

CHAPTER 11

ASSESSMENT OF WATER QUALITY VARIATIONS IN IMPACT OF HUMAN INTERVENTION ON THE TOPOGRAPHY AND ECOLOGY AT KALARIKUNNU, CHELANNUR, KOZHICODE, KERALA, SOUTH INDIA

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ABSTRACT

Degradation of midland hills brings about simultaneous collapse of ecosystems including hillocks, valleys and wet lands. The hill ecosystem of Kalarikunnu, Chelannur, Kozhikode is facing degradation. It will destroy the pristine ecological balance of the hillocks and valleys nearby. Hence a study was undertaken to understand the impact of human interference on the topography and ecology of Kalarikunnu, Chelannur, Kozhikode, Kerala with the aims to understand the diversity of flora and fauna associated to Kalarikunnu, Chelannur, Kozhikode and to analyze the soil and water parameters in explored and unexplored areas of the hill and to evaluate the human intervention on the topography as well as the ecology of the area. The natural vegetation present in the area include herbs, shrubs and trees. A laterite hill plateau can be considered as an amphibious ecosystem. The alternation of very wet and dry condition creates an unusual ecological situation that supports a unique biota. In the recent times the rate of exploitation was increased and exceeded what has happened for centuries. The hill region was devastated and excavated the soil digged out and constructed a road up to top hill area. There is simultaneous collapse of three eco systems - the hillocks, valleys and the wetlands. The entire hill disappears within a few years time. The seriousness of the situation has not been formally assessed by any official agencies.

Key words: Midland hillocks, Laterite soil, Flora, Ecological imbalance

Introduction

In Kerala, midland hills are beautiful natural gifts, giving a curvaceous shape to the entire landscape, with plenty of vegetations and a rich array of animals. The laterite hills are the most imposing but extremely threatened topographical floristic and faunistic feature of northern Kerala (State of Environmental

Report Kerala, 2007). People are often unaware of the importance of the midland hills that are being demolished due to the growing commercialization of land, expanding urbanization and booming construction industry (The Hindu, 2004). The uncontrolled deterioration of the laterite hills causes irreparable damage to the ecosystem, bio diversity and nature's water conservation

strategies. Degradation of hills resulting in loss of vegetation, destruction of the animal fauna, land deterioration, ground water loss, dust pollution, change in wind pattern and its influence in traditional faiths, rituals and culture of localities. Only a few and brief studies are available on the socio-economic aspects of the hillocks. Biodiversity of hillocks has been studied along with sociological and ecological importance. Padmanabhan (2002) gives a comprehensive description of the historical, geological and ecological aspects of the hillocks. (Mid-land Laterite Hills of North Kerala, an ecological Approach). Jaffer (1998) made a study of species diversity of Madayipara. The studies available on wetlands (NaliniNaik, 2002) and that of sacred groves of this region (Jayarajan, 2004) documented the relation of these habitats with hillocks. The study of biodiversity of Kalliassery (Sreedharan, 2001) gives an idea of the mid-land habitat.

Rocky surfaces, grass lands and green patches of hills are rich and diverse habitats accommodating vast varieties of flora and fauna. The age old biological activities have transformed these areas into bio-rich realms which are the nature's gifts. Degradation of midland hills brings about simultaneous collapse of ecosystems including hillocks, valleys and wet lands. The hill ecosystem of Kalarikunnu, Chelannur is facing degradation. It will destroy the pristine ecological balance of the hillocks and valleys nearby. Hence the present study gains its relevance to fill the lacuna. In this regard

the present investigation is carried out to understand the diversity of flora and fauna associated to Kalarikunnu, Chelannur, Kozhikodu, to analyse the soil and water parameters in explored and unexplored areas of the hill and to evaluate the human intervention on the topography as well as the ecology of the area

