Management of Natural Resources through NRIS – A Case Study

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Overview

1. Introduction

The creation of the nature, natural resources, are under severe pressure by another form of creations, i.e. living beings who in turn utilize the natural resources for improving their living standards. The natural resources tapped for development required careful planning in order to decide the extent of its use for the present versus the reserves for the future thus adopting the sustainability concept. This essentially required first the extent of present use and the available potential. These data are to be provided to decision makers in order to help them to take scientific decisions. The advancement in the space technology and computational capabability has given opportunity to map the available natural resources covering the area quickly and in an accurate and reliable manner.

Today, the manager has the desktop with sufficient computing power to handle complex models and advanced visualization techniques with the advent of very high resolution imaging systems and the reliable and high quality data they provide. In order to effectively harness the power and capabilities of these technologies, it is essential to organize the data acquisition, processing, storage and retrieval. The management of our natural resources calls for higher order of balance between competing demands and protection of the fragile environment. Keeping this in view, the Natural Resources Information System (NRIS) database has been created for Dharmapuri and the Nilgiris districts and made available for management of natural resources.

2. Objectives

The main objectives of NRIS project are as follows:

- To collect all the natural resources, environment alstatus, physical resources and socio economic data and update the same through remote sensing interpretations and field surveys.
- To prepare profiles of district resources at periodic intervals
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- To provide analyzed information to the local bodies and other line departments on the management of natural resources for scientific decision making and planning.
- To train implementers and decision makers in the concept and use of Natural Resources Information System.
- To provide feed back on quality of data and their utilization.

3. Data Layers Used in NRIS Project

The NRIS consists of a comprehensive list of database elements, both spatial data on 1:50,000 scale and non spatial data, which includes 20 primary spatial layers, eight primary non-spatial layers, 17 derived spatial layers and three derived non-spatial layers. For each of these elements a unique name has been given as well as a detailed coding scheme has been defined for the individual classes. Spatial layers consist of landuse / cover map, geomorphic units & landforms, lithological units , geological structures, soil type, depth, texture etc, drainage, canals, elevation contours/ spot height points, watershed hierarchy polygon, state/district boundaries, district / taluka boundaries, village boundaries, forest management boundaries, location of wells, settlement locations, road, network, rail network along with railway Stations, rainfall / temp observation, minerals and SOI toposheet references. The derived layers consist of slope, groundwater prospects, composite land development units, land resources development plan, water resources development plan, land capability, watershed prioritisation, run-off potential, polygonised meteorological data, soil irrigability, land irrigability, water quality for irrigation and drinking purpose and service centre hierarchy. Aspatial layer consist of demography, occupation, education facilities, medical facilities, communications, general, land use and power database. The derived layers are composite functionality index, agricultural development index and village development index.

4. Application of NRIS Database

The databases are created for Dharmapuri and the Nilgiris districts. The various applications for which the data sets created are made use of are presented below.

4.1 Dharmapuri District Profile: This district occupies the northern most part of Tamil Nadu State and covers an area of 9581.26 sq.km. Geographically it is situated between 11° 46' 21'' to 12° 53' 23'' North latitude and 77° 28' 34'' to 78° 44' 13'' East longitude. This district is situated on the western side of the Eastern Ghats. A major part of the district is hilly, rocky and uplands with steep to gently to moderate slopes, radiating in all directions and merging in to the stream courses which are flowing throughout the district. The altitude of the district ranges from 380 to 1395 m above MSL.

4.1.1 Application of NRIS Data Base for Dharmapuri District: Both spatial and non-spatial data created were integrated to form a unique solution for the following activities.

i. Prioritization of watersheds
ii. Land resources development plan
iii. Suitability for land irrigability, land capability and soil irrigabilty and
iv. Forest management.

4.1.1.1 Prioritization of Watersheds: The methodology for prioritization of watersheds were two fold one based on severity of soil erosion and another by using DPAP scheme norms. The norms for soil erosion are.

