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Effect of Laterite Mining on the Land Use of Midland Hillocks of Kannur District, Kerala - A Case Study

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Abstract: ***The various dimensions of human intervention on natural processes and systems are of grave concern to geographers. Mining is one of the oldest professions of the world and it grew with the evolution of man and civilization. Environmental impacts of mining are important to the society in and around the mining complexes not only because of the direct impacts but also the indirect impacts. It being the fact, all the activities the human beings do are for the benefit of the society, the mining activities should also yield benefits to the society, which so far has not been taking place. Laterite is a typical rock formation found commonly in the tropical monsoon regions as a capping over the hillocks. It is best developed in the Western Ghats and its foothills. The thickness of lateritic cap varies from 10 to 70 meters. It is the characteristic feature of midland hillocks of north Malabar region of Kerala especially Kannur and Kasaragod Districts. In the areas of extensive laterite formations, its mining has emerged as a major economic activity of the local people. Present investigation is an attempt to analyse the effects of laterite mining on local land use from a geographical perspective.***

Keywords: Laterite; Mining; Midland hillocks; land use

1. Introduction

Land use is dynamic in nature. It is basically a function of physical and cultural variables. The land use pattern of a region is an outcome of natural and socio – economic factors which decide the utilization of land by man over time and space. The efficient use of land depends on the capacity of man to utilize the land and to manage it. Land is not only a resource, but also a resource base by itself. Land resources being finite in extend imply more judicious use to meet the ever-increasing demands. The unsustainable and unplanned exploitation of land resources is the major reason for degradation of our environment. This requires prudent use of land use/ land cover in the area. Mining industry has considerable aerial coverage, which is next only to agriculture among the primary activities. As mining yields quick (but short time) returns, agriculture always looses in competition where ever extractable resources occur. Here comes the significance of destiny of lateritic mesas of the study area. Mining and resultant socio-economic changes in the society make drastic changes in the land use pattern of the locality. In this context a case study on spatio-temporal analysis effects of laterite mining on the land use pattern of mid land hillocks of Kannur district in Kerala is taken as the core theme of the present investigation.

2. Study Area

Irikkur block is typically the midland portion of Kannur district. The block extends from 11^{o} 55' N to 12^{o} 05' N latitudes and from 75^{o} 20' E to 75^{o} 45' E longitudes. It extends over a total area of 433 sq. km. The Block comprises of ten panchayaths namely Kolachery, Mayyil, Kuttiattur, Malappattam, Irikkur, Padiyoor, Sreekandapuram, Eruvessi, Payyavoor and Ulickal. (Fig.1). The eastern hilly tract gradually merges to the foothills of Western Ghats. Some parts of the block, mainly the areas adjoining to the Kattampally Lake, are flat and lie almost at sea level. The block has a general slope from northeast to southwest (Fig.1). Ulickal, Payyavoor and Eruvessi panchayaths are comparatively highland areas whereas Mayyil, Kuttiattur and Kolachery panchayaths are comparatively low lying areas. The study area is endowed with a well developed drainage network. Valapatanam River, one of the major west flowing rivers of the State flows through the central part of the block.

