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RESEARCH ARTICLE

A CHANGING PATTERN LAND USE AND LAND COVER IN PALANI HILLS, DINDIGUL DISTRICT USING GEO-SPATIAL TECHNOLOGY

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Abstract

The current investigation is about the effect of formative exercises, for example, the travel industry, resorts, urbanization and concentrated agribusiness on characteristic vegetation of Palani slopes and furthermore to build up an activity plan for asset the executives in a manageable manner. The satellite (IRS P6) information examination plainly indicated that stamped changes of land use/land cover types have occurred in various types of backwoods lands, which incorporate thick woodland, open deciduous, open scour and corrupted timberland territories. The change detection assessment study evidenced that conversion of forest land into other land use types is the main type of land use / land cover change in the hill area. The reasons for the timberland cover change are diverse which remember move for development, unlawful logging, woodland fire and extension of farming area. This happens attributable to extreme populace pressure. Agricultural activities vary depending on the changes in management regimes and the changes in cropping patterns. Expansion in populace lays extra weight on its delicate regular assets.

Key words: Geo-spatial, urbanization, sustainable, natural resources, hill development, tourism potential.

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Introduction

Man's great dependence on forests is an ample proof of the fact that a large area of forest is needed for our growing population. Indian forests were about 33 per cent of the land surface, but by 1951, this was reduced to about 23 per cent

indicating deleterious human impact on the ecosystem. Though human impacts on forests back to antiquity and even to pre-history, documenting such impact on genetic diversity of forest trees is a difficult one as existence of quantitative data in this regard is less (Ledig, 1992). The process of diversion of forest areas into non-forest areas and their degradation has caused floods, water shortage, water logging, increased erosion in fertile lands and silting of rivers and dams. If this continues, very soon the demand for forest produce viz., timber, fuel and fodder can not be met. The hole between the organic market of backwoods produce is augmenting. To fulfill these needs, there is a pressing need to embrace enormous afforestation programs in the nation.

Palani hills

Palani hills are an eastern off shoot of the Western Ghats with a most extreme east to west bearing to a length of around 65 km and to a greatest width of around 40 km. The area is bounded by Palani Taluk on the north, by those of Dindigul and Nilakottai Taluk on the east (Dindigul District), by that of Periyakulam Taluk on the south (Theni District) and on the west, partly by Coimbatore district and partly by Kerala state. The limit between the two primary divisions of Palanis – the upper and the lower Palanis – can be around completed by drawing a line from the town of Palani in the north to Periyakulam in the south.

Remote sensing

Far off Sensing is the science and specialty of getting data about an article, territory or wonder through the examination of information procured by a gadget that isn't in actual contact with the item, zone or marvel under scrutiny.

It is largely concerned with the measurement of electromagnetic energy from the sun, which is reflected, scattered or emitted by the objects on the surface of the earth. Various articles on the outside of the earth reflect various measures of energy in various frequency of the electromagnetic range. Satellite remote sensing provides multi-spectral, multi-spatial, multi-temporal data, which are useful for resources inventory, monitoring and their management. Satellite information is managable to both visual translation and computerized analysis.

Literature review

During the most recent twenty years much examination work on subjects like plant variety, land use, Sholas' change recognition, the travel industry sway, land slide zonation and scenic routes has been done by researchers using various methods in different parts of the world. In the recent past, making good use of Remote Sensing and Geographic Information Systems (GIS), researchers and R&D voluntary organisations have made considerable contribution towards the above studies. The current section manages the commitments made by different individuals from various pieces of the world. An examination led by Chand Basha et al., (1992) in Western Ghats has made parcel of commitments to the plant variety region. As indicated by them, the Silent Valley National Park is the biggest piece of nearly undisturbed zone aboding equatorial jungle in the entire of Western Ghats. The vegetation of this territory is captivating from the phytographical perspective with Asiatic endemic and Indo-Sri Lankan components ruling the situation. It is important that felling activities should be discouraged in order to maintain the forest structure and biodiversity of plantation. Parthasarathy et al., (1992) focused on its significance in ensursing the preservation of important timberland bio-assets in tropical wet evergreen woodlands of Kalakad public park situated in Western Ghats of Tamilnadu state, Southern India.

