

PREPARATION OF LAND SUITABILITY ACTION PLAN USING GPS AND GIS FOR SILLAHALLA (Kf2) WATERSHED IN NILGIRIS DISTRICT

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1.0 INTRODUCTION

Nilgiris is one of the important hilly areas in South India and lying in the junction of Eastern and Western Ghats of India. It includes many hill stations those are all rich of various flora and fauna, which are manifested at all levels. Nilgiris is one of smallest district in Tamil Nadu, with the geographical area of 2549 km². Nature manifests itself in the forms of Forests, Grass Lands and Tea Estates over here. Over a period of twenty years there is a lot of change in the agricultural practice resulting in the soil erosion in many parts of the district. This study has been taken to evaluate the role of Remote Sensing, GIS and ground control surveys using GPS for delineating such zones and to suggest suitable changes in the existing agriculture practices.

2.0 OBJECTIVE OF THE STUDY

The main objective of the study is to address the remedial/developmental measures using Remote Sensing, GPS and GIS to arrive at site-specific action plans for tackling the following problems:

Improper Land use Practice (Land use in conflict with slope)

Deforestation/forest conditions

The broad objectives of the integrated study are:

To develop a reliable database of all natural resources in the Sillahalla (Kf2) Watershed using Remote sensing, GPS and GIS technology

To evolve and arrive at local-specific developmental action plans considering Land and forest resources for their optimal utilization and to address the remedial/developmental measures for the said problems

3.0 ABOUT THE AREA

3.1 Geology

Based on the detailed geological, structural and geo-morphological studies and number of evidences have led to the conclusion that block faulting resulted in the upliftment of the Nilgiris plateau.

Structurally the Sillahalla(Kf2) watershed comprise Archaean metamorphic rocks made up of charnockite, biotite gneiss, and magnetic quartzite, hornblende granite along with some intrusive bodies like pegmatite dolerite and quartz veins. Apart from these, small enclaves of schistose rocks like talc chlorite schist are also found. The laterite found over the charnockites is hard. Structurally the area is highly disturbed and is subjected to faulting. Due to these tectonic activities the deep-seated metamorphic rocks have undergone considerable deformation during Precambrian times, which resulted in different structural features such as folds, faults and joints. The major rivers in the district flow along the prominent fractures. The prominent fractures in the district are trending northeast, northwest. (GSI, 1982).

4.0 SPECIFIC PROBLEMS OF THE AREA

Though the study area has 56% under forest cover and has bountiful of vegetation/greenery with an annual average rainfall of 1800- 2000 mm the fragile ecosystems is under threat due to biotic pressure/human activities and improper land use practices. The major issues, (i) Degradation of shola forest and grassland (ii) forest fire/encroachment, (iii) Landslides and (iv) Biotic pressure. In the present study an attempt has been made to identify the areas affected by improper land use practice and suggest remedial measures using an integrated approach.

4.1 Land use practices in conflict with the terrain

The major problem of the area is the improper land use practices, which has caused severe damage to the fragile environment. It is observed that annual crops (vegetable crops like cabbage, potato, carrot, etc.,) and agricultural plantations such as tea are grown on all slopes. This type of Land use practices has resulted in heavy soil erosion, land degradation and siltation of streams/rivers/reservoirs.

Annual cropped areas remain fallow for about 6 months in a year and these areas on high slopes are the most vulnerable to soil erosion especially during rainy season (the area receives heavy rainfall). It is estimated that about 40 tons/ha/year is the soil loss from the above areas. In potato growing areas, the tilling is done along slopes to avoid brown rotting of potato but due to this the soil erosion is further accelerated. The main agricultural plantation of the area is tea and is seen on all slopes and on all types of terrain. Contrary to the belief that lush green tea estates does not cause any land degradation, it is observed that during the initial 4 years of new tea plantation (till the tea bushes come up) the soil loss is estimated to be around 3 tons/ha/year. Tea plantations without adequate two and three-tier tree cover (silver oak etc.,) are found to be causing soil erosion. Tea plantation in valley region is many times damaged by frost. Majority of the tea estates and annual cropped areas are earlier grasslands and shola forest and had kept the fragile environment of the area in balance.

