Analysis of the Rocky Coastal Geomorphology and Geo-chemical Aspects in Tropical Evergreen Rainforest of Uttara Kannada Coastal Districts, Western Sahyadri Range, India using Synthetic Aperture Radar (SAR) Data

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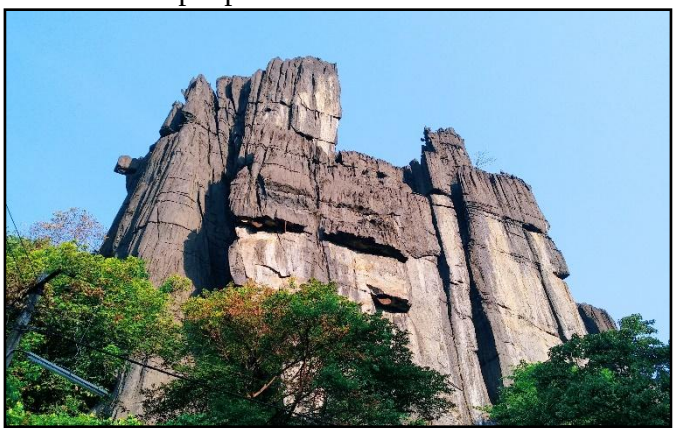
Abstract:

The coastal region of India is undergoing rapid land use changes, but little attention is paid to the implications of this change for rural community. At present it is very urgent need to assess the vulnerability level of coastal estuaries towards the control of land use and landscape change which is an important step for enhancing the view to discuss for the reduction of such vulnerability. The study area has been selected as Uttara Kannada coastal blocks for its tremendous beauty of rocky coastal geomorphology and the tropical rainforest region of Western Sahyadri range which is morphologically diversified with the coastal rocky features, coastal erosional and depositional features, characterized by mainly four rivers i.e. Kali river in north and Gangaveli, Aghnashini & Sharavati river in the south of Uttar Kannada. The shoreline configuration of north Kannada district is highly crenulated with the development of mature stage in coastal evolution at present. The shoreline is characterized by headlands, coves, bays, embayments, cliffs, beaches, tombolos, stacks and island with erosive basalts, dolerites, in situ lateritic sandstones and Limestones. The coastal features are also characterized by deformation of terraces, escarpments, vertical cliffs, basal sapping cave at different altitudes and various planation surfaces along the coastal front of Western Ghat hills. The main objective of the work is to assess and analyze the rocky coastal geomorphology of the area and to study the morphogenetic regions of Uttara Kannada coastal blocks with the geo-chemical appraisal of the study area. The morphodynamic changes of Uttara Kannada coast has been studied using Synthetic Aperture Radar (SAR) Data. The river water carries a large quantity of organic materials from the forest in the catchment area of the Western Ghats and deposits the same in the estuary. The morphogenetic region has been divided into zones using Peltier model with the help of temperature and rainfall which shows four types of morphogenetic zones i.e. Savannah, Boreal, Semi-Arid & Tropical Maritime. It is observed in the study that the constant churning and circulation of waters due to the flow of freshwater from one side & the tidal influx from the Arabian Sea oxygenates the water and circulates nutrients. The study also reveals that the local water quality of the river at Gokarna is affected due to the active rain-wash processes on the lateritic terrain during monsoon months along the shore fringe. Thus it is an imperative way to formulate appropriate measures to conserve the whole estuary landscape and its resource for sustainable development.

