IMPACT: International Journal of Research in Humanities, Arts and Literature (IMPACT: IJRHAL)
ISSN (P): 2347-4564; ISSN (E): 2321-8878
Vol. 6, Issue 7, Jul 2018, 355-370

LANDSCAPE OF KANNUR: A GEOMORPHOLOGICAL APPRAISAL

T. K. Prasad
Assistant Professor, Department of Geography, Government College,
Kariavattom, Thiruvananthapuram, Kerala, India

Received: 22 Jul 2018 **Accepted: 26 Jul 2018** **Published: 31 Jul 2018**

ABSTRACT

Geomorphology is the study of landforms and the analysis of processes that shape them. The most significant fact about the earth surface is that each area is unique and has its own assemblage of bio-physical setting. Since the combination of landforms and geomorphic processes varies from one region to the other, a proper understanding of them is essential for planning and development. Kannur is one of the fourteen districts of Kerala located in its northern part. It is characterized with diversified surface relief and distinctive geomorphic processes. The land undulates from steep slopes of Western Ghats in the east to the seashore in the west having a series of hills and valleys intersected by streams and rivers. Elevation ranges from 10 to 1800 meters. The geological formations in the district range from Precambrian to recent age. Kannur district is endowed with a well- developed drainage system. The district has a humid climate with an oppressive hot season from March to the end of May. Physical conditions are most ideal for insitu weathering and laterization. Isolated lateritic mesas rise abruptly all along the midlands of the district. Landscape possesses innumerable permutation combinations and their arrangement over the space is a basic domain of geographical research. The present study is intended to perceive the configuration of landforms in the study area from a geomorphological standpoint. This Paper is one of the outcomes of the Minor Research Project of the author, funded by ICSSR, New Delhi.

KEYWORDS: *Geomorphology, Landforms, Landscape Analysis, Laterites, Laterization*

INTRODUCTION

Landforms are natural irregularities on the earth surface. Geomorphology is the study of landforms and the analysis of processes that shape them. The most significant fact about the earth surface is that each area is unique and has its own assemblage of bio-physical setting. Socio-economic as well as cultural characteristics of man is an outcome of the physical setting of the region and his interaction with them. In fact, it is this myriad combination that shapes the status of a region in the economic fabric. Man is basically a terrestrial animal. The ever-increasing demand for food and space exerts more and more pressure on the land resource. The era calls upon an optimal growth of the human economy through sustainable utilization of natural resources. Since the combination of landforms and geomorphic processes varies from one region to the other, a proper understanding of them is essential for planning and development. Land possesses innumerable permutation combinations and their arrangement over the space is a matter of great importance for the advancement and sustenance of human society. This spatial variation or areal differentiation is the basic domain of geographical research. The present study is intended to examine the configuration of landforms in the study area from a geomorphologic standpoint.

THE STUDY AREA

Kannur is one of the fourteen districts of Kerala located in its northern part. It lies between 11° 40'N to 12° 48' N latitudes and 75° 10'E to 75° 57'E longitude (Figure 1). The district is bounded by the Ghat section of Coorg district of Karnataka State in the east, Kozhikode and Wayanad district in the south, Lakshadweep Sea in the west and Kasaragod, the northernmost district of Kerala, in the north. The total area of the district is 2966 sq. km. According to Census 2011, the total population of the district is 25, 23,003. The total number of male population is 11,81,446 and female is 13,41,557. The district registered a decadal growth rate of 4.84% between 2001and 2011. The study area is characterized with a sound agricultural base. Paddy, coconut, arecanut, cashew, and rubber are the major crops in the district. The area under rubber is increasing at an alarming rate in the last few years (Prasad, 2013). Due to the rapid decline of paddy fields and the occupational migration to other remunerative ventures, the number of agricultural laborers in traditional cultivation sectors has been steadily decreasing.

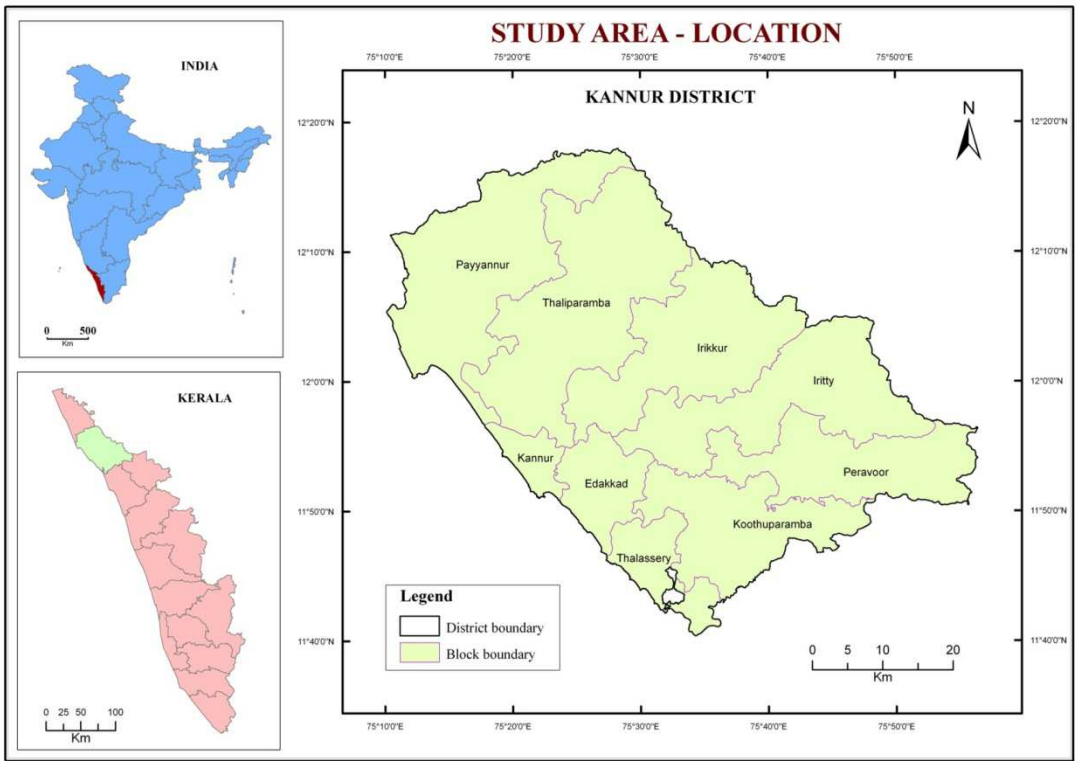


Figure 1

Like other districts of the State, Kannur also is rich in its plant life with different types of forests along the eastern part, plantation crops of the hilly region and the Midlands and other crops of the coastal and Midland region. The district has a humid climate with an oppressive hot season from March to the end of May. This is followed by Southwest monsoon which continues till the end of September. October and November form the post-monsoon or retreating monsoon season. November to March may be called the cool season.