(i) Severity of soil erosion.
(ii) Landuse such as crop land, plantation, wasteland, forest etc.,
(iii) Slope group from nearly level to very steep
(iv) Rainfall.

Based on the above silt yield index were computed for all micro watersheds in the area. The following DPAP norms were used for prioritization of the watershed by the administrators viz.

1. Predominance of wasteland/ degraded land
2. Areas having low ground water potential
3. Severity of soil erosion
4. Predominance of SC/ST population
5. Low irrigation potential

4.1.1.2 Land Resources Development Plan: The spatial integration of various maps results in segmentation of various land units to consider for any development activities. Each land unit possesses a variety of information on the land form, physiography, behaviour of soil, productivity potential etc., land resources grouping have been arrived at with site specific solution. The recommended categories for the region are as follows: (1) Intensive agriculture, (2) Dry farming with soil and water conservation, (3) horticulture, (4) Agro Horticulture and Agro forestry, (5) Afforestation and (6) Social forestry – fuel wood and fodder.

4.1.1.3 Ground Water Prospects Map: Integrated studies involving geomorphological, lithological and structured investigation followed by hydrogeological and hydrogeochemical exploration led to the identification of groundwater potential zones.

The prospects identified were

1) Good to moderate
2) Moderate to poor and
3) Poor to nil

4.1.1.4 Suitability for land capability classification: The land capability classes place soils into general order of suitability or unsuitability for cultivation, forestry, grassland or other uses for sustained production. The soils that have the least limitation or hazard and respond best to management are placed in the higher order. It also evaluates soils with respect to their susceptibility to erosion, soil depth, drainage problem and other soil characteristics that would affect to sustained production of crops. In this district five different land capability units were identified.

4.1.1.5 Land irrigability class: The suitability of land for Irrigation depends on physical land features and socio-economic condition, quality of water, drainage requirement etc. The land irrigability classes established were viz, (1) Lands that have few limitation for sustained use under irrigation, (2) Lands that have moderate limitation for sustained use under irrigation, (3) Lands that have severe limitation for sustained use under irrigation, (4) Lands that have marginal for terraced use under irrigation because of severe limitation.

4.1.1.6 Soil irrigability classes: Soil irrigability classes are very useful for making group of soil for their sustained use under irrigation. The classes are defined in terms of degree of soil limitation as reflected by the soil properties like effective soil depth, texture, presence of minerals, NPK, etc., Five soil irrigability classes have been established as follows :

Class A. None to slight soil limitations for sustained use under irrigation

Class B Moderate soil limitations for sustained use under irrigation

Class C Severe soil limitations for sustained use under irrigation

Class D Very severe soil limitation for sustained use under irrigation

Class E Non irrigable soil class

In Dharmapuri district three classes of soil irrgability classes were identified.

4.1.1.7 Dharmapuri - A Success Story: The implementation of IMSD activities with the on going developmental activities of the district planners were carefully monitored. The process over the decade under IMSD by way of suggesting alternate landuse practices, water harvesting structures, ground water exploitation

were found fruitful. The actual development indicates as per the latest landuse /landcover dated year 2000, that the intensive double cropping area has gone up to 16.09% from 13.65% of the total area suggested by the action plan generated for land use/landcover dated year 1992 .

By this, it implies ironically, that remote sensing technology combined with GIS has its own responsibility for the constructive activities for development at all times.

4.2 The Nilgiris District Profile : The Nilgiris district, Tamil Nadu with a geographical area of 2549 sq.km is one of the smallest districts in Tamil Nadu. It is bounded by 11° 0' and 11° 55' North latitude and 76° 13' and 77° 00' East longitudes. Nilgiris is mostly a hilly district located on the fragile environment of Western Ghats with an elevation ranging from 300 m in the Moyer gorge to 2634 m at Doddabetta above MSL.

The district experiences very diverse climate owing to large variation in the altitude. The maximum temperature recorded in the month of February is 24.3°c while the minimum temperature is in the month of January 6.0°c. The average annual rainfall is between 1300 mm and 2000 mm in the Eastern part and 2000 mm and 4600 mm in the western part.