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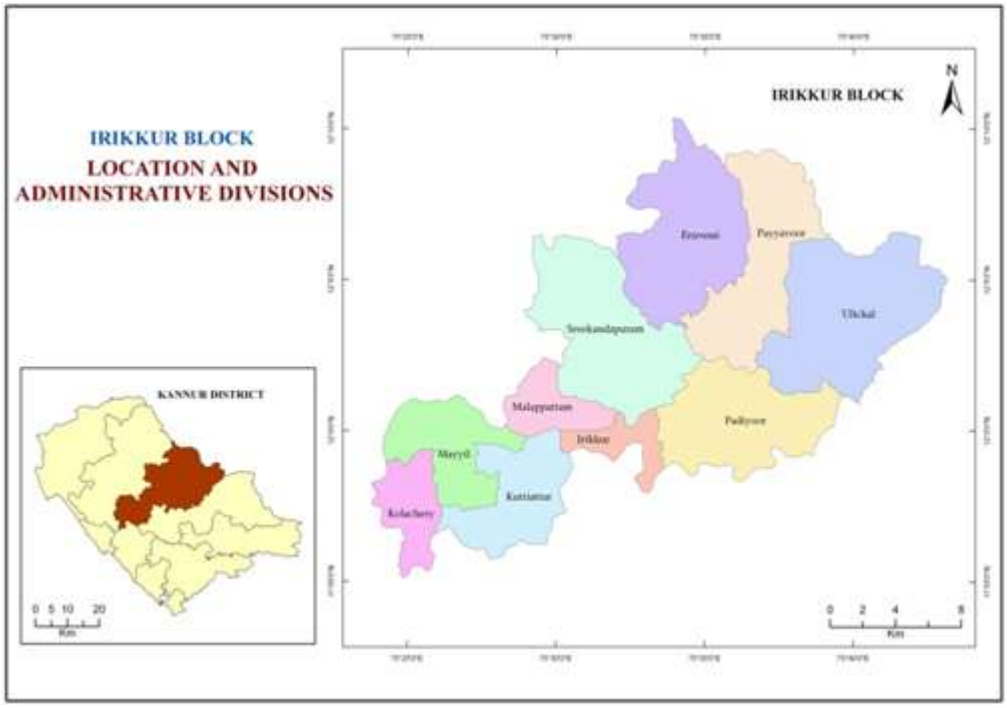
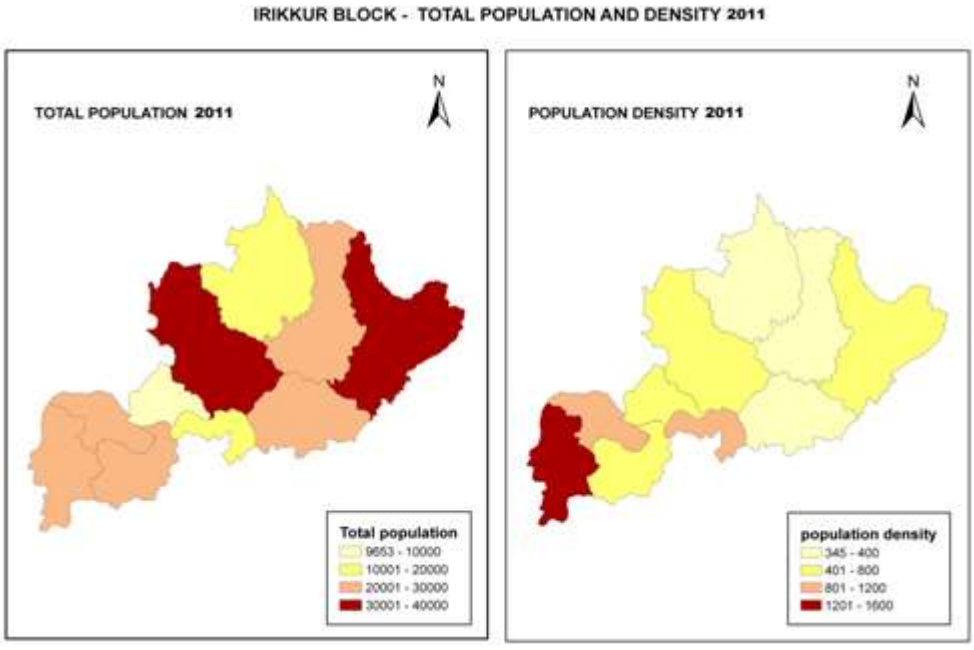


Figure 1

Study area 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. The average annual rainfall is 3900 mm and more than 75% of this occur during the period of Southwest Monsoon (June to September). Maximum rainfall occurs in the month of July. Geological formations of the block range from Archaean to recent ages. Crystalline rocks of Archaean groups are found in the northern part of the block. Igneous intrusions are found extensively in the northern panchayaths. One of the most significant features is the wide distribution of laterites. Laterites in the block are the extension of laterite sheet from North Wayanad which is the southern tip of the Deccan plateau (Narayanaswamy et. al. 2010).

