalathur, Adhanur&Alangudi

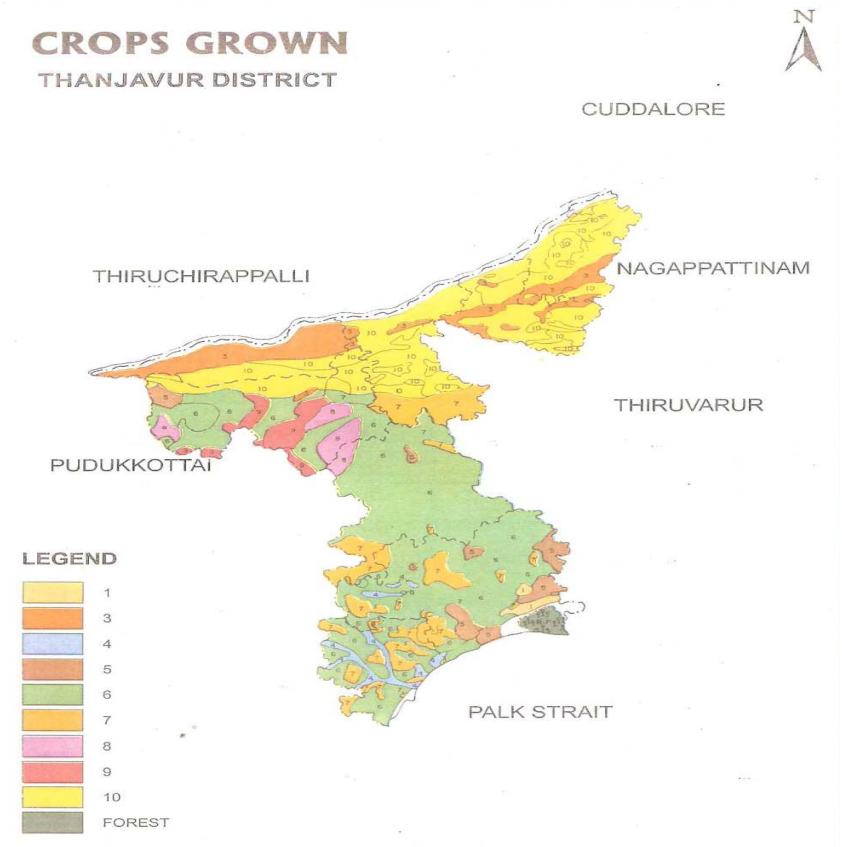

Figure: 6 Crops grown map

DISCUSSION

The study area is mainly for plain area topography. The presences of river, streams, are depositing the soils forming materials of sand, silt and clay. Area of linearment and some fault features and uplands are quite away from the drainage pattern. The interpretation shows that the major parts of the study area are covered by alluvial soil and the undulating sandy soil. Table shows the correlations of physiographic units, soil types and the cultivations in the study area which are all described as follows:

Alluvial plain.

A level or gently sloping tract or a slightly undulating land surface produced by extensive deposition of alluvium, usually exhibit adjacent to a river where periodic overflows exhibited on its banks. It may be situated on a flood plain, a delta or on alluvial fan. The Thanjavur dt is fully covered by the alluvial plain. The alluvial plain is predominantly found in the present watershed.

The study area displays alluvial plain deposits of proximal medial and distal facies. The nature of sediments varies from coarse gravel, boulders fine gravel and course sand. The major distributor of Cauvery is the broad and braided channel system of the Coleroon River. In addition to that there are some more there active channels of the Cauvery and distributaries like the Arasalar, the Vennar, and Thirumalairajanar etc, the area filled up with medium to coarse sand up to the adjacent flood plain levels.

Aeolian activity in the form of the dune is seen on the banks of Coleroon and Cauvery. Dunes developed over the channel bars of abounded channels with braided system, later enabled the formation on or sites suitable for urbanizations such as kumbakonam and Thanjavur. Large parts of the study area are gently sloping and covered by the recent alluvial plain. The presence of lineaments in this area is less. The plain is cultivated by paddy, pulses, sugarcane, cotton, groundnut and coconut are identified on account of red tonal contrast from the imagery.

Abandoned channels.