METHODOLOGY

A detailed portrayal of the spatial distribution of various landforms and land uses were collected from the topographical maps. SOI Toposheets of 1:50,000 scales covering the study area were used for preparing base maps. The trends in land use pattern and land system are compared with satellite imageries. Since the study requires frequent field visit and ground survey, potentials of GPS have utilized effectively. Concepts and methods of terrain analysis have been examined through literature review. Land forms of the study area are classified into different landscape units based its bio-physical setting. As there exist spatial variations in the regional landforms and geomorphologic processes in the district, a detailed geomorphologic analysis has carried out. They are examined on the grounds of available literatures as well as cartographic techniques based on field experiences. Arc GIS 10.3 is used for spatial analysis and cartographic presentation.

RESULTS AND DISCUSSIONS

The study area is characterized with diversified surface relief. Elevation ranges from 10 to 1800 metres. The land undulates from steep slopes of Western Ghats in the east to the seashore in the west having a series of hills and valleys intersected by streams and rivers. Topographically the district can be divided into coastal, Midland and hilly upland regions running more or less parallel to the coast along the entire length of the district. In order to examine the salient features of the landscape and geomorphologic processes that shaped/shape them, it is important to have a sound back up on geology, soil, and drainage of the region.

GEOLOGY

The geological formations in the district are of Archaean to recent age (Narayanaswamy 2004). Archaean formation comprises mainly of gneisses and charnockites. Gneiss predominates the geological structure of the study area. There are two varieties of gneiss found in the region namely Biotite Hornblende gneiss and Hornblende gniess. Biotite Horn blende gneiss are found extensively in the midland region of the district which extends upto the southeastern hilly tracts also. It covers the regions of Thaliparamba, Sreekandapuram, Kolachery, Chavassery, Kanichar, Kolayad and Kottiyoor. The southwestern coastal plain of the study area covering Thalassery, Chockli, Patiam, Panoor and Thrippangottoor are under Hornblende gneiss. Charnockites beds are found extensively in the northeastern part of the district. There are three belts of charnockites found in the study area. One of it passes through the northeastern part of the Payyannur block through Pulingom, Peringom, Vayakkara upto Alakkode. Another small belt covers the eastern part of Iritty and Peravoor blocks mainly in the regions of Aralam and Ayyankunnu. The third belt of charnockites is along the southern part of Koothuparamba block covering the regions of Cheruvanchery and Thrippangottoor (Figure 2).

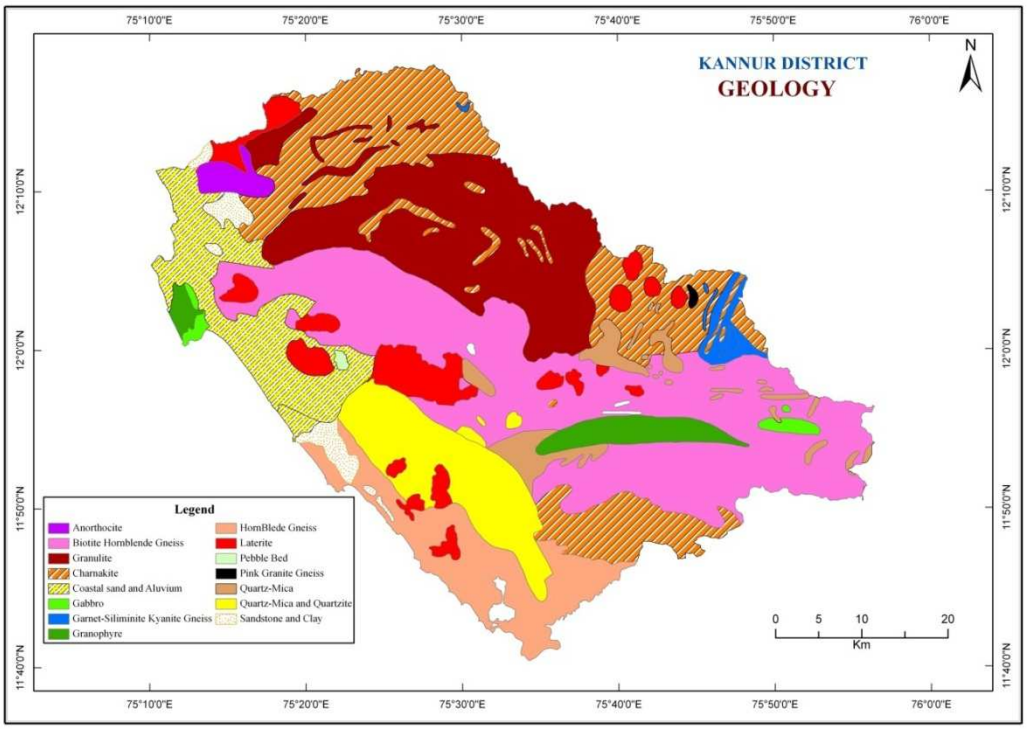


Figure 2

Granulite formations are found in the eastern part of Thaliparamba and Irikkur blocks. The stretch of Granulite passes through Pariyaram, Kooveri, Naduvil, Vellad, Eruvessi, Payyavoor, Nuchiad, and Padiyoor regions. A small patch of Anorthocite is found north of Payyannur, mainly in Eramom, Kankol and Velloor regions. Granophyres are seen in two regions mainly. The first is along Ramanthali-Ezhimala region. The other is in the eastern part of Iritty block i.e., in Chavassery-Muzhakkunnu region. Isolated Patches of Quartz-mica are seen in Payam, Kannavam and Koodali. In Ramanthali and north of Kunhimangalam a belt of Anorthocite is found. Geologically, Kannur coast region is of recent bed coastal alluvium. In the northern part of the coast, Tertiary or Quaternary sediments are found in association with coastal alluvium. The belt sprawls over Kannur, Azhikode, Kalliassery, Cherukunnu and Kunhimangalam regions. River alluvium and valley fill materials comprising talus and screen are found in coastal belts and river beds. Tertiary sedimentary formations like sandstone, ball clay, lignite and carbonaceous clay occur in a number of places in the coastal belt of the District. Recent unconsolidated formations include sandstone and clay found in two patches mainly, Chirackal-Puzhathi and Kankol-Peralam regions. Residual laterite of sub-recent age occurs as a thick blanket over the crystalline and sedimentary formation and is the major litho unit of the coastal area. Laterite cappings are found extensively over the midland hillocks in Peringom, Panappuzha, Kadannappalli, Thaliparamba, Kurumathoor, Chepparamba, Irikkur, Kuttiattoor and Ulickal regions.