As per census 2011 the total population of the block is 2,39,621. Out of which 48% are males. Among the Panchayaths Ulickal and Sreekandapuram are most populated and they together share 28 % of total population of the study area. Mayyil and Kolacheri also posses comparatively higher share of population. Malappattam and Irikkur are the panchayaths characterized with lowest population. The spatial pattern of distribution of total population and density are shown in the Fig. 2 and 3).



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Objectives of the Study

- Map the location of laterite mines in the study area and carry out a spatial analysis of their distribution.
- Analyse the effects of mining on the bio-physical set up as well as land use pattern of the region.
- Analyses impacts of mining and suggest remedial measures for the sustainable development of the region.

3. Methodology

Nature of the present study call up on frequent field visits and keen observation around the laterite mines in the study area. Both primary as well as secondary data have used for this study. SOI Topographical maps of the region are used for preparing base maps. They are most helpful in getting ample basis for physiographical setting of the study area. Office records of Dept. of Mining and Geology, State Landuse Board, Dept. of Economics and statistics and Local Governing bodies are examined and analysed. The locational attributes of laterite mines are collected with the help of GPS and the same has transferred to GIS maps. The past laterite mines and present active mines, both are studied and mapped separately. The distribution of laterite mines are superimposed over the 3D map of the region and examined how far the midland hillocks are affected by ruthless mining. The land use changes of the region are made keen observation from 1069. Data collected from different sources brought under proper cartographic and statistical analyses. Prospects of GPS Survey along with Analytical capabilities of GIS software are fruitfully utilized for examining the landuse conversions.

4. Results and Discussions

Laterite and its mining

Laterite is a typical rock material of monsoon region. Laterites are residual sedimentary rocks, reddish or brownish coloured, comparatively soft rocks, containing high degree of porosity and are carrying vermiform structures (Fermor, 1911 and Maclaren, 1906). Laterite stone was used as building material in Kerala for centuries. Ancient buildings like temples are examples. Laterite brick is generally red in color. It is porous and shows vermicular structure. In vernacular, it is called as *"chenkallu", "Ishtikkallu", "cheekkallu", "vettukallu"* etc. Laterite can occur at every altitude from sea level to about 2500 m.

Laterite occurs principally as a cap over the summits of Basaltic hills and plateaus and is the characteristic feature of tropical monsoon regions (wadia 1975). Its geological nature was described only later by Francis Hamilton Buchanan, a medical officer of East India Company(Buchanon 1801). Laterite has the peculiar property of being soft when newly quarried, but being hard and compact on exposure to the air: Also, loose fragments and pebbles of rock tend to re-cement themselves into solid masses as compact as the original rock. On account of this property it is usually cut in the form of bricks for building purposes. lrikkur block panchayath in Kannur district of Kerala is now well known for its good quality laterite bricks. Here the ruthless mining of lateritic hills brought about drastic changes in the local environment as well in the economic set up of the people.

Table 1 shows the spatial distribution of laterite mines in the study area. Map is based on field survey. Out of the total block area of 433 sq. km., mining is carried out in about one sixth of the area (72.7 sq. km.). However there exists wide variation in the total mining area in different panchayaths. The block has a general slope from northeast to southwest (Fig. 6). The northern panchayaths are comparatively elevated regions. In these panchayaths laterite formations are not extensive. Isolated patches of laterites are found in these areas but they are not utilized as bricks as they are not of good quality from constructional point of view. In most of the areas, laterization process is in a transitional stage and yet to attain complete formation. Among the panchayaths, Mayyil, Kuttiattur, Sreekandapuram, Irikkur, Malappattam and Padiyoor are charecterised with intensive mining activity.