1. INTRODUCTION:

Uttar - Kannada is one of the biggest coastal districts of Karnataka State. The term "Canara" is said to have been used initially by the Portuguese and the Dutch people. Historians are of the view that a Dutch visitor by name Von Linschoten called the people of this area "Canarians"1(1583). The Portuguese called the territory as "Canara" which may have been derived from Charnataka or Karnataka referred to, by the Portuguese historian Faria Y. Souza. It is also said that, during 1619,when the Britishers established a factory at Bhatkhal, the then first Governor of this region Sir. Thomas Manroue called this area "Canara"2.Further when the Britishers acquired this territory from Tippu in 1799,they divided it into two separate districts: Northern Part was called northKanara and Southern region as South Canara.The government of Karnataka removed English nomenclature andnamed the district as Uttar Kannada from 31.01.1977, earlier during the 19th Century, north Kanara was under MadrasPresidency and then subsequently came under Bombay Presidency After independence, consequent upon, states re-organization the district was merged into Karnataka and it was then, popularly known as Karwar district.



Photograph No.1: Faulting Structure of Yana Cave

In the entire located area there are primary four rivers are situated Kali River, Aghanashini River, Gangavelli and Sharavati River. The coastal stretch of the area is about 160km from Karwar to Bhatkhal block of Uttara Kannada district of Karnataka.

Photograph No.2: Wind rose sampling in Honnavar Sea Beach

Some parts of the coast are subject to natural hazard ranging from cyclone and flooding to erosion and deposition. The accretion levels of some coasts are very high and eroded most of the sandy coast. People are displaced and their activities are affected by such hazard over the years. The primary activity of such peoples are fishing and cropping in the zone of the coast. Coastal sand dunes, sandy sea beach, rocky coastal landforms, saltmarsh, mangrove swamps, estuaries, limestone caves, the Sahyadri forest provide a particular set of habitats environment. The total area of the study area is divided into dry deciduous

forest, moist deciduous, tropical evergreen and coastal vegetation. The richness of biodiversity is the most important in the study area. There are so muchwildlifesanctuaries and national parks are situated.

The area is full of geomorphologically diversified area; many geomorphic features are developed in the area such as coastal geomorphology and upland geomorphology. Due to wave currents of the ArabianSea, there are developed notches, tombolo, wave cut platforms, sea arch, stack, stump,etc. And also, on the otherhand, the Deccan plateau have much more geomorphic features such as waterfalls, George, denudation plateau, hills and valleys etc.

1.1 Location of the Study Area:

The study area is located at the Middle Western part of Uttara Kannada District in Karnataka state. The extension of the study area is 74˚ 8’ 00” E, 14˚ 50’00” N and 74˚ 55’00” E, 15˚ 8’00”N to 74˚ 40’00”E, 13˚ 59’00”Nand 74˚35’00”E, 13˚ 39’00”N.The Geographical area is about 4812.535 sq.km. The western part of the study area bounded by the Arabian Sea. Eastern part of the area bounded by Dharwad District of Karnataka, and Sirsi block, Siddapur block of Uttara Kannada district. The northern part is bounded by Supa block and haliyal block of Uttara Kannada district and also the northwestern part of the study area is bounded by Goa state. The study area has six blocks Karwar, Ankola, Kumta, Honnavar, Bhatkhal, and Yallapur block. Karwar block is geographically more important because the main river Kali is situated in the block is bounded by western part is the Arabian Sea and the eastern part is hills and valleys the study points in this block is kali river estuary, Karwar beach, Angediva Island, kadle dam, and kali Nadi reservoir.The study area of Ankola block is Ankola beach, Gokarna beach, Om beach. The study area of Kumta block is Kumta beach, kadle beach, and Yana cave and