The prominent impressions of the old river courses are generally, termed as abounded channels. They are easily recognized from the aerial photos due to their contrasting disposition of being placed in a linear and sinuous shape. In my study area142.65 sq kms are founded in the channels. The abandoned channels are noticed along the Cauvery, Arasalar, Thirumalairajanar and Mudikondan rivers. These channels are formed due to the shifting of the original river course and abandoning of old channels. The old Channels from the place where it meets the present course have been traced. In the western part of kumbakonam the Arasalar River has shifted its course to the southern side of the water shed area. The Thirumalairajanar and Mudikondanar river courses have shifted their courses towards the northern direction in the present river course.

Chenier's are sandy linear ridges, well above the high water line, separated from the shore as a result of deposition of fine grained marshy sediments on its sea ward side usually associated with

delta flats that receive substantial fluvial input. Chenier's are scarcely distributed in the study area. It is only well developed on the both sides of Vellar and Coleroon Rivers. The sediments brought by Vellar and Coleroon River must have exposed for reworking under marine processes during the trend appeared in the deltaic condition. This land or soil mainly cultivated for agriculture activities.

Upland

The upland areas are mainly founded in NW and Eastern part of the study area. The upland is mainly generated in river side of the features. The features are land elevated above other land. The features are higher ground of a region or district an elevated region. The land or an area of land lying above the level where water flows or where flooding occurs. In my study area the features are 6.58sq km. In some places the area is covered by sand and silt which is poorly cultivated.

Pediplen

The pediplen areas are founded by southern side of the pattukottai area center portions are founded in the features. These features are mainly for agriculture activities. The extensive slightly inclined denudation plain, relative to the mechanism of the formation of pediplena there is no unanimous opinion. It is considered that the main and necessary condition of forming pediplena is the long absence of the motions, which create inclines, and the fixed attitude of the basis of denudation, which determines the descending development of relief and leveling off under any climatic conditions, this area cultivation is more. The features are founded by 56.01 sq km.

Natural vegetation.

Landforms of deltaic region include natural levees bordering river channel and backed by low lying swampy or flooded depressions in the lower part of the river valleys. Levee deposits are among the coarser deposits of the over bank environments. They are the reflection of the proximity to active channels typically ranging from sands through silty sands to silty clays. In that rapid interbedding of course with fine sediments is one of the most characteristic features of levee deposits. The levees are mainly for seen in the meandering courses of the rivers. The natural levees are seen in the north and south of the Coleroon, Cauvery and Vennar, Vellar river basins. Now a day's most of these levees are used for active cultivation.

Coastal plain.

The Coastal plain areas are mainly for Pattukottai taluk of the southern part. The taluk is mainly founded in younger coastal plain and older coastal plain deep areas are founded. Younger coastal plain areas are small size of the area. Older coastal plain areas are large size of the area. The areas are mainly for present day sea levels were also observed in the study area, indicating the higher sea levels in the geological past. These sediments are mainly composed of sand, silt and clay in which the sand content nearly constitutes 60% of the total.

Mud flat

In the study are the Mud flat areas are founded in pattukottai taluk of the coastal area. The fine inorganic material and the organic debris being deposited along the coast river head etc are

called as mud flat. The grain size of the deposits mainly fine in nature with silt, shells etc. Davies [2] the mud flat is normally located adjoining to the area. The study area shows six sets of mud flats with a total area of 1.38km^2. It remains to be constant. In the study area, mud flat regions are found to be of swampy region and more or less permanently filled in with tidal water because of its shallowness. Mangrows debris and high organic wastes are the source of sediment constituents of this area. Fine silts and mud are increasing towards sea word side. This area cultivation is marshy type of vegetation example by groundnut, coconut and others.

Salt flat

Generally these features are founded to south eastern side of the study area. The salt flat areas are 15km ^{2} extended in the area. This feature is mainly founded in coastal side of the feature. In my study area southern side is coastal areas are situated. So that places salt flat areas are founded. Salt flat areas are salt left by the evaporation of a body of salt water. An extensive level tract located with salt deposits left by evaporation of rising ground water or a temporary body of surface water. This area cultivated is poorly.