16.8% of the total area of the block is under laterite mining. Kuttiattur panchayath has nearly half its area (46.9%) under mining. It is followed by Malappattam panchayath with 35.8% of its area under mining. Irikkur (26.4%), Sreekandapuram (23.9%) and Padiyoor (23.9%) panchayaths also have a higher share of area under mining, compared to the block average (Fig. 6.5). In Eruvessi (2.8%), Kolachery (2.4%) and Payyavoor (1.4%) panchayaths, area under mining was comparatively low. Other panchayaths have a moderate share (Fig.4).

Table 1: Irikkur block – Distribution of laterite mines

Sl No	Panchayath	Area of Panchayath in sq. km.	Total mined area in sq. km.	Total mined area in %	Area of active mines in sq. km.	Area of active mines in %	Total no. of active mines
1	Sreekandapuram	66	15.8	23.9	8.9	13.5	110
2	Payyavoor	49	0.7	1.4	0.3	0.6	6
3	Eruvessi	67	1.9	2.8	0.8	1.2	7
4	Mayyil	33	3.5	10.6	2.6	7.9	30
5	Kuttiattur	35	16.4	46.9	5.7	16.3	66
6	Malappattam	19	6.8	35.8	4.2	22.1	30
7	Irikkur	11	2.9	26.4	0.7	6.4	19
8	Padiyoor	54	12.9	23.9	4.1	7.6	41
9	Ulickal	78	11.3	14.5	3.4	4.4	35
10	Kolachery	21	0.5	2.4	0	0.0	0
	Total	**433**	**72.7**	**16.8**	**30.7**	**7.1**	**344**

Source: Compiled by the investigator from Field study

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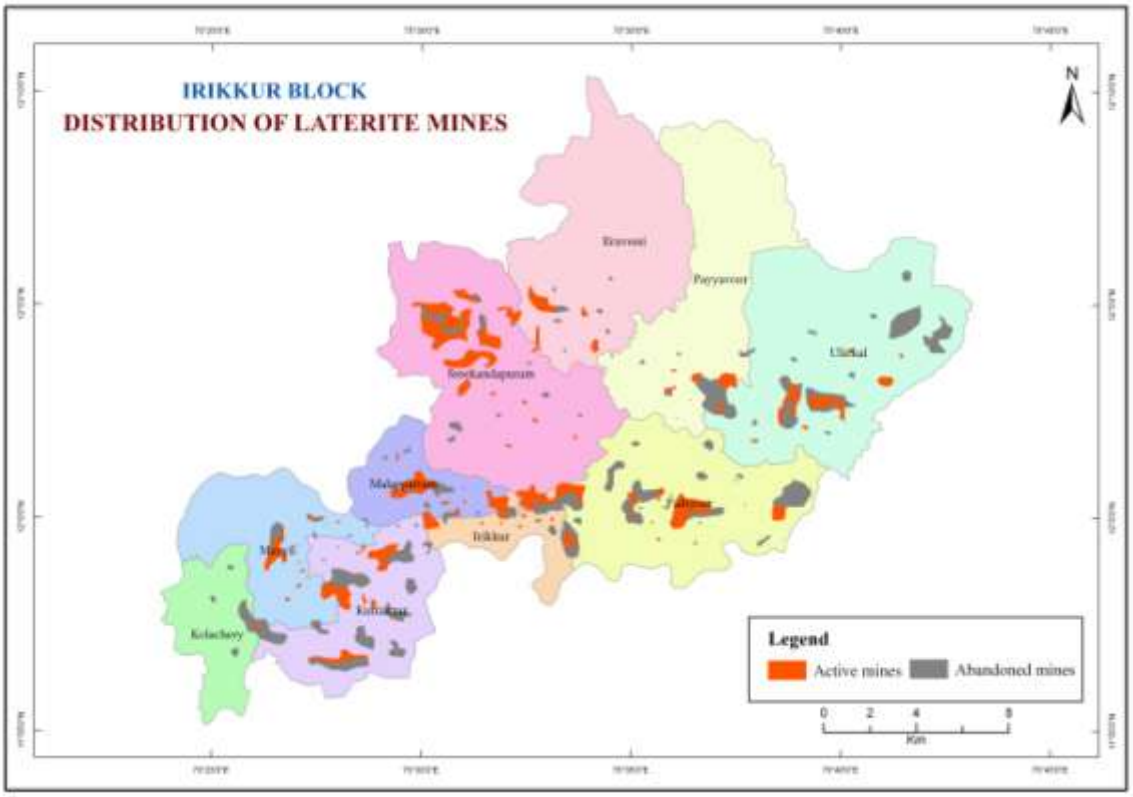