SOIL TYPES

The soil is the basic natural resources that support all life on earth's surface. Its thickness varies from a few centimeters to a few meters on earth's surface, but it takes millions of years for its formation. Knowledge of soils is fundamental to well being of the present generation and the prosperity to come. The soil is one of the major resources of land which determines the use potential. There are mainly four types of soil observed in the district (Figure 3).

- **Coastal soil** – The coastal soil is seen in the western coastal tract of the district and shares an area of 7.1% of the total area of the district (Figure 2.8). The coastal plain is characterized by secondary soils, which are sandy and sterile with poor water holding capacity. The marshy soil in the coastal plain supports mangrove vegetation and is found at the estuaries and backwater extending inland along their courses. The soil is composed of recent deposits predominantly marine with some fluvial sediment along the coastline. These soils are immature with high sand content.
- **Riverine alluvium** – This type of soil is found along river valleys which are flowing across the extensive fields of lateritic soils. It spreads over 11.2% area of the district. It is found extensively along the lower basin of Valapatanam River, Kuppam River, Ancharakkandy River and Ponniyam River. The soil is very deep with the surface texture ranging from sandy loam to clay. It is fertile, with water holding capacity and plant nutrients which are regularly replenished during floods.

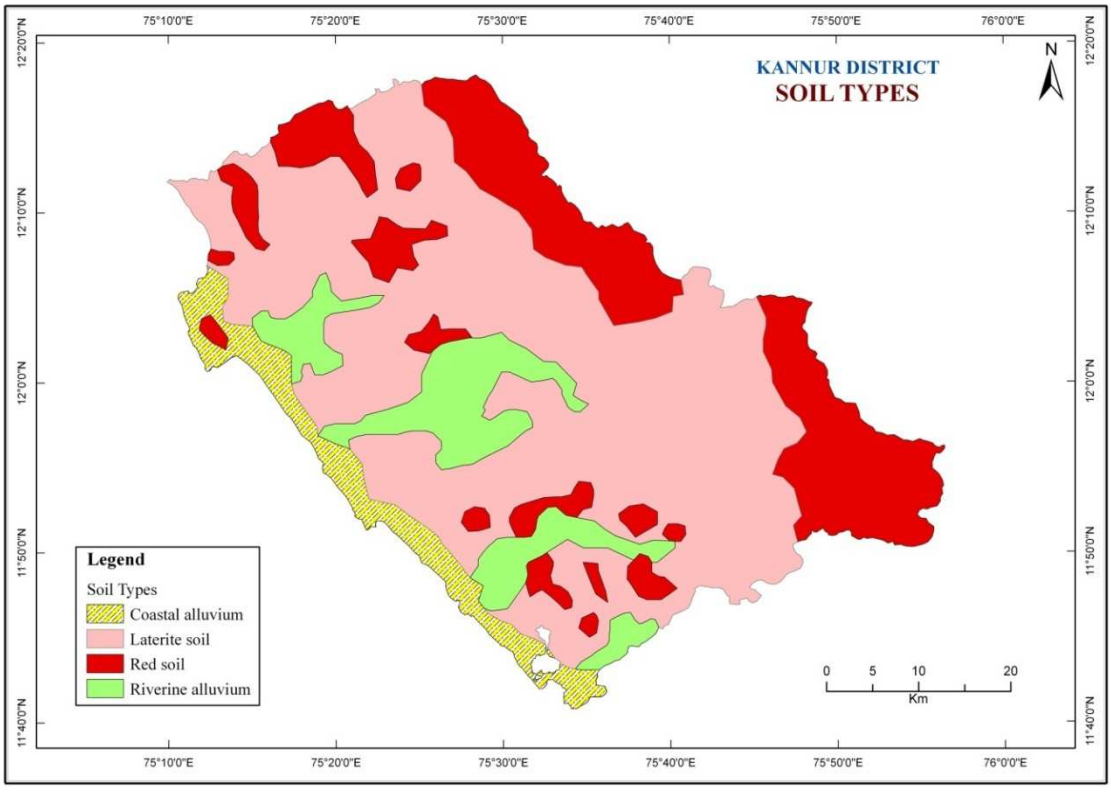


Figure 3

- **Red Soil** – These soils are found mainly in the eastern hilly areas of the district and share 19.3% of the total area. They are generally acidic and are with loam to silty-loam texture. These are also found as isolated patches in the valleys between undulating topography in the Midlands and in the low-lying areas of the coastal strip in the district
- **Lateritic Soil** – Lateritic soil pre-dominates the study area and shares 62.7% of the total area of the district. It is a peculiar weathered product derived under humid tropical conditions. It is found extensively along the midland region of the study area and lower slopes of eastern hilly areas.

DRAINAGE

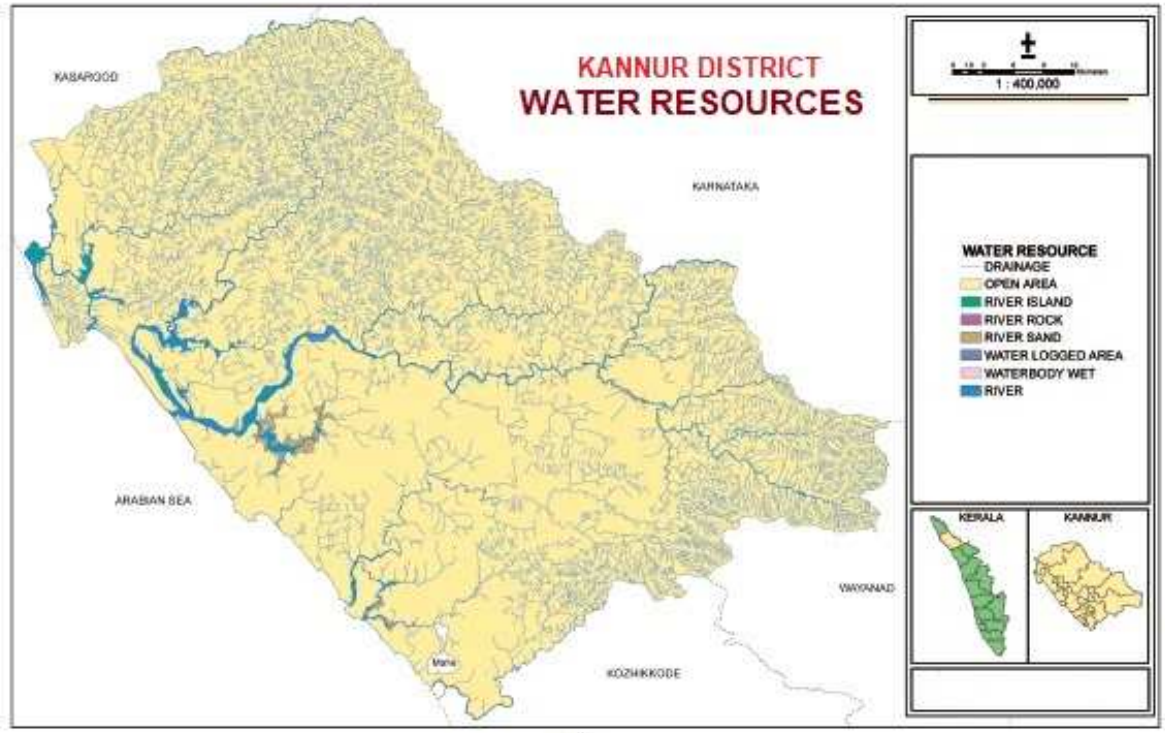
Kannur district is endowed with a well-developed drainage system. Out of 44 major rivers in Kerala, 7 are in Kannur district. They are Ramapuram River, Kuppam River, Peruvamba River, Valapatanam River, Ancharakandy River, Ponniyam River and Mahe River (Table 1, Figure 4). All of them are perennial in nature.