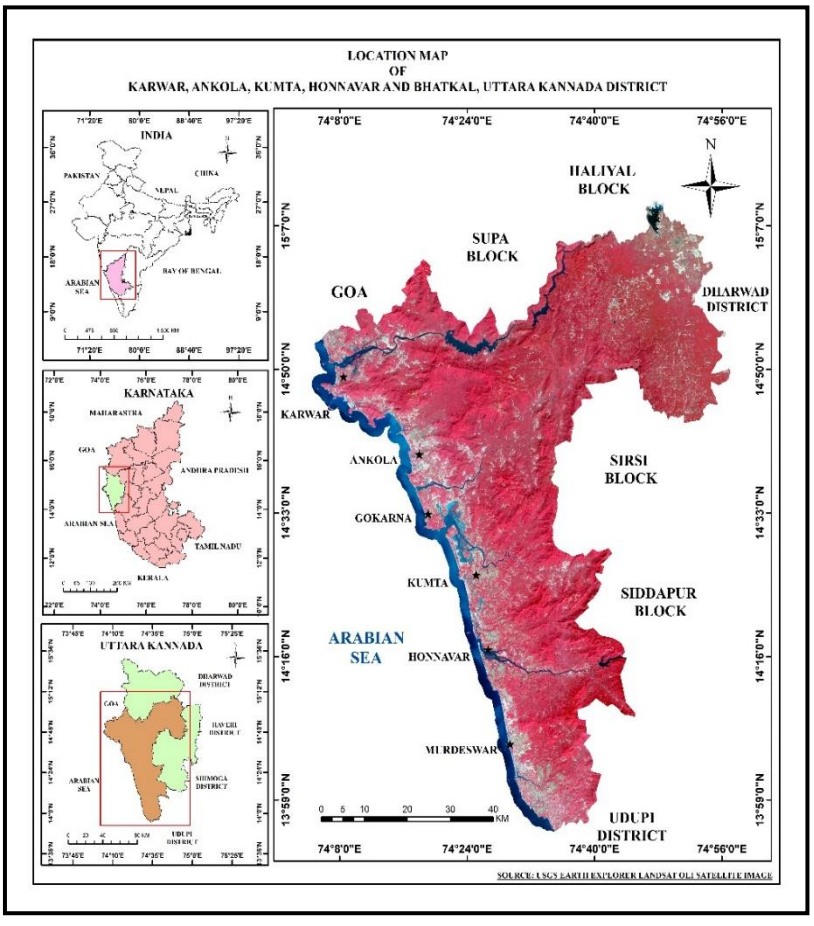


Figure No. 1: Location Map of the Study Area

surroundings. The study area of Honnavar block is Honnavar sea beach, Pavinakurvey beach, Sharavati river estuary. Kali river, Sharavati river, Aghanashini river and Gangavelli river area the main rivers in this study area. There are many study points in the whole study area but the main points are Kali river estuary (Karwar) (14˚50'42.03"N, 74˚07'52.82"E), Gangavelli beach (14˚36'00.54"N, 74˚17'36.11"E), Gokarna beach (Gokarna) (14˚32'36.05"N, 74˚18'49.50"E)Aghanashini river (14˚29'35.39"E, 74˚22'47.74"E) Kumta beach (Kumta) (14˚25'11.28"E, 74˚23'06.11"E) Honnavar sea beach (Honnavar) (14˚13'43.10"N, 74˚26'35.02"E) Murdeswar tombolo (Bhatkhal) (14˚05'35.90"N, 74˚29'06.26"E).

2. AIM & OBJECTIVES:

The aim of the study is to assess the water quality parameters for the analysis of rocky coastal geomorphology.