Figure 4

As the laterites are exhaustible in nature, the miners tend to identify new areas of mining. In many parts of the block, mining has stopped completely and now new mining areas have come up. Hence the region has both active and abandoned mining areas. The total area of present laterite mines is only 30.7 sq. km., which shares 7.1% of the total area of the block. Now Malappattam panchayath is having 22.1% of its area as active mines. In Kuttiattur panchayath, the area of present mines shares 16.3% of its total area. Sreekandapuram panchayath also possesses considerable share of its area (13.5%) under active mining sites. Mayyil and Padiyoor panchayaths also share 7.9% and 7.6% of their total area respectively as active mining centers. Eruvessi (1.2%) and Payyavoor (0.6%) have very low share of area under active mines. In Kolachery panchayath, there are no mining areas now (Fig. 4).

Effects of Laterite mining on land use

Generally the process of laterite mining is crude, which involves the uprooting of plant and trees, scraping and removal of overburden and then mining by open pit method. Vegetal as well as the soil cover over the areas are surrendered in all respects. Most of the areas affected by laterite mining had been under sparse vegetal cover or cashew plantations. All of them were cleared completely for mining, which bring high economic return to the land for a certain period of time, till the laterite get exhausted. Laterite Mining made tremendous hike in the land value also. Locals considered the lateritic areas as waste lands as they were not useful for agriculture or settlements. The mining boom altered the scenario into a large scale business node. People began to lease their land for mining and got unexpected figures for their waste land. Land value shoots up tremendously from few hundreds to lakhs. Most of lateritic areas were left as barren lands as they will not support any crop to flourish except cashew. There were scattered cashew trees on lateritic areas where some topsoil was available. But the lateritic duri-crusts were devoid of any vegetal cover. The mining left huge piles of debris and soil which caused revival of agriculture over these 'waste lands'. In some places the laterite mining led to mechanical production of soil and witnessed revival of lost vegetal cover. Most of the mines were backfilled with soil and now in most of the mined areas peoples started cultivating cashew and rubber extensively. In Malappattam and Kuttiattur rubber plantations have successfully raised. In Sreekandapuram, banana and tapioca cultivations are common.

The General land use pattern of the study area in 1969 and 2007 is portrayed in Fig. 5 with its spatio-temporal variations.