4.2.1 Application for NRIS Data base for the Nilgiris District: With the advent of the query shells, Gelap, Geosmart, Geolawns and Decision Space, the spatial and non-spatial data were integrated, to form the following layers, which are of great use to the user departments, in the district.

i. Land resources development plan (LRDP)
ii. Customization of watersheds into local names
iii. Land irrigability, land capability, soil irrigability and runoff potential.
iv. Forest management as per forest administration norms eg, division, circle etc.,

4.2.1.1 Land Resources Development Plan: Using the Gelap shell the LRDP was generated. Landuse and soil layers were integrated to form the CLDU. As for as the Nilgiris district is concerned, landuse and slope play a dominant role in the action plan, because of the complex hilly terrain. The recommendation for the region are as follows :

1. Afforestation
2. Afforestation/Gap filling
3. Annual crop/ AGRO horticulture
4. Conservation
5. Horticulture/Forest Plantation
6. Multiplayer
7. Preservation
8. Silvi pasture/forest plantation
9. Silvi pasture/grass land

4.2.1.2 Customization of Watersheds: As per the NRIS standards the watershed codification were done, upon user request, the micro watersheds have been customized to the local names. There are about 75 micro watersheds in the Nilgiris district. The HADP schemes are implemented and monitored watershed wise. The customized watershed layer is very useful and appreciated by the user department, as it caters the needs of the user as a base map.

4.2.1.3 Land Capability Classification: Erosion III unit intensity I and Soil II unit intensity II are the two major classes derived for the entire Nilgiris district.