Materials and Methods

Study area

Kozhikode District was the capital of the erstwhile Kingdom of the mighty Zamorins and once a renowned commercial Center. The city of Calicut, the Anglicized form of Kozhikode, is the headquarters of the district. The district of Kozhikode is 38.25% urban and is bordered by Kannur district to the North, Wayanad to the East, and Malappuram to the South. To the West, lies the mighty Arabian Sea. The district is situated between latitudes 11° 08'N and 11° 50'N and longitudes 75°30'E and 76°8'E. The division of the district into 4 Taluks came into effect in 2001. They are Kozhikode, Vadakara, Koyilandy and Thamarassery. The present study was undertaken at the Chelannur Panchayath. Topographically the district has three distinct regions - the sandy coastal belt, the rocky highlands formed by the hilly portions of the Western Ghats and the lateritic midland. Of the total area of 2344 sq.kms, the sandy coastal belt is 362.85 sq.kms, lateritic midlands 1343.50 sq.kms and rocky highlands 637.65 sq.kms.

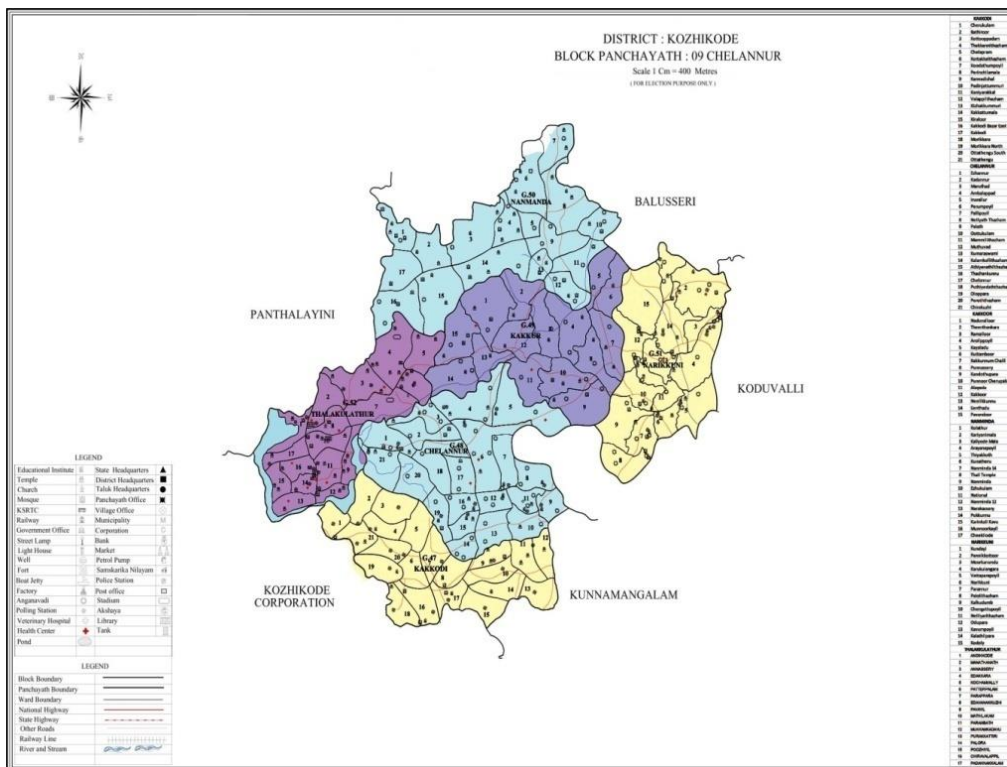


Fig. 1. District of Kozhikode- Chelannur Panchayath

The district has a humid climate with a very hot season extending from March to May. The rainy season is during the South-West monsoon which begins in the first week of June and extends up to September. The North-East monsoon extends from the second half of October to November (Fig 1).

Kalarikunnu is located at the midst of Chelannur Grama Panchayath. At the foot hill area the Sree Narayana Guru College, Chelannur is located. So far no relevant studies were carried out to explore the diversity and human interference at Kalarikunnu. The present investigation will try to full fill the lacuna.