According to Ghale Utkarsh et al., (1998) evergreen and wet deciduous timberlands display moderate to high thickness and moderate degrees of peculiarity of species piece in the Western Ghats. Changes in woody species composition, abundance and forest strand structure were investigated in three sites of tropical wet evergreen forest around Sengaltheri in Kalakad-Mundanthurai Tiger reserve, Western Ghats, South India (Parthasarathy, 2001).Plant biodiversity of an undisturbed mid-elevation evergreen forest in the Southern Western Ghats was assessed by Ganesh et al., (1996).Plant diversity of an undisturbed low-elevation (2500 m above MSL) evergreen and moist deciduous forest in the Southern Western Ghats has also been assessed Sundarapandian and Swamy,(1997).Vegetation structure and species composition of tropical

ecosystems were studied through nine transects at Veerapandi and Kalamalai reserve forests in the Western Ghats. They reported the variations in plant diversity and population structure are largely due to anthropogenic perturbation and other abiotic factors Swamy et al., (2000).

Environmental problems

Important environmental problems noted on the Palani hills due to change in pattern of land use and land cover categories are:

- Soil erosion
- Land slides
- Siltation of stream valleys, reservoirs and lakes.
- Reduction in water holding limit of repositories and lakes.
- Vulnerability for floods around the slopes.
- Excessive surface run-off.
- Reduction in ground water energize.
- Change in atmosphere and disappointment of rainstorm.
- Reduction in natural habitat of wildlife and extinction of wild animals.
- Deforestation

Objectives

a. To study the land use pattern during 1970 using the topographical maps [as a base period], as the present study is to compare with the satellite data,
b. To carefully map the land use design for the year 2010 utilizing IRS P6 advanced information and contrast and the past time span and discover the change discovery
c. To make a specific study from the digital maps the changes caused by natural and man-made activities in the study area.

Methodology

The general methodology adopted for the present study is planned to cover all the important elements involved in ecological changes in the present study area. A special emphasis is given on plant diversity, land use change detection, impact of tourism and population on ecology and suggestion and recommendation on greenways formation and improvement. Information base age was the chief action required to begin the current investigation. They were collected from different sources and analysed through Geographic Information Systems (GIS) software Arc GIS 9.1. One of the significant and modern information source utilized here is distant detecting information. Rainfall, temperature, population data were collected from secondary sources. Spatial and non spatial data involved in the present study.

Location and extent

The Palani hills are an eastward spur of the Western Ghats with a maximum east–west length of 65 km and a maximum north-south width of 40 km. Total area of Palani hills is about 2068 sq. km. Kodaikanal Taluk, a major part of Palani hills with 1050 sq. km in area is bounded by Palani taluk in the north, by those of Dindigul and Nilakottai taluks of Dindigul District in the east, that of Periakulam (Theni District) in the south, and partly by the Coimbatore district and partly by Kerala state in the west (Figure-1).

Population

Population in Kodaikanal town is gradually increasing every year because of its salubrious climatic condition. It has increased to threefold, when compared to the 1951 and 2011 census dataIn the previous 7 years, increment in female populace is high when contrasted with male populace.

Table 1 shows the growth of population from 1951 to 2011 and also the decadal variations have also been indicated, by male and female with total population of Kodaikanal. By taking sixty years, the populace has multiplied multiple occasions in both male and female classes, regardless of the climatic states of this uneven territory. This is for the most part because of the way that the populace development wherever in the state just as the uneven

territory are being involved because of the quiet idea of the geology.