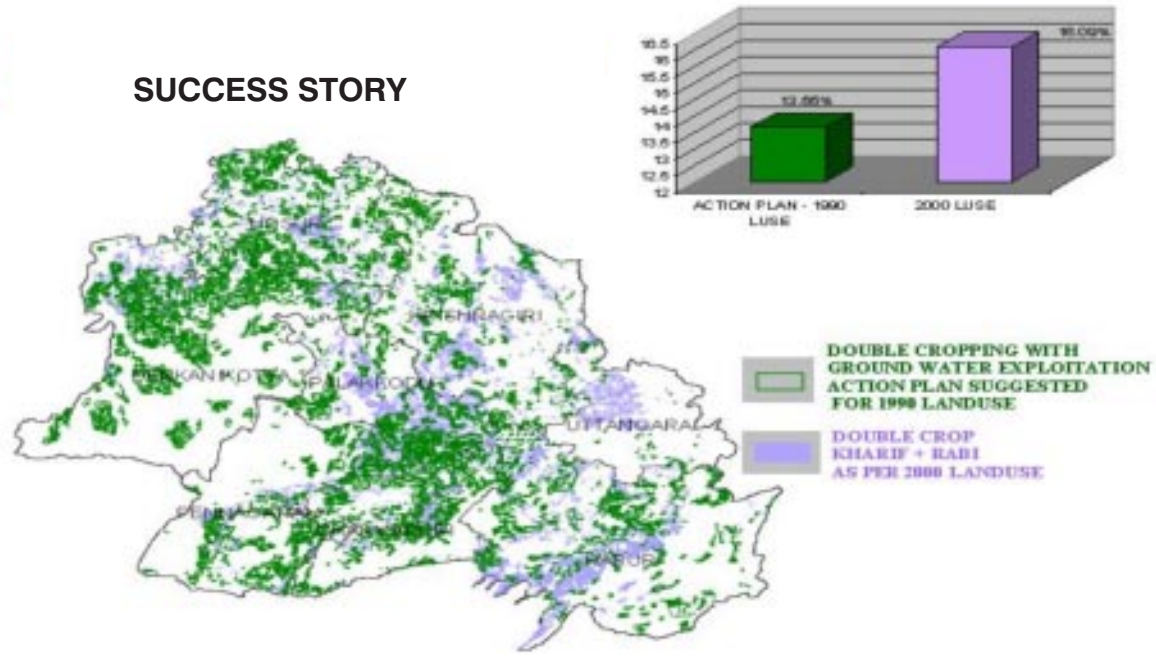

FIG.1 SUCCESS STORY- OVER LAY OF 1992 LRDP OVER 2000 LANDUSE

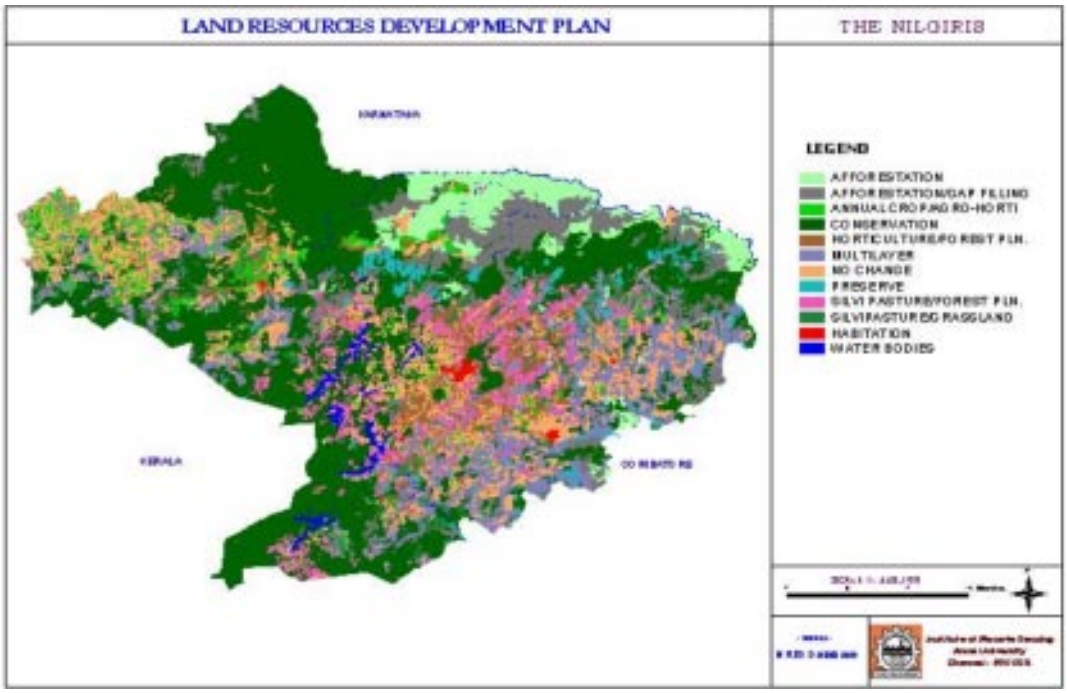

FIG.2 Land Resources Development Plan for The Nilgiris District

4.2.1.4 Land Irrigability Classification: Three classes are in this layer. The dominant class is " very severe limitations for sustained use under irrigation", the next dominant class is "moderate limitations for sustained use under irrigation" and the less dominant class is "severe limitations for sustained use under irrigation".

4.2.1.5 Soil Irrigability: Soil conservation is one of the major priorities for the HADP. The soil irrigability layer is one of the important information to the user departments. Three classes were classified viz., (i) Moderate soil limitations for sustained use under irrigation, (ii) Severe Soil Limitations for sustained use under Irrigation, (iii) Very severe soil limitations for sustained use under irrigation.

4.2.1.6 Runoff Potential: The Nilgiris district has a higher percentage of slope, and the runoff potential plays a vital role of information for planning purposes. The runoff potential zone has been categorized into (i) High, (ii) Moderately high, (iii) Moderately low.

5. Conclusions

The NRIS system, both at Dharmapuri and the Nilgiris nodes, prove to be user friendly and cost effective. The system caters to the needs of planners in identifying watershed/villages lacking basic amenities, implementing and monitoring of schemes. The system is useful in preparing action plans for land resources development activities.

6. References

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