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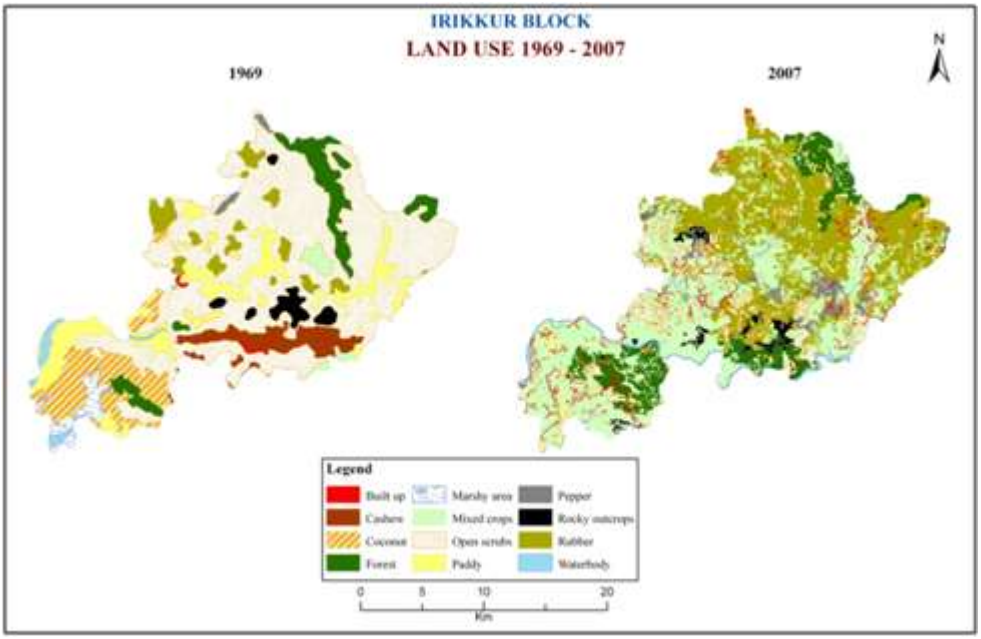

Figure 5

Fig.5 shows the change in general land use of the study area from 1969 to 2007. The land use details of 1969 are traced out from 1:50,000 SOI maps whereas 2007 map is prepared from remote sensing data. The conversion of various land uses to mining is on fast track now. More areas added and surrendered to mining sector by 2017. Detailed questionnaire survey and field visits have been conducted to analyse the salient features land conversion for laterite mining in the block. As the secondary data on laterite mining sector is not available, primary data is collected through field surveys. All the laterite mines and previously mined areas are visited and mapped with the help of GPS. The recent conversion of various land uses to mining is shown in Table 2. It is clear that Sreekandapuram, Kuttiattoor and Padiyoor panchayaths witnessed crucial changes in the land use pattern after the sprawl of Laterite mining. Fig. 6 shows that Laterite mining consumes the midland hillocks of the study area.