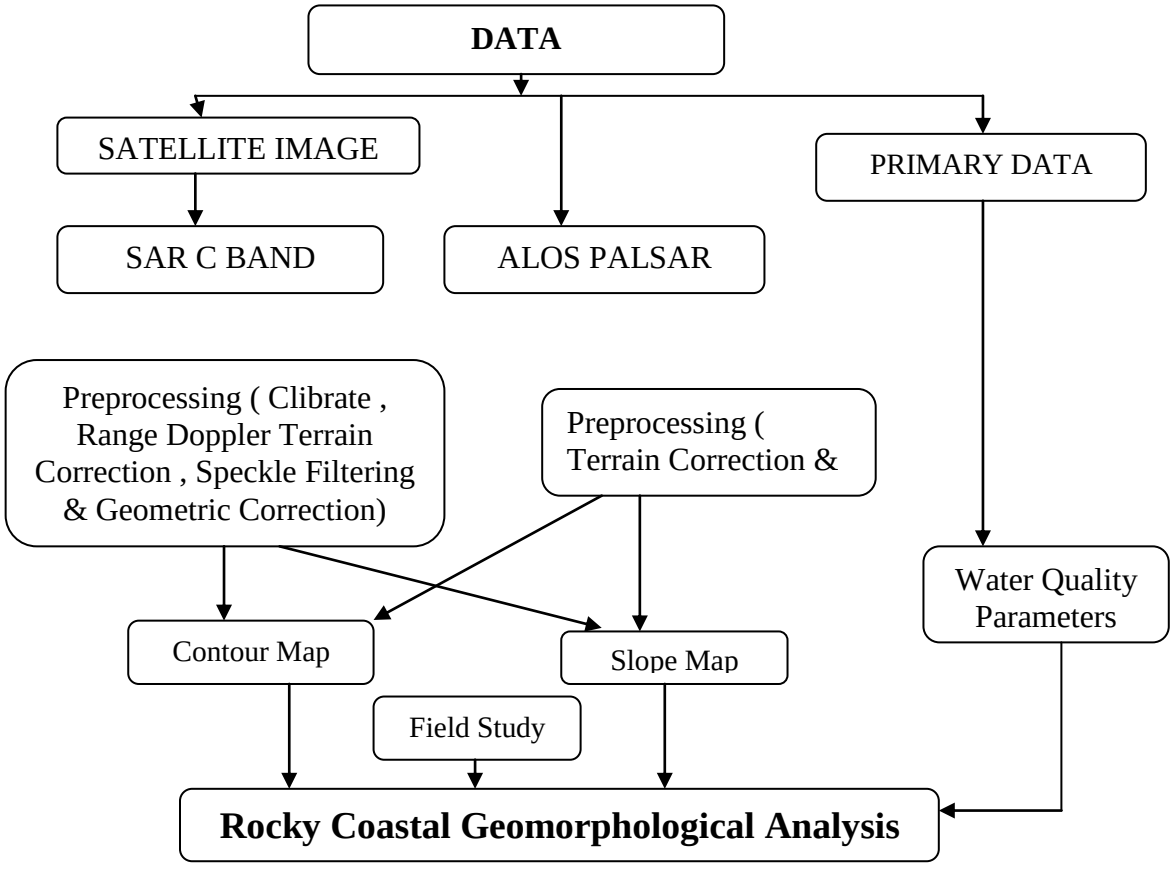
2.1 Objectives of the Study area:

The objective of the study includes;

a) The assessment of rocky coastal geomorphology with the contour and slope analysis using SAR(Synthetic Aperture Radar) data.

b) The geo-chemical properties of the water samples collected from the coastal sides

3. METHODOLOGY



4. RESULTS AND DISCUSSION:

4.1 CONTOUR PLAN TO ESTIMATE THE NATURE OF TOPOGRAPHY:

In cartography, a contour line (often just called a "**contour**") joins points of equal elevation (height) above a given level, such as mean sea level. A contour map is a map illustrated with contour lines, for example, a topographic map, which thus shows valleys and hills, and the steepness or gentleness of slopes.A contour map helpsin understanding the terrain characteristic. In the study area, the highest contour is 700 mt. in the upper part of the Karwar block. And the lowest contour is 0 mt. on the western coast. In the contour map, the contour interval is 100 mt.it was helped to understanding the entire topography of the area from the contour position of the area the region is classified into major three parts such as the coastal region 0 to 10mt. then the uplift ridge part is starting from 20 to 700 mt. and the third region is plateau region in the eastern part of the area. The elevation of the plateau region is 400 to 450 mt.