(Table 4) Physiographic Units Interpretation from IRS-P6 Satellite Imagery

Physiographic units	Tone	Size	Shape	Texture	Pattern	Association
Alluvial Plain	Dark Red, reddish pink	varying	Irregular	Fine	Linear and distinct pattern	Sandy plain to places of paddy, sugarcane, and groundnut
Generally undulating sandy plain	Pink brown shade	varying	Irregular	Fine to medium	Irregular	Sandy plain to the places of vegetation
Upland	Gresh white	similar	Square	Coarse to medium	similar	Area of scrub lands
Pedi plan	Pale blusih pink	similar	Square	Medium to smooth or fine	Similar	Irrigated and cultivated land
Coastal plain	Dark bluish and white	varying	Irregular	Fine	similar	Irrigated and sand
Mud flat	Light grey	varying	Irregular	variable	similar	Irrigated and clay of forest land
Salt flat	Dark yellow with blusidh	varying	variable	Fine	similar	Irrigated and salt land
Low lying lands	Greyish	varying	Irregular	Fine to red	similar	Sandy plain and cultivated by vegetables
Natural vegetation	Dark Red	varying	Irregular	Fine to red	Distinct pattern and canals	Different type of vegetation

(Table 5) Soil Types and Land Use pattern in Different Physiographic Units: Interpreted from Aerial Photos.

Physiographic units	Soil Type	Tone	Texture	Pattern	Association	Cultivation	Cropping pattern
Alluvial Plain	Sand,silt and clay	Dark	Fine	Irregular	Alluvial sediments deposit by river and stream	Very strong	Paddy,pulses, oilseeds, groundnut,cotton coconut and sugarcane.
Generaly undulating sandy plain	Sand,silt and clay	light	Fine	Irregular	Eroded and deposited by local streams	strong	Paddy, groundnut, sugarcane.
Upland	Sand and silt	light	Coarse to medium	Similar	Coarse sands associated with silt	poor	Scrub lands, grasses and trees
Pedi plan	Sand, and clay	Light to moderate	medium	Similar	Irrigated of the agricultural land	Moderate to strong	Paddy,cholam,cumbu, pulses, oilseeds, cotton, sugarcane
Coastal plain	Sand, and silt	Moderate to dark	Fine	Regular	Sands associated with silt	poor	Salt lands, and Trees,
Mud flat	Sand, clayey	Light to moderate	similar	Regular	Irrigated and deposited river	poor	Trees, and vegetables
Salt flat	Sand and silt	Fine	Variable	Dispersed	Sand, silt	poor	Trees and salt land
Low lying lands	Sand, silt Light and Clayey soil	Light	Medium	Regular	Sands, silt and clay association	Moderate to poor	Pulses, groundnut and cotton
Natural vegetation	Sand, silt and clay	Dark	Fine	Dispersed	Sand, silt	Moderate	Vegetation crops

CONCLUSION

The major part of this study area is covered by the recent alluvial Plains and which are all intensively cultivated. The area is permanently of the agriculture region. Thanjavur district is the Rice bowl of Tamil Nadu because of single piece of land also agriculture activities. Many agriculture crops are cultivated in this region. Mainly this area water resources and climates are suitable for very good condition. So the agricultural production is very high. Most of the peoples are directly are indirectly related to agriculture purposes. The district of the population also very high because of plain area topography. Recently some agriculture areas are transformed to settlements. The study highlight is mainly for the soil types and land use patterns. The soils are suitable for agricultural activities. The soil is mainly for 3 types and good soil

content of the study area. So the agricultural activities are well developed and suitable for climate of the study area.

REFERENCES

[1] Ahuja, R.L.J. *Indian society of remote sensing*. **1992**,Vol. 20:105-120.
[2] Davis.J and Freitas.F. physical and chemical methods of soil and water analysis, soils Bulletin 10. Rome: Food and Agriculture organization of the united Nations,**1972**.
[3] Kumar, Ashok, and Sanjay Kumar Srivastava, *Journal of Indian society of Remote sensing*, **1991**,vol. 19:205-215.
[4] Fabos, J.G.. Land Use planning: Global to Local challenge. Chapman and hall, New York,**1991**.
[5] Fitz, Patrick, E.A. Soils. Longman, New York,**1983.**
[6] Lille sand**,** keieper Remote sensing and Image Interpretation, John Wiley 7 Sons, New York,**1979**.
[7] Saha, S.K., Singh, *B. M. J. of Indian soc. of remote sensing*, **1991**, vol.19:19:67-76