Table 1: Kannur District – Major Rivers

Sl No	Name of River	Place of Origin	Length in km		Basin Area in sq.km.
			Total	Navigable	
1	Valapatanam River	Brahmagiri Ghats	113	45	1191
2	Kuppam River	Padinalkad Forest	71	24	536
3	Ancharakandy River	Kannoth forests	64	27	113
4	Mahe River	Wayanad Ghats	55	24	233
5	Peruvamba River	Eramom-Kuttoor Ghat	51	17	287
6	Ponniyam River	Kannoth Forests	29	22	108
7	Ramapuram River	Pariyaram village	19	6	92

Valapattanam River: It is the largest River in the Kannur District. Valapatanam River originates from the Brahmagiri of the Western Ghats in Coorg district, Karnataka at an altitude of 900-1350m above mean sea level. This river drains into the Arabian Sea along with Kuppam river near Azheekal. After flowing through Karnataka for about 19 km, it passes through lritty Irrikur, Kalliasseri and Valapatanam villages. Major tributaries of the river are Sreekandapuram River, Valiyapuzha, Barapole, Venipuzha and the Aralampuzha. The total drainage area of the river basin is 1867 sq.km of which 564 sq.km lie in Kamataka.

Kuppam River: This River is also known as *Mattool River*. It originates from the Padinalkad Ghat reserve forest in the Coorg district of Karnataka State and flows westward through Thadikkadav, Kuveri, Thaliparamba and joins the Valapatanam River. It has a total length of 71 km and a basin area of 536 sq.km. lt flows through Kannur and Taliparamba taluks. Before it exits into the Arabian Sea, it joins with the Valapattanam River from a place called Mattool near Azheekal. The main tributaries of this river are Pakkatupuzha, Alakuttathode, Kuttilolpuzha, Mukkuttathodu and Chiriyathode rivers.



Source: *Kerala State land use board, Tvpm (1995)*

Figure 4

Anjarakandy River: The Ancharakandy River originates from Kannoth Forests in Thalassery Taluk. The river has a total length of 64 km and passes through Kannavam, Kadamkunnu, and Vemmanal before it joins the Lakshdweep Sea. It has a total basin area of 113 sq. km. The major tributaries of this river include Kappu Thodu and Idumba Thode. Navigable length of the river is 46 km. spread over nearly 200 acres; the cinnamon valley on the banks of the Anjarakandy river is the largest cinnamon plantation.

Mahe River: The Mahe River is also known as The Mayyazhi Puzha. It originates from the Wayanad Ghats and passes through Mananthawadi Taluk of Wayanad district, Vadakara Taluk of Kozhikode district and Thalassery Taluk before it joins the Lakshadweep sea at Mahe about 6 km south of Thalassery. It has a total length of 55 km and a basin area of 233 sq.km. It is located in Mahe belonging to Pondicherry UT. It flows through Naripetta, Vanimel, lyyancode, Bhekiyad, lringannore, Tripangathur, Peringalam, Edacheriy, Kacheri, Eramala, Kariyad, Olavilam, Kunnumakkara, Azhiyoor and Mahe before falling into the Arabian sea about 6 km south of Thalasseri.

Perumba River: The River rises from Eramom-Kuttoor ghat section of Alakkode region. The head stream is known as Panappuzha. Another head stream Kallankulam thode rises from Ezhilamvayal. Both the head streams join at Korom and form the main stream of Peruvamba. The river joins the Arabian Sea very near to Payyannur town. It has a total length of 51 km. and a basin area of 287 sq km. It flows through Payyanur region in Kannur district. A tributary of Perumba which is called as Vannathi River flows through the Mathamangalam.

Ponniyam River: The River rises from Kannoth Reserved Forest region. The total length of the river is 29 km and has a basin area of 108 sq. km. As the river drains to Lakshadweep Sea very near to Thalassery town, it is also called as Thalassery River. It is also known as Tellicherry River or Eranjolipuzha.

It originates in the Kannoth forest of the Western Ghats. This is one of the smallest rivers in the region having a length of 28 km with a drainage area of the 132 sq.km.

Ramapuram River: This small river rises from a hillock near Pariyaram and flows through Ezhilode and Kunhimangalam and joins the Arabian Sea a little north of Madayi. The river has a total length of 19 km and a basin area of 92 sq km.

LANDSCAPE UNITS OF KANNUR

The study area is endowed with diversified local relief. Though its relief can be broadly classified into three units namely highland, Midland and lowland, the study area possesses six distinct landscape units as given in Table 2. A briefing on the geomorphologic setting of these landscape units has given below.

Eastern Highland Region

Eastern hilly region is part of the Western Ghats. It is actually the part of plateau scarp of the Deccan shield and has a pronounced effect on the terrain character of the district. The elevation is generally above 600m. The terrain is rough and undulating with numerous hills and valleys. This landscape unit comprises the villages of Peringom, Cherupuzha, Udayagiri,, Alakkode, Naduvil, Northern Eruvessi, Payyavoor, Ulikkal, Ayyankunnu, Aaralam, Peravoor, Kelakam, Eastern side of Kolayad and Kottiyoor. The eastern highland region is highly rugged (Figure 5 and Figure 6). It comprises of 21.4% of the total area of the district (Table 2.1). The average elevation the region is 1100 m above mean sea level. Elappeedika in Peravoor block is the highest point in the district (1724 m). Kanmadapara (1396 m.), Kanhirakkoli (1386 m.) and Vaithal Mala(1372 m.) are the highest peaks in this region.