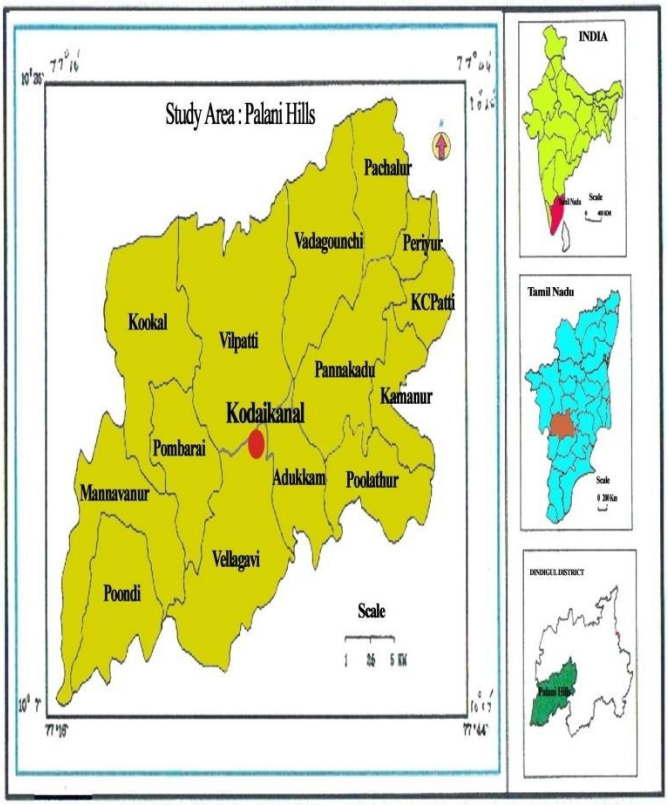

Figure - 1

Table -1
Growth of population - Kodaikanal

Year	Population Records		
	Men	Women	Total
1951	5717	5224	10941
1961	6672	6188	12860
1971	8440	8041	16481
1981	10511	9940	20451
1991	14507	12916	27423
2001	16777	16154	32931
2011	17133	16887	34020

(Source: 2011 Census Data)

Transport network

The area of study which focuses its attention upon road connecting major cities in the state and country. The following are the main road connections to important centres of South India from Kodaikanal city. Madras (520 km), Salem (260 km), Dindigul (100 km), Kodaikanal Road (80 km), Kumili (105 km), Bodinayakanaur (105 km), Coimbatore (172 km), Uthagamandalam (240 km), Palani (65 km), Bangalore (450 km) and Erode (190 km).

Database generation

Study of India geographical guide sheets viz 58F/7, 58F/8, 58F/11, 58F/12 were utilized as hotspot for deciphering land use classes for the year 1970. Geological sheets are giving acceptable measure of lucidity in deciphering different land use classes, for example, tanks, settlement, thick backwoods, open deciduous woods, open scour, rough out harvest and manors. In order to interpret various land use classes for the year (2010), IRS P6 LISS III (Figure 2) geocoded data were visually interpreted. Different other better land use classes could likewise be deciphered from satellite symbolism. Apart from land use classes interpreted from topographic maps includes dry crop, fallow land and degraded forest.

These two land use maps have been digitized and necessary attributes were keyed in through PC ARC / INFO. Proper editing to remove damages, over segments, labeling, etc. have been done then and there.

Map generalization

As land use classification for the year 1970 does not match with land use classification of 2010, there is a need to generalise these classes into common category. Change location investigation in GIS is important just when comparable kind of grouping happened. Therefore, sub classes of forest land use such as dense forest, open deciduous, degraded forest and open scrub were generalised to forest category. This was finished by performing 'break down' capacity of ARC/INFO GIS.

Land use and land cover classification

There are upwards of seven wide land use/land cover classes found in Level I and ten classes found in Level II for the Palani slopes dependent on Rashid (1993) Land use/Land cover

characterization frameworks. The interpreted classes on land use / land cover are listed in Table -2.

Water bodies incorporate tanks, lakes and supplies found on the slopes. Woods land incorporates thick, blended, open deciduous, corrupted timberland, open scour and ranch woodlands like wattle, eucalyptus, pine, oak, and so forth Farming area comprises of orange ranch and plantations. Settlements, dry crop, fallow / harvest land and rocky outcrop also come under the purview of this study.