4.2 Degradation of shola forests and grasslands

These two land cover types are unique of the Nilgiris district. Evergreen shola forests are the vital zones for groundwater discharge source of origin of many springs/perennial streams. In many areas the shola forests are cut and the area have been converted into tea estates, commercial plantations like wattle etc., and in some areas the shola are cut for firewood. Similarly the grasslands are also getting affected by indiscriminate and large scale grazing by the large number of cattle, and also transformation of grasslands into tea estates, commercial (Wattle eucalyptus etc.,) plantations, and for agricultural activities. Both sholas and grasslands i.e. the original land cover of Nilgiris are significant in terms of bio-diversity and prevention of soil erosion/land degradation.

4.3 Database Creation

The entire area has been photographed on 1:6000 scale, the photos have been rectified and orthophotos and Contour maps are prepared on 1:5000 scale. These maps are used for the preparation of various thematic maps such as, Land use, Soil, and Drainage etc., Extensive control surveys have been conducted using differential GPS, for generating Orthophoto maps and Contour maps.

4.4 Slope map

The slope maps are prepared from contour map using venworth method. The following nine classes were identified.

Sl.No	Class in %	Slope Description
1	0-1	Nearly level
2	1-3	Very gentle sloping
3	3-5	Gently sloping
4	5-10	Moderately sloping
5	10-15	Strongly sloping
6	15-25	Moderately Steep to steep sloping
7	25-35	-do-
8	35-50	-do-
9	>50	Very steep sloping

These slope classes were regrouped as per the slope-based zonation. Slope Class vs. Land use practices (i.e. particular slope class is suitable for specific type of land use activity). The regrouped classes are:

1. 0-10% Nearly level to moderately sloping
2. 10-33% Moderately to steep sloping
3. > 33% Very steep sloping

4.5 Watershed Boundary map

Since, watershed forms a basic unit for better planning management and development of land and water resources it was essential and necessary to delineate the watershed boundaries. Watershed management is considered to be the most effective system for the conservation, development and management of soil, water and other land resources on a sustainable basis. Therefore watershed has been taken as the unit of development and is managed as per the potentiality capability and suitability of the land

4.6 Land use/land cover map

Land use/land cover map for the area has been prepared using 1:5,000 scale from orthophotos along with field observations and collateral data for finalizing the map with following land use/ land cover class.

Village

Agricultural land

Fallow land

Horticultural & Plantation

Dense Forest

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Fairly Dense Forest

Open forest

Degraded forest

Forest plantation

Land with or without scrub

Barren rocky / sheet rock

River / Stream

Grass land

Slope based land use Practices

Sl.No	Slope%	Landuse Practice
1	0-10	Annual crops (vegetables like Potato, Cabbage, Carrots etc.)
2	10- 33	Agriculture Plantation horticulture/ forest plantation
3	> 33	Afforestation / grasslands / silvi Pasture permanent vegetation cover

The above criteria were adopted while integrating the layers for arriving at action plans

4.7 Soil map

The soil map has also been prepared using the 1:5,000 scale aerial photographs. Soil survey method include (i) identification of kind of soil (ii) description of kind of soil (iii) classification of the same and (iv) mapping their extent and distribution on the standard scale base map. The soil maps along with its derivatives such as land capability map