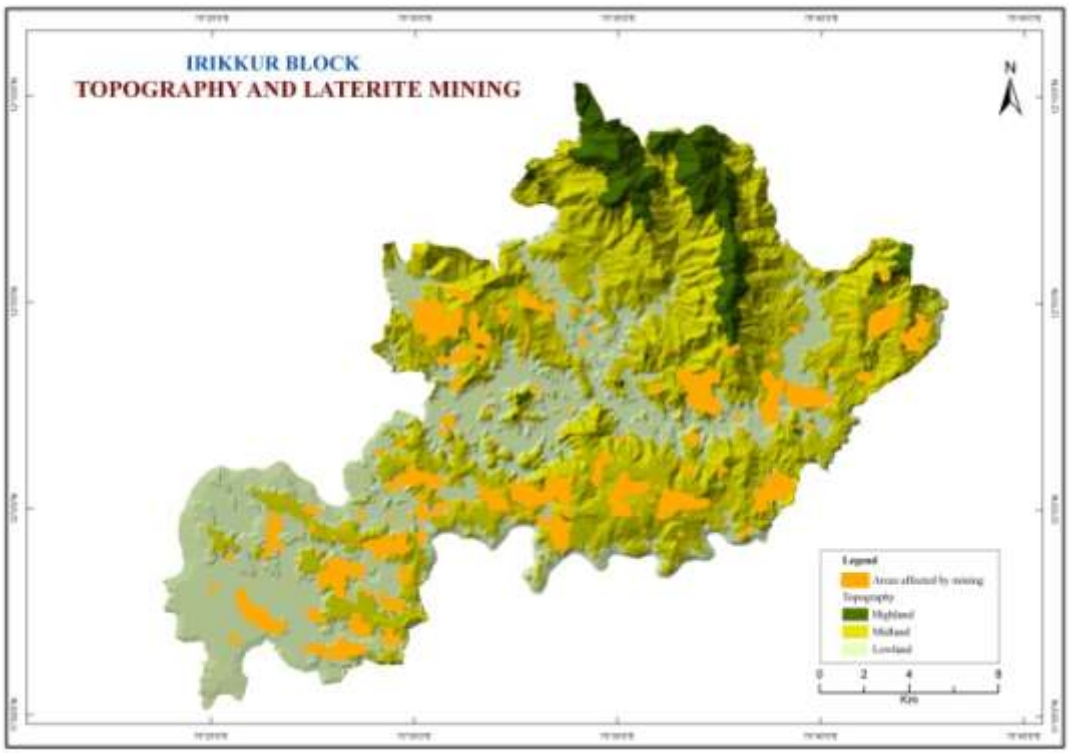

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Table 2: Irikkur block- land use conversions for laterite mining 1969-2016 (Area in sq,km)

Panchayath	Rubber	Rocky out crops	Open scrubs	Mixed crops	Forest	Coconut	Cashew	Total
Sreekandapuram	1.2	0.2	12.9	0.8	0	0.1	0.6	**15.8**
Payyavoor	0.2	0.1	0.3	0.1	0	0	0	**0.7**
Eruvessi	0	0.1	1.7	0	0.1	0	0	**1.9**
Mayyil	0	0.1	2.1	0.5	0.1	0.4	0.3	**3.5**
Kuttiattur	0	0.4	4.2	2.1	0.9	8.4	0.4	**16.4**
Malappattam	0.1	0.2	3.2	1.5	0.9	0.3	0.6	**6.8**
Irikkur	0.1	0.6	1.4	0	0	0.2	0.6	**2.9**
Padiyoor	1.6	0.2	8.8	0.4	0.3	0.1	1.5	**12.9**
Ulickal	0.7	0.2	7.1	2.1	0.7	0	0.5	**11.3**
Kolachery	0	0	0.1	0	0	0.4	0	**0.5**
Total	**3.9**	**2.1**	**41.8**	**7.5**	**3**	**9.9**	**4.5**	**72.7**
Percentage share	5.4	2.9	57.5	10.3	4.1	13.6	6.2	100

Compiled by the investigator, 2016

The following are the key observations on the land use scenario of mining areas in the study area.

- Out of the total mined areas of 72.7 sq. km., 41.8 sq. km. area (57.5%) was open scrubs. Among the panchayaths, Sreekandapuram is the area where large extension of open scrubs (12.9 sq. km.) converted for mining. In padiyoor and Ulickal panchayaths the conversion is 8.8 and 7.1 sq.km. respectively. In Kuttiattur (4.2 sq. km.) and Malappattam (3.2 sq km) also considerable area of open scrub lands converted for mining purposes.
- Sudden progress in the mining sector changed the attitude of the people towards agriculture. Quick and high return from mining sector resulted withdrawal of peoples – both farmers as well as workers – from agriculture sector and tilted towards mining sector. Traditional agricultural operations suffer acute shortage of labourers. 13.6% of the total area of mines i.e. 9.9 sq. km. area was under coconut plantations in 1969. In Kuttiattur panchayath alone 8.4 sq. km. area of plantations cleared for laterite mining.
- Area of mixed crops also consumed much for the extension of mining areas. Actually 7.5 sq. km. area i.e 10.3% of the total mined area was under cultivation. Conversion is most notable in Kuttiattur (2.2 sq. km.) and Ulickal (2.1 sq.km.).
- Cashew plantations are another victim of laterite mining. 4.5 sq. km. (i.e. 6.2%) area was under cashew plantations in 1969. In Padiyoor panchayath, 1.5 sq. km. areas converted for laterite mining.
- Some patches of Rubber plantations also uprooted for mining. 3.9 sq. km. area of rubber plantations are now intensive mining sites. It accounts for 5.4% of the total mining area. It is more noticed in Padiyoor (1.6 sq. km.) and Sreekandapuram (1.2 sq. km.) panchayaths.
- 4.1% of the total mined area was under forest cover in 1969. 3.0 sq. km. of forest area have been converted for mines. More conversion occurred in Kuttiattur and Malappattam panchayaths table 6.15)|.
- Considerable decline of lateritic durricrusts in Irikkur block have already been discussed. 2.1 sq. km. of lateritic outcrops (2.9%) are now mining area. In Irikkur panchayath 1.2 sq.km. of durricrust area is now utilized for mining.