Landscape development in the fringe of Eastern highlands is associated with scarp retreat along the structurally weaker planes like lineaments, fractures, foliations, etc. (Chattopadyay, 1995, Soman 2004) The highland unit, as the source area of all the rivers of the study area, plays a very important geomorphic, ecological, economic and cultural role to the region. Soils on the hill tops and side slopes are generally deep and gravelly clay loam in texture developed over weathered charnockite or gneiss and support a wide variety of crops like rubber, cashew, coconut, pepper etc. as well as and different types of forests. Hills have very steep slopes towards the west. The eastern hills are generally devoid of laterites. It is a structural cum denudational landform and the hilly tracts consist of highly rugged terrains. This unit is characterized by steep slopes, deep valleys, scarp faces, elongated ridges and some table land surfaces. The eastern high lands are responsible for the high and steady rainfall in the district. The abrupt rise of the Ghats from 100 m upward with precipitous slope is a characteristic feature of the topography of the district that controls hydrology, climate, land use, infrastructural development and settlement distribution.

Denudational Hill Slope

Denudational hill slope is the physiographic unit which founds adjoining to the eastern hills and is sprawling as two belts in north and south. The northern belt comprises the central part of Peringom Vayakkara, and southern parts of alakkod and Chapparappadav. The southern segment of this landscape unit is comparatively broader. It includes Eastern parts of Sreekandapuram, Padiyoor, Keezhoor Chavasseri, Thillankeri, Muzhakkunnu, Western parts of Kolayad. It has an area of 17.3% of the total area of the district. Rugged terrains are mostly on hard rocks and radial drainages usually characterize the areas affected by granite intrusions. Structural control is well evident in drainage development. The slopes

are undergoing intensive erosion and in many places bed rock is exposed. Analysis of valley configuration, particularly the valley wall, indicates topographic rejuvenation, valley incision and scarp retreat along the headwaters (Chattopadyay, 2004). In fact, scarp retreat and resultant Sedimentation along the foot slope are the principal geomorphic process that shaped this landscape in Kannur.

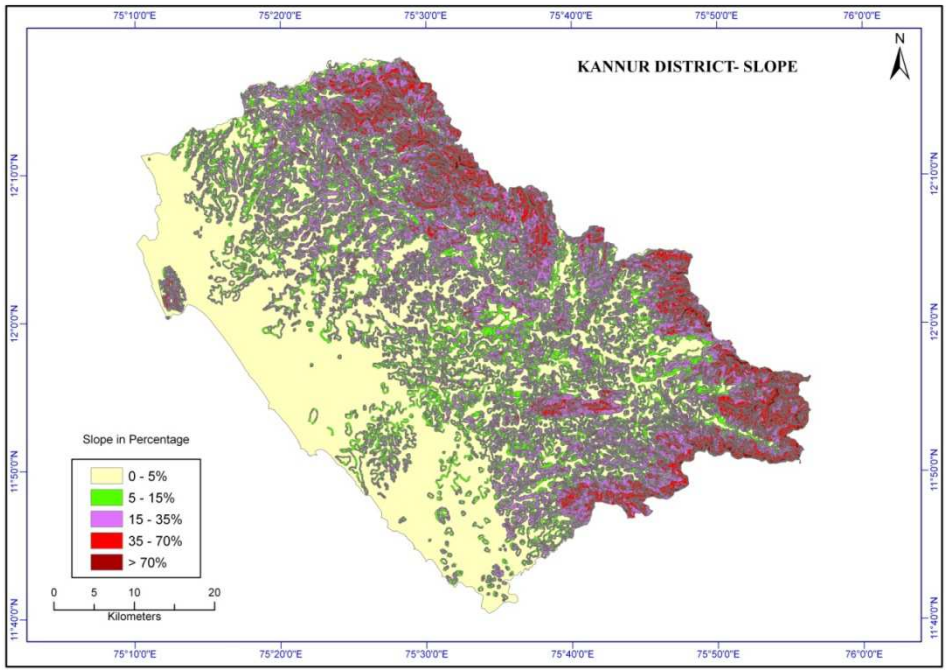


Figure 5

The central Undulatory Terrain Comprising the Midland Region

Midland region forms the largest landscape unit of the study area. It shares 38.7% of the total area of the district. It is actually upland with isolated hillocks and river valleys. This zone stretches from the northern end to the southern tip of the district. The landforms are characterized by lateritic mesa, mounds, slopes and ridges. The soil is a lateritic, gravelly loam type. This region lies immediately to the east of the coastal strip, rising from 40 to 300 m altitude. The hilly tract along the eastern part of the district constitutes the highland region and is highly rugged. Most of the valleys are gorge like and V shaped cut by youthful streams. Development of badland topography along the margins of the valley is a common feature observed in some parts of the district.

With a number of hills and dales, the midland topography presents an undulating surface gradually ascending and merging with the slopes of the eastern high lands. Gravelly clay loam soils are seen developed over laterite or the underlying disintegrated genesis. Along saddles and gently sloping plains of this region, hard laterite, either quarriable or non-quarriable type is seen to occur extensively. Side slopes and foot hills with shallow to moderately deep soils are used for cropping and the hard laterite patches are left unutilised. The villages of Karivelloor, Peralam, Eramam Kuttoor, Kadannappali, Paanappuzha, Pariyaaram, Kurumaathoor, Thaliparambu, Kolacheri, Mayyil, Maklappattam, Sreekandapuram, Koodali, Kuttiyaattoor, Anjarakkandi, Keezhattoor, Mattannur, munderi, Naarath, Mangattidam, Koothuparambu, Kottayam, Chittariparambu, Maaloor, Thillankeri, Thrippangottoor, and Peringalam are endowed with this landscape features.