4.8 Data integration

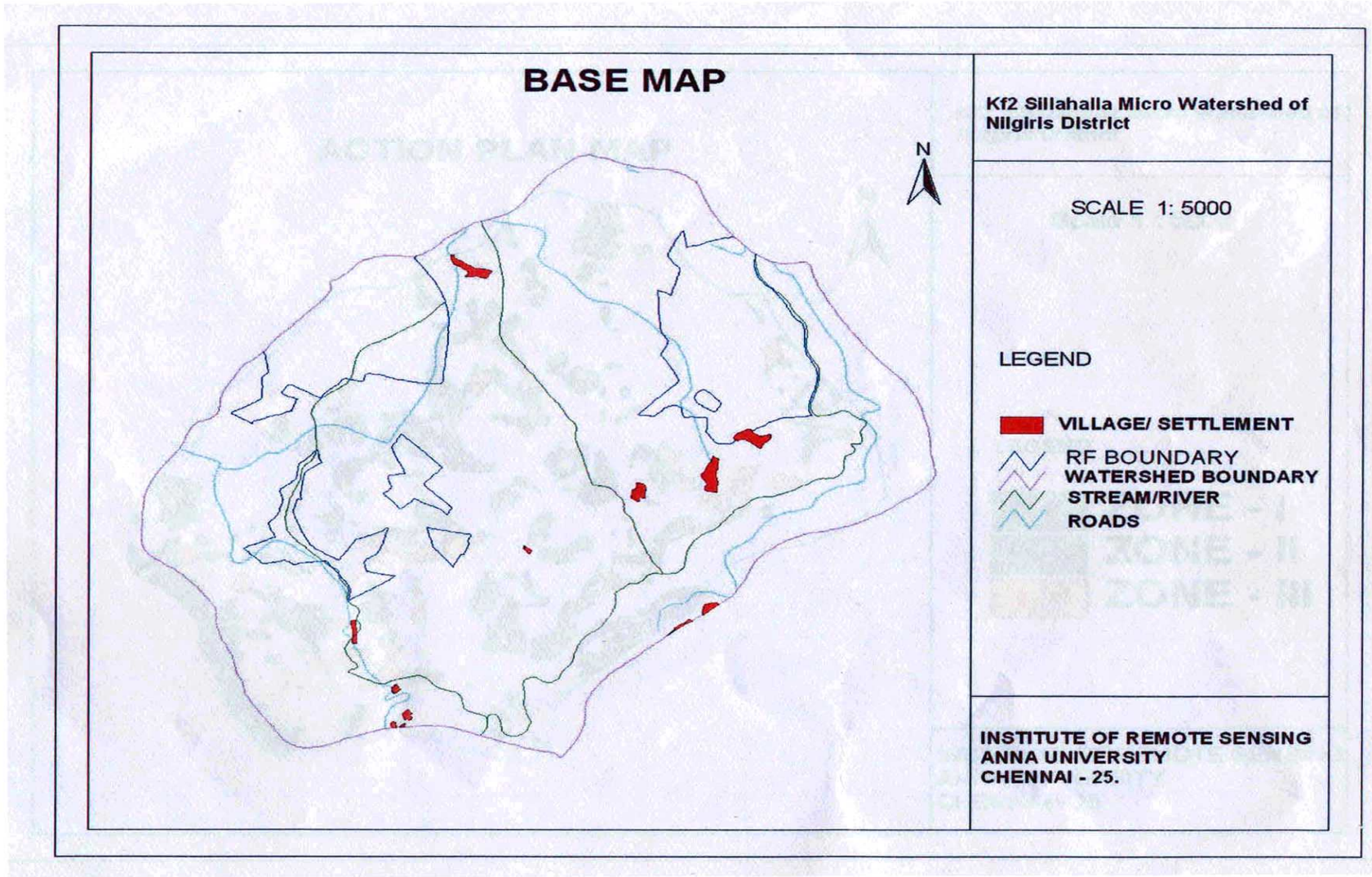
All the above thematic maps were digitized in a Geographical Information System (GIS) Environment using ARC-INFO software. The thematic maps pertaining to watershed were edited, registered, and labeled. Action plans for land resource development were generated for the watershed based on decision rule/suitability ranking method by integrating land use and regrouped slope map. Other information was also used to arrive at action plans. Statistical information on aerial extent etc., were also generated category wise for all the watersheds.