Methodology

First hand information on Kalarikunnu will be collected from Panchayath and Village authorities. Preliminary survey was conducted in and around the Kalarukunnu with the help of Local Government to understand the hill areas and land use methods. Field visits was organized to collect plant specimens during different seasons. Plants will be identified with the help of standard flora and field keys. Soil and water samples will be collected from various regions like foothill, mid area and top hill soils during different seasons.

The analysis of soil parameters will be carried out following the methods described

in APHA, 1995. Soil properties like soil moisture content, percentage of organic carbon, soil pH (Jackson, 1967), percentage of available phosphorus, etc were analysed using standard methods.

The percentage of organic carbon in the soil sample was determined by the following procedure. Take oven dried 10g working soil sample is transferred to a direct 500 ml conical flask and add 10 ml 1N potassium dichromate ($K_2Cr_2O_7$) solution and 20ml conc. Sulphuric acid (H_2SO_4) and mixed it by gentle stirring. Keep the flask to react the mixtures for 30 minutes. After the reaction is over dilute the content with distilled water and add 10 ml of phosphoric acid and followed by 1ml of Diphenyl amine as indicator. Then titrate the sample against 0.4 N Ferrous ammonium sulphate. At the end point color changes to brilliant green was noted. Read the blank with the same quantity of the chemicals without soil. Percentage of organic carbon can be calculated by the formula

% organic matter present in the soil = 10

$(1-T/S) \times 1.34$

Where, T is the ml of ferrous ammonium solution with sample titration and S is the ml of ferrous ammonium with blank titration.

% Organic C= % of organic matter = 1.72

Available phosphate was estimated by taking 3g soil dissolved in 200ml of 0.002N H_2SO_4 in a conical flask for half an hour for dissolution of the soil. After half an hour, filter the sample, take 10 ml of sample and add 5ml of Ammonium Molybdate solution followed by 2-3 drops of stannous chloride solution was added. A blue color was appeared and read it within 5 minute in 690nm on a Spectrophotometer using distilled water blank with same amount of reagents, The percentage of available

phosphorous was calculated using the formula:

% available phosphorous P=

$$\frac{\text{Mg p/r soilsolution} \times 4 \times 1000}{1.724}$$

To evaluate the extend of exploitation

For this an extensive survey was conducted to locate and study the cultivated area, constructions and similar works in the study area.

Result and Discussion

In the present study reveals the soils in the Kalarikunnu is one of the natural gifts and it is the chief source and means of production. The fertility of the soil totally changes the economic activities of the people especially increasing he yields of cultivated crops (Majoribank, 1908). The deposits of alluvium (Bristow 1929) and blown sands increase the agricultural products of the area. The upper plateau of the hill is laterite and it is very hard in texture. It provided with many crevices which may be formed by the continuous activity of the rainfall. Grasses and some cashew trees are present in the area. At the area some shrubby and small to medium trees are present. In the mid hill and foot hills many medium houses were built and peoples occupy them. Their surroundings were converted into agricultural field.

The prosperity of Calicut during the medieval period was largely derived from the agrarian economy. Much importance was attached to land, as it was the chief source and means of production. The fertility of the soil totally changes the economic activities of the people especially increasing the yields of cultivated crops (Majoribank 1908).

Floristic study

An elaborate and extensive study on the flora was carried out in the present investigation.

The natural vegetation present in the area include herbs, shrubs and trees. A laterite hill plateau can be considered as an amphibious ecosystem. The alternation of very wet and dry condition creates an unusual ecological situation that supports a unique biota. To survive in such an ecosystem a species must be able either to tolerate a wide range of conditions, or to grow and reproduce in a short time. The present study accounts many angiosperms in the study area.

The study area of the present study floral diversity is astounding with different species of shrubs, herbs, trees and creepers growing at the surfaces and in the slopes of the hills. The identified plant species mostly belongs herbs, shrubs and trees. The small groves of *Ixoracoccinea*, *Ziziphusoenoplia*, etc. give refuge to a large number of small animals and birds in addition to providing nectar to butterflies and other insects during the flowering season. Many species are rare and are facing threatening due to the over exploitation.