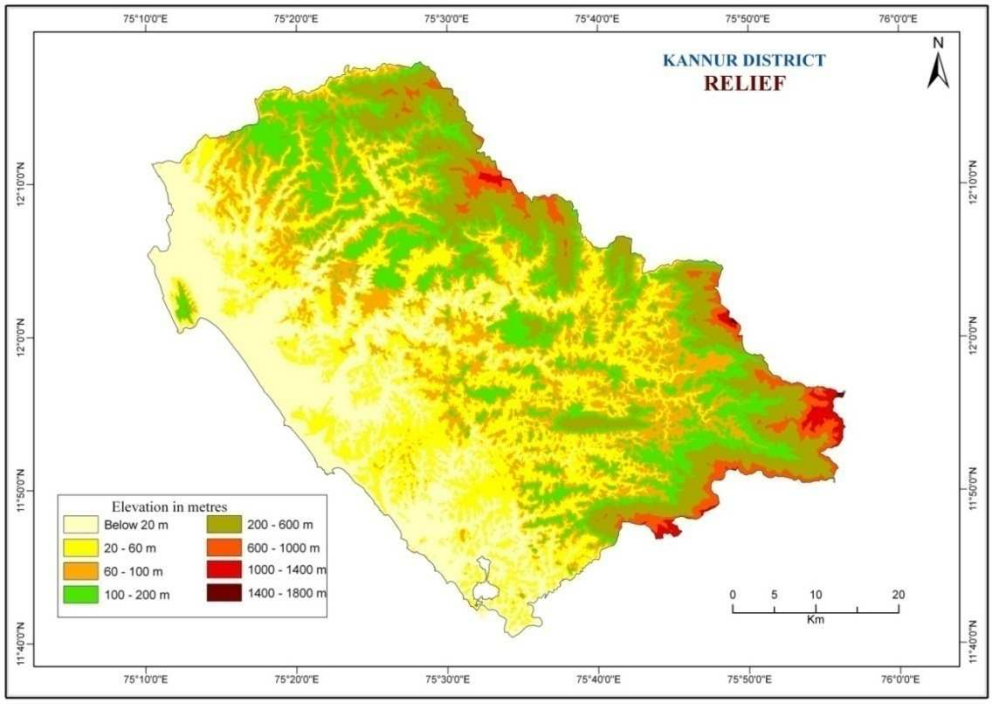


Figure 6

Midland region forms a plateau land at certain places covered by a thick cover of laterite. Elevation of this region displays remnants of plantation surfaces as well. Two former plantation surfaces with fairly extensive remnants are characterized by laterite cappings (Narayana swami 2004). Vestiges of still older surfaces are identifiable at higher altitudes. The gently sloping and uneven terrain of Midland has a predominance of lateritization, and high structural control on drainage pattern of the region. These two topographic characteristics have, together, imposed certain restrictions on the development of the fluvial landscape (Chatopadhyay). Flat-bottomed valleys, flanked by moderate to steep side-slopes, are important geomorphic features in the district. These valleys owe their origin partly to slope wash and scarp retreat than to normal fluvial action. Another notable feature of the region is that some of the river valleys are found to be a misfit. Some of the tributaries of Valapatanam River, Anjarakkandy River, and Kuppam River drain through misfit (over fit) valleys. The streams are flowing through a valley, which is much wider than their flowage and possibly not carved out by the present river system.

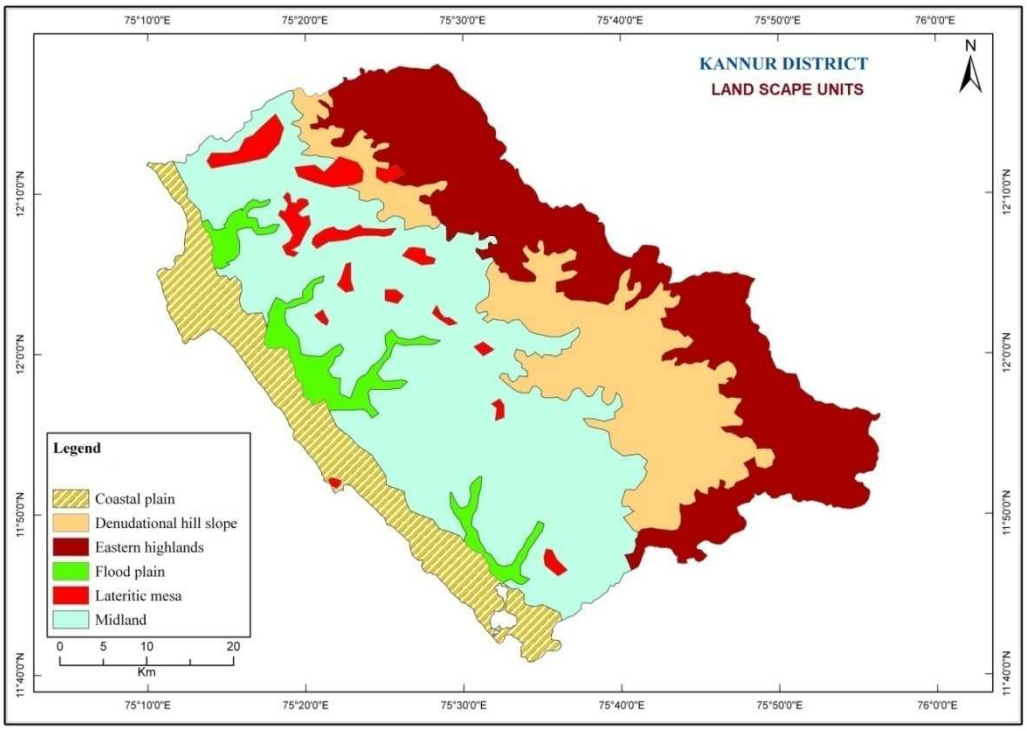


Figure 7

Table 2: Kannur District - landscape Units

Sl. No	Geomorphologic unit	Area in sq km	Area in % Percentage
1	Eastern highland region	636	21.4
2	Denudation hill slope	514	17.3
3	The central adulatory terrain comprising the midland region	1146	38.7
4	Lateritic mesa region	127	4.3
5	Flood plains	122	4.1
6	The coastal plains and lowlands	421	14.2
Total		**2966**	**100**

Lateritic Mesa Region

Kannur is a type locality of laterites. Laterite is a typical rock formation found commonly in the tropical monsoon regions as a capping over the hillocks. Laterites are residual sedimentary rocks, reddish or brownish colored, comparatively soft rocks, containing the high degree of porosity and are carrying vermiform structures (Thomas 1974, Maclaren, 1906 and Fermor, 1911). Laterite stone has been used as building material in Malabaar for centuries. In vernacular, it is called as “chenkallu”, or “vettukallu”. Laterite has immense economic value as it contains the ores of iron, aluminum and manganese.