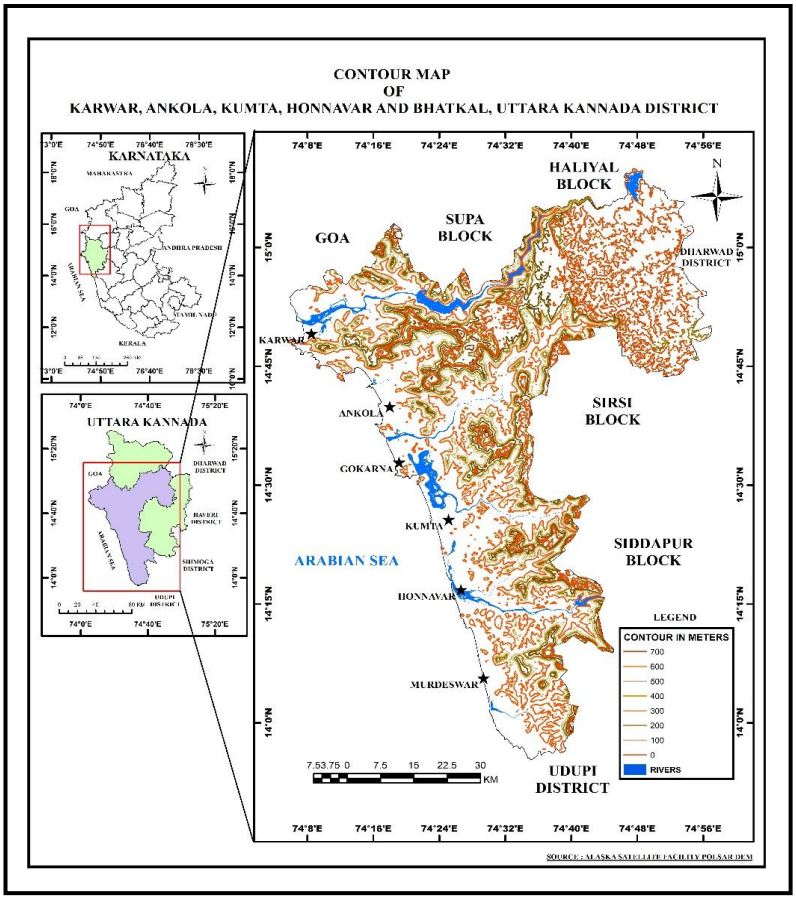


Figure No. 3: Contour Map of the Study Area

4.2 Slope:

The grade (also called slope, incline, gradient, main fall, pitch or rise) of a physical feature, landform or constructed line refers to the tangent of the angle of that surface to the horizontal. It is a special case of the slope, where zero indicates horizontality.