The average soil pH and percentage of soil moisture content studied was depicted in the Table.1. It shows that in the upper soil layer of the top hill was almost neutral (pH 6.5) while the acidity increases with increase in soil depth (Table 1).

Table 1. Soil pH and moisture content

	Soil Layer	pH	% Moisture Content
Top hill	Upper layer	6.5	1.02
	Lower layer	6.3	2.25
Mid hill	Upper layer	5.6	5.01
	Lower layer	5.2	8.21
Foothill	Upper layer	4.8	11.30
	Lower layer	5.1	12.60

The same pattern shows all the study sites. Maximum percentage soil moisture content was noticed in the foothill area. In the top hill soils exhibited almost dry powdered nature. The water holding capacity of the surface soil particles in the top hill soils was comparatively low. The maximum moisture content was obtained in the foot hill region (Table 1).

The result of percentage organic carbon content in the soil studied was depicted in the table2. It is clear that in the top hill area percentage organic carbon content is very less compare to other layers of soils.

Table 2. Percentage of Organic carbon

	Soil Layer	% Organic Carbon	% available phosphorus
Top hill	Upper layer	2.1	2.1
	Lower layer	1.2	1.2
Mid hill	Upper layer	5.3	5.3
	Lower layer	6.0	6.0
Foothill	Upper layer	8.1	8.1
	Lower layer	8.7	8.7

Maximum percentage was observed at the foot hill area where agricultural practices were carried out. Many cash crops and vegetables are present in the area. Mid area resulted comparatively medium results. In all study areas lower area resulted more percentage organic carbon than upper layer except top hill, where upper layer resulted high percentage organic carbon then lower layer.

While analyzing the percentage of available phosphorus content per gram of samples collected from the mono and mixed crop agricultural fields, it was found that, majority of samples from the lower layer of mono crop field were not detectable (table 2).That

means their phosphorus content is very low. The present investigation is in agreement that the laterite is found in the region of mean annual temperature of 23 to 26°C and rainfall 1200 to 4000 mm and with the number of rainy months 8 to 10. Laterite can occur at every altitude from sea level to about 2500 m. A considerable area of the former cultivated land is covered by laterite. Plateaus formed are flat topped. Undulating and slopping plateau surface occur based on parental rocks. Laterite can be formed from any type of rock. Removal of top soil

(alkaline upper horizon) creates an acidic environment which further accelerates the laterisation process (Jayarajan, 2004). The percentage of organic carbon and available phosphorus are also due the same property of acidity in the study area.

For analysing the significance of the parameters like soil pH, Moisture content, organic carbon and phosphorus content, two way ANOVA was performed. The results are depicted in the table 5. It is clear that all the parameters studied were significantly related to each other (Fig 2).