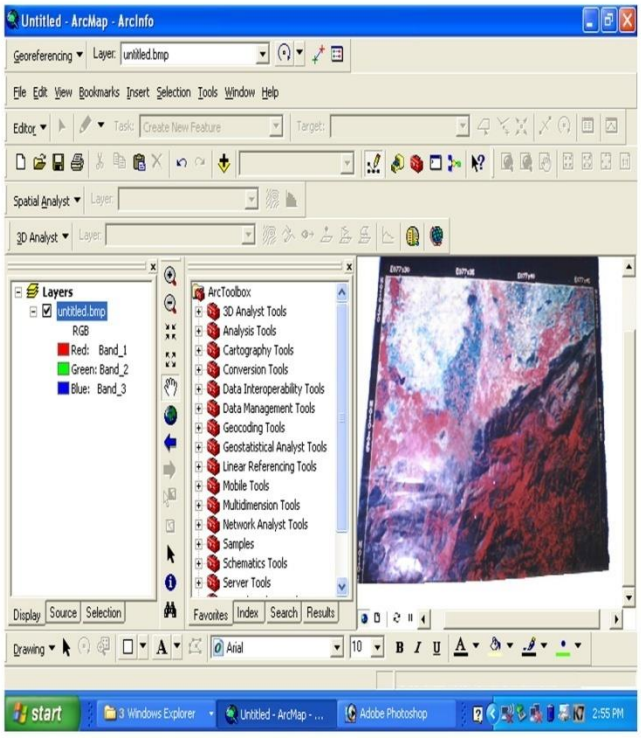

Figure -2

Table -2
Land use / land cover classification

Land use / Land cover			
1970 (Topographic Map)		2010 (Satellite Imagery)	
1.	Tanks	1)	Tanks
2.	Settlement	2)	Settlement
3.	Dry Crop	3)	Dry crop
4.	Fallow / harvest	4)	Fallow / harvest
5.	Forest	5)	Dense forest
		6)	Open deciduous
		7)	Degraded forest
		8)	Open scrub
6.	Rocky outcrop	9)	Rocky outcrop
7.	Plantation	10)	Agriculture

Spatial distribution and pattern of change: Forests are seen concentrated along the slopes of Palani hills on all sides. Dense forests concentrate in the north-eastern parts and along the deep valleys in the southern slopes of the hills. In southern parts, it is generally found as pockets. Northern and north western parts of the study area are occupied by these dense forests. Open clean timberlands to a limited degree are found in the western locale of the valley. A couple of pockets of open scour are found in focal and focal eastern parts. These are surrounded by open deciduous forests which are mainly found in the northern and southern regions of the hill valley. Central part and south western corner parts of the study area also occupy pockets of these type of forests. Degraded forests are found in the south-western region of the valley and the rocky outcrops in the western region of the hillsNeglected terrains are situated in the focal area and southern edges of the slope valley. Settlements are arranged in the focal part encompassing a lake. The Berijam lake is at the southern most piece of the valley. Dry harvests are found in the western finish of the sloping locale.

Change assessment

Transformation of timberland land to other land use is the principle sort of land use/land cover change saw here. The forest cover change is multifarious, such as shift in cultivation, illegal logging, forest fire and expansion of agricultural land. The increased demand for agriculture land compels farmers to move to the surrounding hill sides to bring more and more areas of land under cultivation. Populated territory has likewise made the extra weight on its delicate normal assets base.

The present study is essentially based on the forest of Palani hills and its ecosystem which has changed a lot owing to natural calamities and man-made activities. Land crumbling over the two planning time frames was distinguished and procedures were recommended to relieve the issue.

Settlement territories show a quick extension over a time of 40 years. In 1970, the absolute zone

was 1.77 sq. km. also, in 2010 it developed into 5.09 sq. km. The reasons traced out for this tremendous expansion are many such as developmental activities of Government, Commercial expansion, economic growth of the local people, mass tourism and so on. the part of mass the travel industry is urgent as it goes about as the reason for every enormous change. Too many tourists in an area quickly change its character. The expansion of Kodaikanal Township is of this nature (Figure - 3).