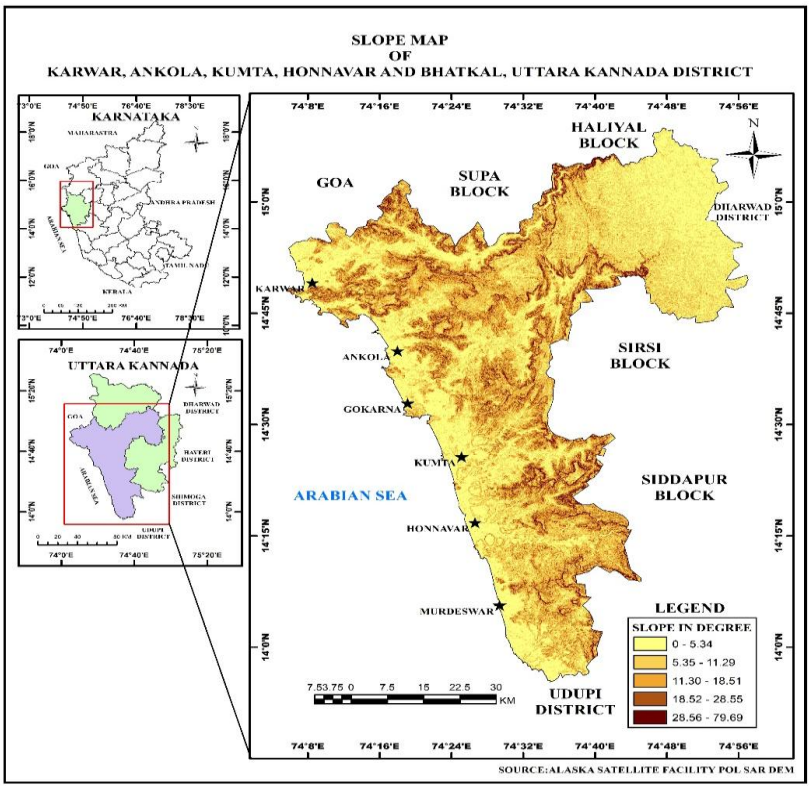


Figure No.4 : Slope Map of Study Area

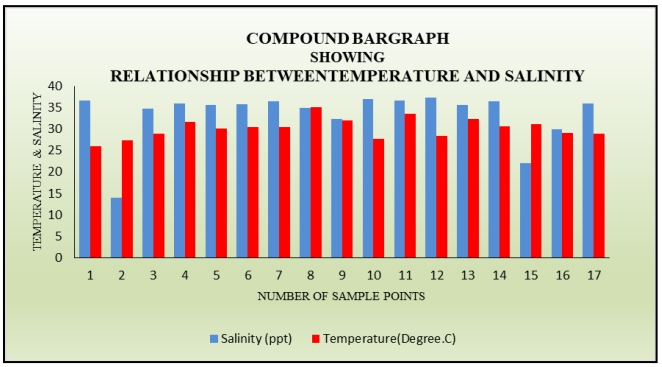
Slope means a measurement of the steepness of a line, or a cross-section of a line, connecting two points. Aslope is the rise or fall of the land surface. A slope is easy to recognize the hilly area. The DEM (Digital Elevation Model) is applied for the delineation of the slope. The slope has been calculated using Arc GIS tool. The DEM help us to identify the slope pattern of the study area.From the result, we can observe the highest slope is about 79 degree and the lowest slope is 0 degree. In generally the coastal region of the area Karwar, Ankola, Kumta, Honnavar, and Bhatkhal coastal area are the lowest slope those are the plain land exception there are some headlands are the steep slope in the Karwar and Gokarna.

Photograph No.3: Hilly Slope near Gokarna Beach

The highest slope is found in the hilly region of the area. Such as hilly region of Karwar block and Yallapur block, Yallapur is a plateau region in such a way there are steep slope found. And also there are some waterfalls are observed with a steep slope.

5.0 Relationship between Different Water Quality Parameters:

5.1 Relationship between Temperature and Salinity:

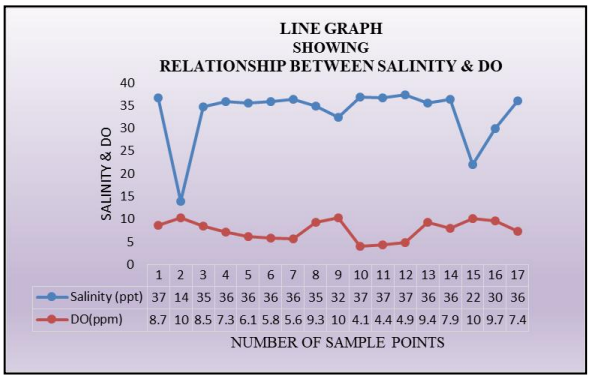


Graph No.1: Relationship between temperature and salinity of water

The relationship between water temperature and salinity was expressed on the diagram. The diagram showing the relationship between the temperature of water and salinity (ppm). It has been observed that when salinity is high then the temperature is generally low and when Salinity was low temperature was high.