4.9 Action plan generation

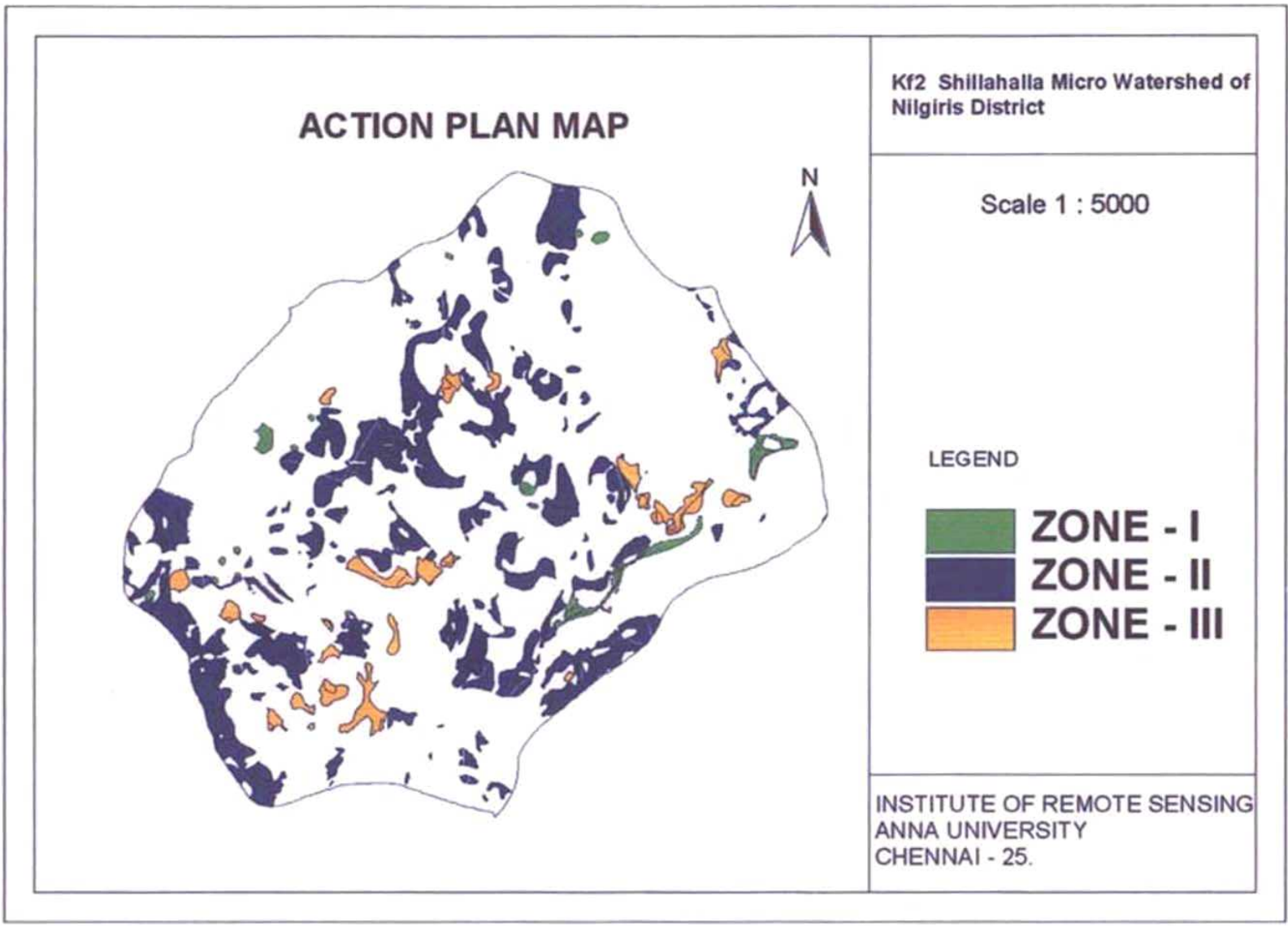
The spatial data for the watershed were integrated using the decision rules arrived at by incorporating the inputs from HADP Nilgiris. The slope categories were regrouped and the Slope based zonation is as follows: (i) Slope Class 1 (0-10%) suitable for annual crops, (ii) Slope class 2 (10-33%) suitable for tea/agricultural plantations, (iii) slope Class 3 (>33%) suitable for forest/grassland/permanent tree cover from the original 9 classes. Decision rules for each land use category with respect to the corresponding slope class were arrived at and applied while integrating the layers for action plan generation. The analysis clearly brought out the following

1. Areas whose land use practices are in tune with the slope and thus need not be altered.
2. Areas to be conserved/preserved
3. Areas whose land use practices are not in tune with slope and need to be altered/modified suitably.

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