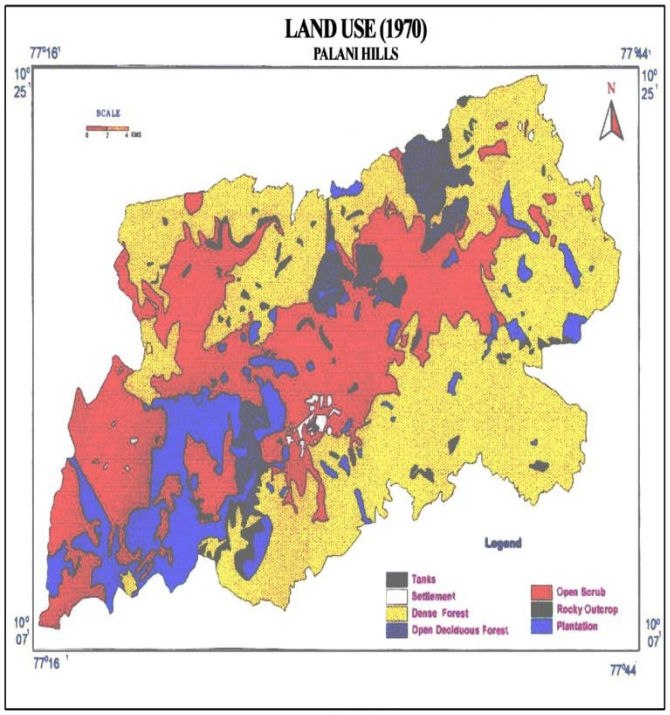

Figure - 3

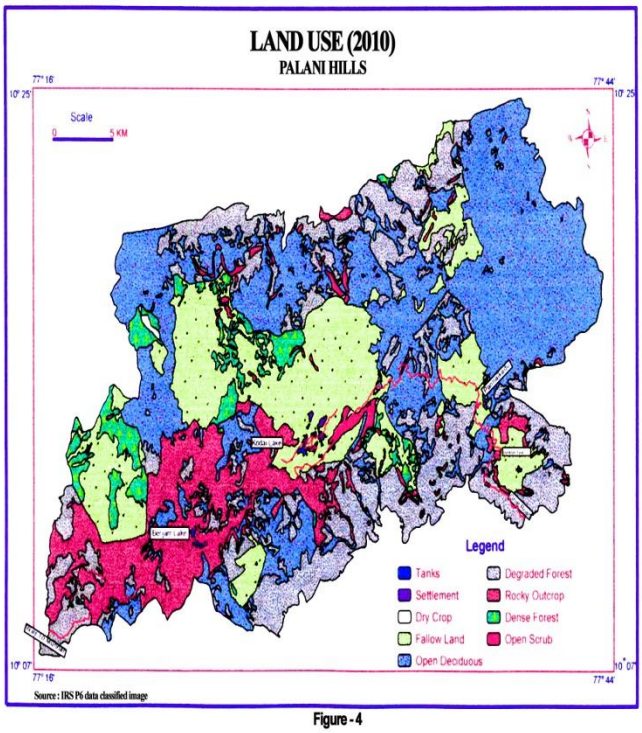

Figure - 4

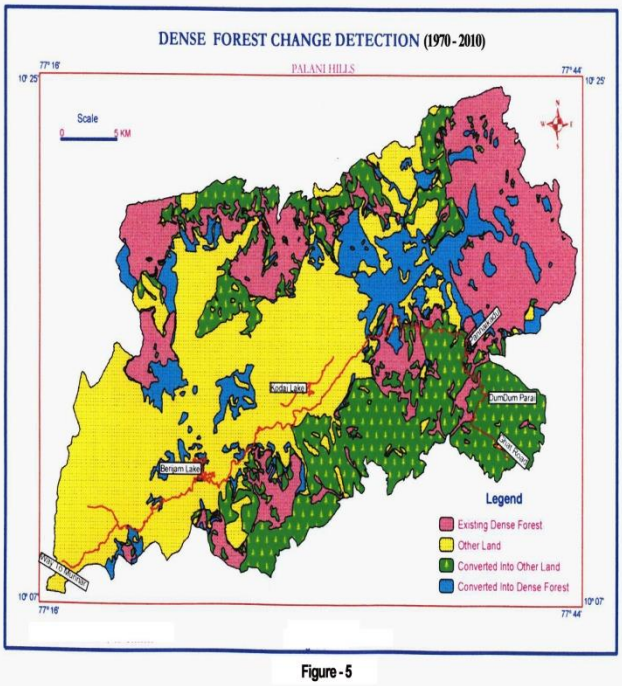

Figure - 5

The absolute territory of the slopes, the level of timberland cover was 60.89 sq. km. in 1973 and it reduced to 55.82 sq. km. in 1982. There are four