5. Suggestion and Conclusion

Laterites of midland hillocks are the product of complex weathering processes which is most typical to monsoon humid regions (Thomas Varghese etal 1993). Laterization is an exceedingly slow geological process but its mining has been aggravated recently at an alarming rate. It is to be realized that the man can't exist alone on the earth. Earth is the habitat for millions of life forms including man. The co-existence and interdependence of biotic and abiotic elements of the earth system makes it live and unique. The unsustainable and unplanned exploitation of laterites will invite severe troubles in the future. So an attempt is made here to suggest possible strategies to conserve mining areas.

The excavations should be controlled by the local governing body and directed towards the total well being of the local people. As with 'polluter pays' policy, the damaged land should be restored by the people undertaking the excavation. The mining should be permitted only in a particular direction so that adjacent abandoned pits can be restored (leveled) to useful land in a planned manner. It is necessary to level the mines as much as possible. Mining areas are to be rehabilitated to its original landscape, followed by providing adequate vegetal cover. These provisions are to be insisted up on while contractor's leasing. Afforestation and protection of existing plantations are necessary in the study area. Social forestry would do well in this area, as the region is well suited for trees of all categories. In some areas, near the peripheral zones, the gravel bed could be removed so as to expose the underlying fine silty material that can be used for cultivation. At present such fine sediment is accumulated in the intervening valleys whose narrow flood plains are cultivated.

Drilling should be prohibited especially in inhabited areas. In scenic spots mining shall not be allowed. Due weightage should be given to the type of productivity and quality of soil before the land is leased out for mining. Quarrying can be allotted in such hillocks where agricultural productivity has been proved very low or areas with little vegetal cover. In densely populated areas manual mining can be recommended subject to certain environmental safe guards. Even in the case of manual mining, sprinkling of water over the laterites will bring down the quantum of suspended particulate matters in the air that will reduce air and noise pollution considerably. The present regulatory system of controlling laterite mining is ineffective and evasive.

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Panchayat institutions should take the responsibility of local environment. The district planning officer under the district planning committee should be the "regional planner" backed up by appropriate legal powers and supported by a set of trained personals to assist him in various environmental matters including EIA.

Laterite mines offer splendid job opportunities for the unemployed local people in the rural areas. Mining areas now came to grown as busy centers of economic transactions and many small town ships have evolved out recently around the mines. The increased income and resultant hike in standard of living are obvious in the study area. While appreciating the impetus on the socio-economic set up of the region, its drastic impacts of land sue conversions on the environmental side cannot be ignored. The wide spread occurrence of lateritic sheets in the localized pockets of the study area, obviously owe their origin to complex tropical processes such as leaching, and pronounced denudation chronology. Ruthless mining of them transformed the virgin land to a new degraded landscape with devastated surface relief. The excavated area wears an ugly desolate badland like look, with pits of varying depths and sizes are left here and there. Mining has degraded land, water, and air. Health condition of mine workers as well as neighbourhood peoples is in severe threat. All these aspects reveal the fact that mining and its effects on the study area outranges the limits of geography and it has deep implications on economy, society, geology, hydrology and environment.

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