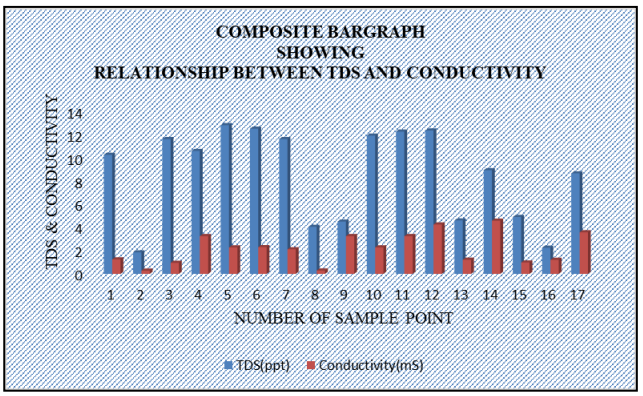
5.2 Relationship between DO and Salinity:

Line graph showing the relationship between salinity and dissolve oxygen of water. From the diagram we are observing that when salinity of water is high then dissolve oxygen is low, and when the salinity of water is low then the dissolve oxygen is high.



Graph No.2: Relationship between salinity and DO of water

5.3 Relationship between TDS (Total Dissolve Solids) and conductivity:

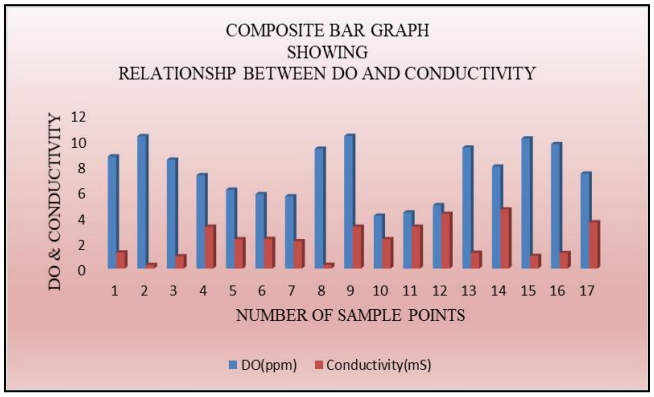


Graph No.3: Relationship between TDS and conductivity of water

The relationship between TDS and Conductivity was shown by the helping of composite bar graph. Here we observed that the positive relationship between TDS and Conductivity of the sample points when the TDS is high in the water sample then the conductivity of water is also high and when the TDS is low in the water then the water conductivity is also low.

5.4Relationship between DO (Dissolved oxygen) and conductivity

The relationship between Do and conductivity was performed by using the composite bar graph. From the graph we are observed that the positive relationship between DO and conductivity of sample points. When DO is high then the electrical conductivity was also high, and when Do is low then the electrical conductivity was also low.



Graph No.4: Relationship between DO and conductivity of water

6.0 Conclusion:

The study area is characterized by rocky coastal morphology which studies forest dynamic and its relationship.The shoreline configuration of north Kannada district is highly crenulated with the development of mature stage in coastal evolution at present. The shoreline is characterized by headlands, coves, bays, embayments, cliffs, beaches, tombolos, stacks and island with erosive basalts, dolerites, in situ lateritic sandstones and Limestones. The rocks of the study areas are highly jointed, fractured, tilted and faulted, as well as weathered. The basaltic rock of cretaceous lava flows are fringed with the shoreline and have deformed by tectonics weathering processes and erosional activities by marine processes at different levels seen cretaceous period. The kali river, Gangavelli, Aghanashini& Sharavati River and others smaller streams are flowing across the coast line to the Arabian Sea in the study areas. The coastal features are also characterized by deformation of terraces, escarpments, vertical cliffs, basalt sapping cave at different altitudes and various plantation surfaces along the coastal front of western ghat hills. The coastal hills are densely vegetated by evergreen forest at present with the tropical moist weather conditions and maritime influences. There is a strong relationship between vegetation, climate and landforms of the areas. Several morphogenetic regions are established for the present study areas on the basis of Peltier model. The forested areas provide ideal conditions for infiltrations during heavy rains within the jointed rocks and weathered rock materials. The dissolved carbonic acid by the production of decompose litters of the forest land have produced the high rate of erosion and solution process to evolve the landscapes as Karstified in few places.

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