primary water tanks which don't show any striking spatial variety somewhere in the range of 1970 and 2010 (Table - 3). The Pranmati, a typical micro watershed, shows that cultivated land has increased at the expense of forest land and partly of pasture land. Water bodies like lakes and supplies in upper Palanis involved 0.07 percent of the absolute region in 1973 and the year 1982 saw a slight expansion in the percentage level from 0.7 per cent to 1.3 per cent that too with the construction of a new reservoir in the north eastern part of the hills. In the study area, as many as four lakes (including Berijam and Kodaikanal town lake) are found to be important. The areal extent of these tanks together was 1.14 sq. km. in 1970. Of the total area of the Palani hills, it shared 0.11 per cent. With the sole point of securing the climate, steps were taken in 2010 not exclusively to protect the current territory of water tanks yet in addition to extend the equivalent to the tune of 1.16 sq. km. The development hence came about however small, appears to be unexpected. Generally water body area gradually gets itself reduced owing to human activities. In the study area it is reverse which is mainly due to the active and timely involvement of the forest department, and other non-governmental organizations to protect the environment.

With respect to woodland cover, thick timberland shows a ton of varieties in its areal degree somewhere in the range of 1970 and 2010 (Figure-4). Major part of the forest is converted into open deciduous forest (Figure - 5).

Table- 3
Area and pattern of change of land use / land cover for palani hills during 1970-2010

Land use Type	1970		2010		Variation in (sq. km.)
	Area (sq. km.)	Area (%)	Area (sq. km.)	Area (%)	
Tanks	1.14	0.11	1.16	0.107	+0.02
Settlement	1.77	0.171	5.09	0.49	+3.32
Dry Crop	--	--	1.14	0.11	-1.14
Fallow / harvest	--	--	204.05	19.86	204.95
Dense forest	501.67	48.61	371.42	35.99	-130.25
Open Deciduous	48.97	4.75	253.26	24.54	+204.29
Degraded forest	--	--	126.75	12.28	126.75
Open scrub	338.24	32.78	44.88	4.35	-293.36
Rocky out crop	21.05	2.04	23.29	2.25	+2.24
Plantation	119.12	11.55	--	--	--

The territory of thick timberland was 501.67 sq. km. in 1970 and it came down to 371.42 sq. km. in 2010. The total area of land loss was 130.25 sq. km., during this period. The current situation obviously shows its further change into open deciduous backwoods. Going to the estate crop, it involved a zone of 119.12 sq. km. in 1970. Land loss in this category was total and in 2010 no piece of plantation land could be found anywhere. The 2010, land use/land cover situation shows a sudden change of ranch land into open deciduous woodland. It has also contributed to the formation of fallow land to some extent. The substantial misfortune in manor land is chiefly ascribed to the significant expense of raising estate crops. Those who are engaged in plantation crops are mostly small and individual farmers and they cannot afford this huge cost of raising the crops. Further the cool atmosphere with the hefty fog constantly is a risk to fruitful ranch.

Of the complete zone, rural terrains shared 26.96 percent in 1973 and it developed into 32.42 percent in 1982 (Sukumar et al., 1985). Open deciduous woodland has procured a major land gain to the tune of 204.26 sq. km. inside a time of 40 years. The total area of open deciduous forest in 1970 was 48.97 sq. km. and in 2010 it grew into 253.26 sq. km. (Figure - 6). This was made possible by the intensive activities of the forest department through Social Forestry Schemes and by the tireless efforts of several non-governmental organizations. The land gain was mainly achieved from both dense and scrub forests.