Lateritic mesas at different altitudinal levels below 250 m are conspicuous landform features in the district. Lateritic mesas share about 4.3% of the total area of the study area. This lateritic landscape is primarily a subdued terrain, evolved through pedimentation, lateritisation and parallel slope retreat, valley formation and expansion of gradational plain (Chattopadhyay 2004). Isolated Lateritic Mesas rise abruptly all along the Midlands. The principal geological mechanism

involved in this near-enplaned surface is a horizontal and vertical movement of water and chemical alteration of the parent rocks. Most of the isolated hillocks found in the midland region of the district are covered by a thick cover of the laterite. The general pattern of lateritic profile is similar at all locations, although the individual units of the profiles are not uniform. In the ascending order, the parent rock passes through a zone of the partly altered bedrock, followed by a zone of lithomarge, blocky laterite and vermicular laterite. The vermicular laterite represents the uppermost zone of Laterization, which may or may not have a later formed cover of lateritic gravel and/ or a humus zone.

The highly undulating eastern and southeastern parts of the district have undergone laterization and in a number of places hard crust – mesa-like lateritic landforms have been developed. Laterite profiles of the area generally show two units of vermiform structures which represent two spells of laterization process in pre and post Tertiary. (Narayanaswamy and Chattopadyay, 1996). Isolated but extensive table lands of laterites are found in Ezhimala, Maadayi, Mangad, Kankol, Alappadamba, Kottoor, Kadannappali, Pariyaaram, Kurumaathoor, Chepparamba, Mayyil, Malappattam, Urathoor, Mattannur and Paanoor.

Two types of laterite hills are seen in this region – laterite rock hills and laterite soil hills (Jayarajan 2004). The rock hills are covered by laterite rocks. The exposed laterite in contact with air is converted into hard black colored rocks having an uneven surface. According to Buchanan's (1801) description, 'it looks like the skin of a person suffering from skin disease'. Beneath this surface, upto a certain depth, the laterite stone continues. As it goes deeper, the laterite becomes soft. Beneath it is clay. Such laterite rock hills generally have flat top surface. Madayipara, Moorkhanparamba, Peruvalath paramba and Kalliattuparamba are examples.

Plant growth is possible only in spaces among the laterites where a little soil remains. Usually, the top surface is covered with grass, herbs, shrubs and some smaller trees. Madayipara is endowed with most rare species of flora and fauna (Balakrishnan, 2010). Rock pools and lakes are present on some of such hills Vadamukunda Pool at Maadayippara is an example. The laterite soil hill is comparatively at an early stage of metamorphosis in which the process of laterisation is not complete. There is no rocky structure. The top as well as lower layers, are formed of soil only. The surface consists of red laterite soil. After certain depth the soil becomes clayey. White clay remains at the bottom. On the surface of such hills, certain isolated blocks of laterite stones are also seen in some places. Pools are not seen on such hills. Water percolates to deeper layers at a faster rate. Such hillocks are present more towards the coastal area.

The terrain receives heavy rainfall during every monsoon season and is getting recharged year after year in the pore spaces of laterites. The high porosity of it enhances quick infiltration of rainwater. The peculiar vesicular structure is a favourable factor in the vertical infiltration of rain water to join groundwater reserve. But the lithomargic clay occurring in between the lateritic cap and underlying weathered bedrocks has a low permeability and prevents easy downward movement. This may facilitate retention of water in the pores of laterite for a long period. The richness of ground water in the region owes to the composition of Laterite in the landscape.

Laterite cappings are generally found as isolated but extensive plateaus or as mesas. Lateritic cappings over the erosional surface have played a significant role on the denudational processes (Prasad and Parthasarathy 2018). The top surfaces are flat to gently rolling with centripetal slope and no significant drainage line and the river valleys that normally follow the lineaments cutting across the laterite are narrow, steep sided but flat bottomed. The erosional intensity on these hard crust duricrusts is comparatively less. The process of valley formation in the laterite mesa region conforms more to

the scarp retreat or pediplanation than peneplanation (Narayanaswamy and Chattopadyay, 1996). Although the humid tropics are mainly dominated by peneplanation process the occurrence of hard crust laterites and the consequent edaphic arid situation has been conducive for scarp retreat. Moreover, soft clay layer underneath the hard laterites provides a favorable condition for the lateral widening of stream valleys and scarp retreat. Headward erosion of certain streams is another factor in shaping the mesas (Chattopadyay, 2004). Similar landscape features are also reported in the lateritic terrain of Australia also (Twidale, 1984)

- **Flood Plains**

Floodplains comprise 4.1% of total area of the district. They are found across the Midlands of the study area. Major rivers of the region like Valapatanam River, Kuppam River and Ancharakandy Rivers leave extensive flood plains in their lower course. This landscape unit gradually merges with the western coastal plain of the district. Kunjimangalam, Ezhom, Cherukunnu, Kalliasseri, Valapatanam, kolacheri, Munderi, Kathiroor, Mokeri and Panniyannur belongs to this category. Soil texture is loam, silty clay loam and clay. Black peat soil is recorded in some places. Waterlogging during the monsoon season is widely observed. Landform type includes old and new floodplains, levees, back swamps and saucer shaped basins. Paddy is the main crop. Coconut is also grown extensively. Reclamation of floodplains and valleys is common nowadays. Flooding is a major problem in these areas. Agricultural pollution is another major issue that warrants due attention.

Topographic expressions of fluvial rejuvenation are found in the study area. The erosive capacity of rivers may be increased as a result of the negative change in sea level at the mouth or due to tectonic upliftment in the upper catchment. Thus rejuvenated rivers deepen their valleys due to accelerated rate of vertical erosion. Hence, valley floor becomes dissected, and the old valley is transformed into a terrace. Certain terraces were built in Valapatanam River mainly. The lowlands are characterized by Riverine alluvium. Minor land forms like levees, back swamps loops, oxbow lake and saucer shaped basins are found in Floodplains. Most of the rivers are braided in the west and a number of riverine islands were created. Pamburuthi, Kolthuruthi, Dharmadom, Therlayi, Korlayi, Mayyil Thuruthu, Munambu kadav and Nambram Valiya Thuruthuetc are notable examples.

The Coastal Plains and Lowlands

The coastal plains occur as a narrow belt of alluvial deposits running parallel to the coast with a maximum width of about 15 km. The coastal belt of Kannur is relatively flat, teeming with paddy fields, groves of coconut trees, and heavily crisscrossed by a network of interconnected streams and rivers. Ramanthali, Maadayi, Maattool, Azhikkod, Pallikkunnu, Kannur, Edakkad, Kadamboor, muzhuppilangad, Dharmadam, Thalasseri and New Mahe areas fall into this landscape unit. They share an area of 14.2% of total area of the district. The coastal plain is wide in the northern part, especially around Ramanthali where it coincides with a sedimentary basin. Minor lateritic cliffs rising up to an elevation of 50 to 60 m. above mean sea level are found at Mahe, Thalassery, Payyanur and Barnassery coast. The Ezhimala peak (260 m.) with the characteristic north-south alignment is a distinct physiographic unit of the coastal plain of the study area. Minor cliffs of laterite generally rising to an elevation of 50 to 60 m above mean sea level are found at Mahe, Thalasserry, Pazhayangadi, Maadayi, Ettikkulam and Payyambalam coast.