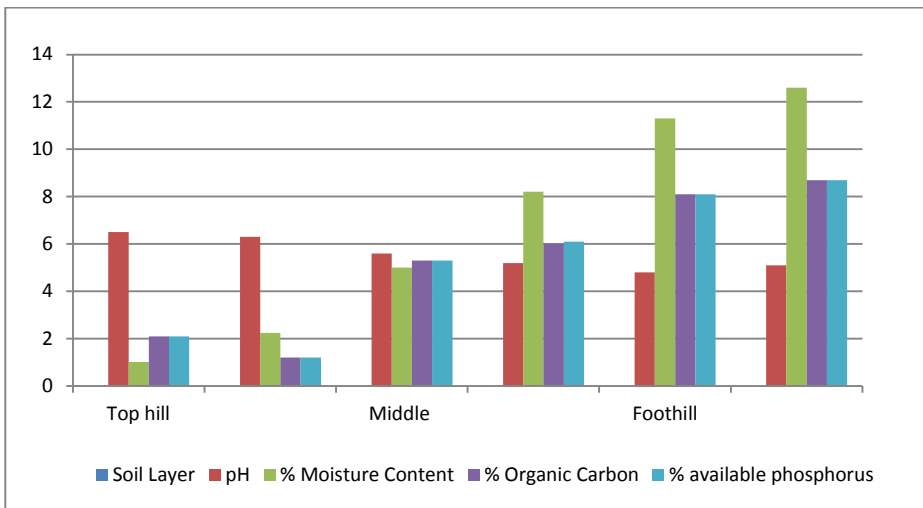


Fig 2: The parameters studied in tophill, Middle and foothill areas

The uphill dwellers are mostly daily wage workers in the agricultural sector and construction sector. They supplement their marginal income by cultivating in the small land holdings around households. The plains below are mostly occupied by middle level farmers with their income supplemented by some earning members in different services. Most of the hill sides have got Cashew nut plantation and thick patches of Bamboos. Some of the families in the hill area are

partially depend on their livelihood. In the hill area a huge construction- a water tank was made by the government authorities in connection with the water supply to the peoples in and around Chelannur. For the construction some area in the mid hill region was devastated and excavated, the soil digged out and constructed a road up to top hill area.

Exploitation started with the beginning of settled life in the hill slopes of the mid-land. In the early periods impact of human activity on nature was limited. Initially man gathered food items and then firewood. Then he started collecting items for house building and utilized fodder as he required. He also found materials for agricultural activities on these hills. Agriculture was in a limited area. Selected items were cultivated on slopes. Some timber extraction and mining activities were present. As the rate of human interference increased, transformation became noticeable. Change in agricultural pattern cannot be neglected here. People attracted by cash crops turned into cultivation of Teak, cashew nut etc. This brought about further laterisation of soil. This resulted in intense soil erosion. As the demand for land increased, houses were built on the hills especially on flat surface. In the past the rate of transformation of hillocks was gradual. But in recent times the rate of exploitation was increased and exceeded what has happened for centuries. The mechanical and large scale method of laterite stone mining was followed by soil extraction. By the introduction of large machines like JCB, the hillocks began to disappear at a fast rate. Construction of new roads and rails also increased the demand for soil. Here there is simultaneous collapse of three eco systems – the hillocks, valleys and the wetlands. The entire hill disappears within a few years time.

The problems of water scarcity now being experienced in most parts of the State, the demolition of hillocks and the filling up of low-lying lands, paddy fields and water-bodies are interconnected. Much of the low-lying lands and water-bodies were filled up with earth made available from the demolished hillocks that were excavated making use of JCBs, the ubiquitous excavator that is seen in every village today. Village roads are full of earth-mover vehicles which cause frequent road accidents because

of their reckless speed to avoid authorities. The seriousness of the situation has not been formally assessed by any official agencies.

Future perspectives

The present investigation on the impact of human interventions look on Kalarikunnu, Chelannur only. Majority of the laterite hill areas of the state are still overlooked. Many of the midland laterite hill areas were demolished within a short period and the remaining will be protected with the help of strong environmental laws. The government and NGO's could take initiatives on this. Educating the peoples with the impact of demolishing the laterite hills is necessary. The present investigation try its level best to aware people in and around a small village in the state ,Chelannur, Kozhikode.

Conclusions

The present investigation reached the following conclusions:

The uncontrolled deterioration of the laterite hills causes irreparable damage to the ecosystem, bio diversity and nature's water conservation strategies. The geological and ecological importance of midland laterite hills are to be highlighted and conveyed to the local people with appropriate propaganda and orientation. Environmental organizations and NGOs should seriously take up the issue by creating awareness on the ecological role of the laterite hills. Proper orientation and education should be given to the local peoples. The interrelationship between the exploitation and degradation of environment and natural resources and development and poverty is particularly relevant in the present context. Sustainable development is the only alternative to conserve nature and natural resources to enable the forthcoming generations to live here safely and successfully.

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