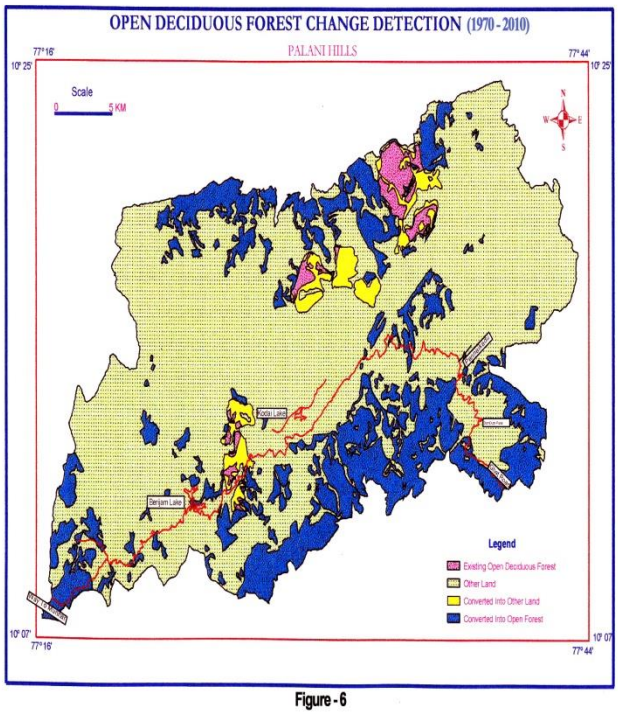

Figure - 6

The open scrub land in 1970 was 338.24 sq. km. and in 2010 it reduced to 44.8 sq. km. The absolute misfortune in open clean land during this period is 293.36 sq. km. and it seems out of proportion to the total area. Most parts of this land were either converted into fallow lands or open deciduous (Figure - 7). In certain places, scrub land is converted into dense forest. Similar conditions were also evidenced in Puruliya district (West Bengal) in which the open scrub lands were most vulnerable to soil erosion (Saini et al, 1999).

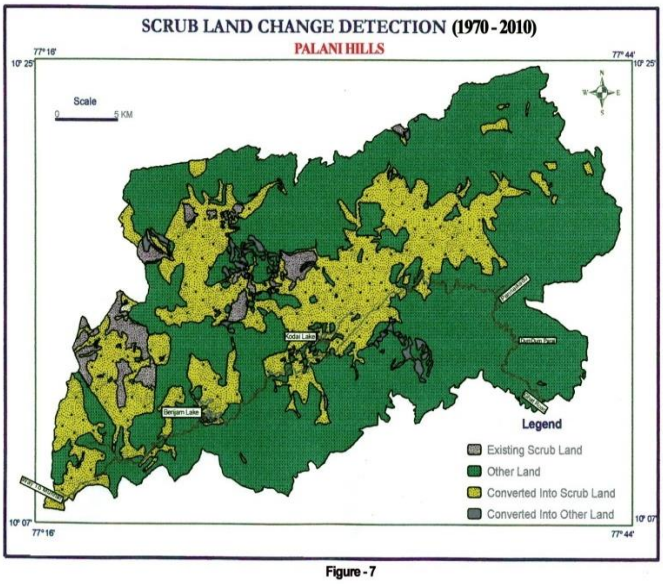

Figure - 7

Eco-development Strategy: Following suggestions are made for the eco-development strategy.

- Area under vegetation cover should be increased.
- Cultivation along steep inclines surpassing 30 degrees should be halted and this area might be changed over into woodland by planting perpetual trees.
- Soil preservation technique is to be carefully followed any place the inclines surpass 15 degrees.
- Extension of farming grounds ought not be at the expense of timberland land.
- Trilling and ploughing around reservoir areas should not be allowed.
- Cutting of forest trees for firewood should be stopped. Alternate fuels like kerosene and Liquid Petroleum Gas should easily be made available at subsidised prices in the hill station.
- Gobar gas plants for fuel purpose could be established in rural areas, during favourable season thereby making manure easily available as crowding

Recreational activities

Outdoors, climbing, horse riding, natural schooling, power sailing, paddling, freshwater fishing might be given more consideration so a lot more individuals will visit this zo

Conservation

To conserve the unspoiled Green belt areas, there should be control over the access to the Green belt areas. Exotic flora and fauna should be eliminated and an ecologically prescribed programme for pyrogenic ecosystems should be established.

Preservation

Management recommendations include limiting human access to sensitive areas, special protection

for endangered species, threatened species and species of special concern.

Environmental education

Since the natural resources are fastly depleting, environmental education related to environmental problems and management aspects should be given more importance.

Conclusion

The equalitarian nature of the contemporary greenway considers Kodaikanal in its entirety, connecting and providing common access to cultural centers, public transit, waterfront and recreational resources and parks. The importance of building upon historic parks and linkages is essential to give maturity and continuity to newly found greenways. Biodiversity is the most important potential ecological benefit of greenwaysIn the event that scenic routes are to be a vital component of reasonable scenes, biodiversity should be a predominant and completely vital segment all through the scene arranging measure. Scenic routes can possibly control the progression of abundance supplements across the scene, especially into riparian frameworks. Even though environmental awareness has grown over the last decade, there is a resistance to change by a public that mistrusts government motives.

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