It comprises narrow beaches interrupted by cliffs, promontories and rocky beds. The region has a maximum height of 7m in the east. The coastal zone in Kannur is not uniform; it exhibits distinct spatial differences in composition, morphology and surface features from north to south. Muzhuppilangad drive in Beach in South, Pazhayangadi Coast in the center and Ezhilamala- Ramanthali region in the north are the indicators of these spatial variations in coastal morphology. Characteristics of sea waves, tidal range and direction of littoral current are the main factors influencing the coastal processes. In addition to these, the rivers directly debouching into the sea have pronounced influence on coastal geomorphology, sediment distribution and beach character. Formation of offshore bars is a characteristic feature of northern parts of the coast. Changes in sea level, river courses and foundering of river mouths are noted in various parts of the district. The river mouths of Kupppam River, and Valapatanam River have interrupted and shifted many times. Raised river terraces, pebble beds and abrupt changes in river course at the mouth are the indicators of tectonic interruptions in the geomorphic history of the region.

CONCLUSIONS

Landscapes are spatially heterogeneous geographic areas characterized by diverse interacting entities. The most salient characteristics of landscape analysis are its emphasis on the relationship among pattern, process and scale, and its focus on broad-scale bio-physical issues. Though we are using the term land or landscape as its most simple sense, conceptually it is a complex entity. The role of physical factors like geology, topography, hydrology, soils, microclimates and flora and fauna are constantly on interaction under the influence of man's interference. This makes the land a holistic entity. It has physical, economic, biologic and spatial dimensions. The land is not only a resource, but also a resource base by itself. From an economic point of view, it is an inevitable factor of production. Biologically land is the basis for terrestrial biodiversity. It produces biomass which forms the energy for biotic materials. From the spatial context, it is the terrestrial space over which man lives and interacts. Thus the analysis of spatial variation in regional landforms and the various processes that shape them are of greater academic significance.

ACKNOWLEDGEMENTS

This Paper is one of the outcomes of Minor Research Project (2017-18) of the author entitled *Landscape Analysis and Sustainable Land use planning for Kannur Dt. In Kerala with Special Reference to Tourism - A Geo Spatial Approach*, funded by Indian Council for Social Science Research (ICSSR), New Delhi. The author is indebted to ICSSR for the financial assistance to carry out this study. Author is also thankful to Prof. Dr. G.R. Parthasarathy, Prof. and Head, Retd, Department of Geography, Madhurai Kamaraj University for academic support.

REFERENCES

1. ***Balakrishnan V.C etal, 2010,*** *Observations on The Flora Of Madayipara, A Midland Laterite Hill In Kannur District, Kerala,* ***Malabar Trogon,*** *Vol. 8 (2&3), pp. 14-20*
2. ***Buchanan, F., 1801, A Journey from Madras through the Countries Of Mysore, Canara And Malabar,*** *East-India CO. London. Vol. 2, pp. 436-460*
3. ***Chattopadhyay, Srikumar, 2004,*** *Land Forms of Kerala- An Overview. In Ravindrkumar, G.R. (Ed.),* ***Earth System Science and Natural Rsource Management,*** *Silver Jugilee Compendium, CESS, Thiruvananthapuram*

4. ***Chattopadhyay, Srikumar, 1995,*** *Terrain Analysis of Kerala- Concept, Methods and application; technical Monograph, STEC Government of Kerala, Thiruvananthapuram*
5. ***Fermor****, L. L, 1911, What Is Laterite?* ***Geol. Magazine,*** *48, pp. 454- 468, 507-516*
6. ***Jayarajan M****, 2004, Land Forms of Kerala- An Overview. In Ravindrkumar, G.R. (Ed.),* ***Earth System Science and Natural Rsource Management,*** *Silver Jugilee Compendium, CESS, Thiruvananthapuram Kerala State Landuse Board*
7. *Jayarajan M, 2004,* ***A Socio-Cultural And Ecological Study Of The Midland Laterite Hillocks Along Kavvayi River Basin,*** *Project Report, SEEK, Payyannur, Kerala*
8. *AR. Sona S, Landscape Maintenance and Practices a Sustainable Approach for Safeguarding the Future of Urban Landscapes, IMPACT: International Journal of Research in Engineering & Technology (IMPACT: IJRET), Volume 2, Issue 4, April 2014, pp. 5-12*
8. *Kerala State Landuse Board, 1995, Land Resources of Kerala, Government of Kerala, Trivandrum.*
9. *Maclaren, M., 1906, On The Origin Of Laterites,* ***Geol. Mag.*** *43, pp. 536-547.*
10. *Nair, K. M., 1995, Geological history and natural resources of lowlands of Kerala. In* ***Science and Technology for Development*** *(State Committee on Science, Technology and Environment, Government of Kerala, Thiruvananthapuram).*
11. *Narayanaswamy and Srikumar Chattopadyay, 1996, Lateritic Landscapes In Kannur District In Kerala,* ***Annals Of The National Association Of Geographers India,*** *Vol. XVI, No. 2.*
12. *Prasad T.K, 2013, Geographical analysis of changing land use pattern of Kannur district in Kerala with special reference to laterite mining,* ***Unpublished Ph D Thesis*** *MKU.*
13. *Prasad T. K. and Parthasarathy G.R, 2018, Effect of Laterite Mining on the Land Use of Midland Hillocks of Kannur District, Kerala - A Case Study",* ***International Journal of Science and Research (IJSR****), Volume 7 Issue 3, March 2018, 1454 - 1460, DOI: 10.21275/ART20181044.*
14. *Prasad T. K. and Parthasarathy G.R, 2018, Laterite and laterization- A Geomorphological Review",* ***International Journal of Science and Research (IJSR),*** *Volume 7 Issue 4, April 2018, 578-583, DOI: 10.21275/ART2018144.*
15. *Prasad T. K. and Parthasarathy G.R, 2018, Developmental strategies to Laterite mining areas- A geographical approach****", Indian Explorer of Social Science &Research,*** *Volume11 (2) 2017.*
16. *Soman K, 2004, Geology of Kerala, Geol. Soc. India, Bangalore, pp. 6-29,*
17. *Thomas M.F., 1974, Tropical Geomorphology, Focal Problem.* ***Geography****, Macmillan, London, p.332*