Application of Geoinformatics in Natural Resource Management at Micro Level

Dr V Madhava Rao†
Dr R R Hermon

Abstract

The pressures on the natural resources have tremendously increased over years by man's greed for commercialisation and livilihood of local people. Devoid of regeneration, population pressure and wide scale tree felling depleted the natural resources to a level, which posed a problem for the very sustenance of man. Therefore it is imperative to understand the consequences of manmade initiatives and to devise proper strategies to counteract these detrimental effects to keep a balance of the environment, ecology, green cover and human livilihood.

Geoinformatics has proven as a powerful tool for studying the natural resources and help in locational features, extent of coverage, monitoring the resources and in generating modeling for probable scenarios, which assists in optimising resource utilisation.

The Geoinformatics application is demonstrated through a Case Study in Keshampet Mandal of Mahaboobnagar District of Andhra Pradesh. Various layers like Landuse and Landcover, Geomorphology, Slope etc have been generated along by integrating both satellite imagery and ground data, which was analysed to generate an action plan for land development.

Geoinformatics use in the natural resource management has proved to be an indispensable management and decision making tool which can ensure optimum use of the resources and help in devising systems for judicious resource use and management practices and generate land based action plans, which can easily taken up by local communities, PRIs, CBOs, NGOs and Watershed Associations. Further monitoring of various activities and impact assessments can be reliably administered for ensuring visible benefits to the community involved.

Geoinformatics would be used extensively by all at all levels in the foreseeable future in a cost effective and time saving manner and would be customised and simpliefied with local language interface to be used by local comunities with ease like the present scenarios of PIK, IT and ITES in rural areas.

Geomatics Cell, Centre for Micro Planning, National Institute of Rural Development,
Hyderabad. (**E_Mails**: mrv@nird.gov.in, rrh@nird.gov.in)

Application of Geoinformatics in Natural Resource Management at Micro Level

Dr V Madhava Rao†
Dr R R Hermon

Introduction

The pressures on the natural resources have tremendously increased over years by man's greed for commercialisation and livilihood of local people. Devoid of regeneration, population pressure and wide scale tree felling depleted the natural resources to a level, which posed a problem for the very sustenance of man. Therefore it is imperative to understand the consequences of manmade initiatives and to devise proper strategies to counteract these detrimental effects to keep a balance of the environment, ecology, green cover and human livilihood.

Geoinformatics has proven as a powerful tool for studying the natural resources and help in locational features, extent of coverage, monitoring the resources and in generating modeling for probable scenarios, which assists in optimising resource utilisation.

The Geoinformatics application is demonstrated through a Case Study in Keshampet Mandal of Mahaboobnagar District of Andhra Pradesh. Various layers like Landuse and Land cover, Geomorphology, Slope etc have been generated along by integrating both satellite imagery and ground data, which was analysed to generate an action plan for land development.

Geoinformatics use in the natural resource management has proved to be an indispensable management and decision making tool which can ensure optimum use of the resources and help in devising systems for judicious resource use and management practices and generate land based action plans, which can easily taken up by local communities, PRIs, CBOs, NGOs and Watershed Associations. Further monitoring of various activities and impact assessments can be reliably administered for ensuring visible benefits to the community involved.

Geoinformatics would be used extensively by all at all levels in the foreseeable future in a cost effective and time saving manner and would be customised and simplified with local language interface to be used by local communities with ease like the present scenarios of PIK, IT and ITES in rural areas.

Geoinformatics Application

The approach takes into consideration various elements of natural resources, viz., all base layers, existing land use / land cover, soil map, hydrogeomorphology, terrain slope, drainage, watershed maps and local peoples' aspirations with respect of socio economic considerations to suggest a suitable action plan for sustainable development of land and water after scientific analysis of the spatial and non-spatial data.

Locale-specific action plans for sustainable development of land and water resources can be generated on watershed basis, integrating thematic information generated using satellite data with collateral/conventional information and socioeconomic inputs. The action plans are basically recommendations towards improved soil and water conservation for ensuring enhanced productivity, while maintaining ecological/ environmental integrity of the area/region. The action plans, to illustrate, address identification of sites/areas for surface water harvesting, groundwater recharge, soil conservation measures - through check dams, vegetation bunding; sites/recommendations for improved/diversified farming systems with fodder, fuel wood plantations, agroforestry, agro-horticulture, etc. These action plans can then be presented to the people for sensitising them to get involved and to integrate their planning with reflections of their aspirations and with a convergence approach for Panchayats and Local Bodies to take decisions. The support organisations for such an efforts can be the Government Departments, State Remote Sensing Centres, universities, private entrepreneurs and NGOs.

To demonstrate the application of geoinformatics in natural resources study, a Study was taken up in the Keshampet Mandal of Mahaboobnagar District of Andhra Pradesh and resource analysis was made for the entire study area with base information and through satellite imageries, the various analysis of which are presented below:

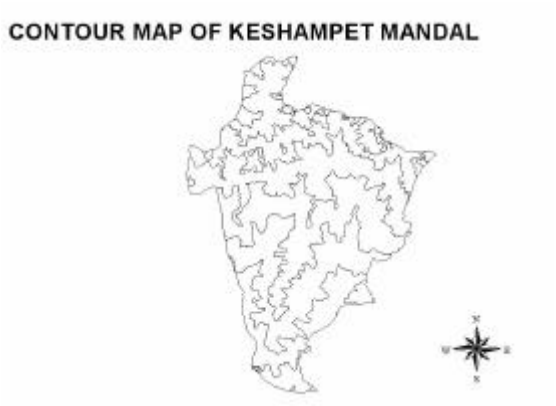

Figure 1

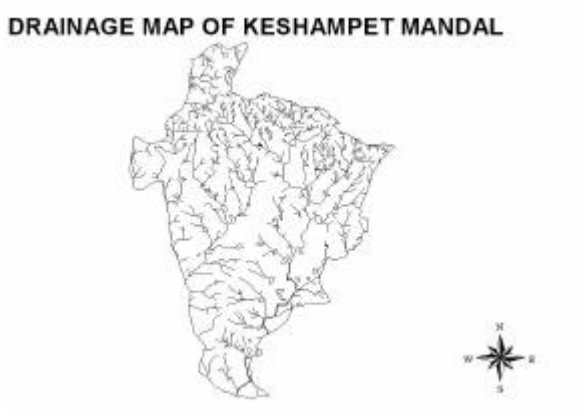

Figure 2

Figure-3

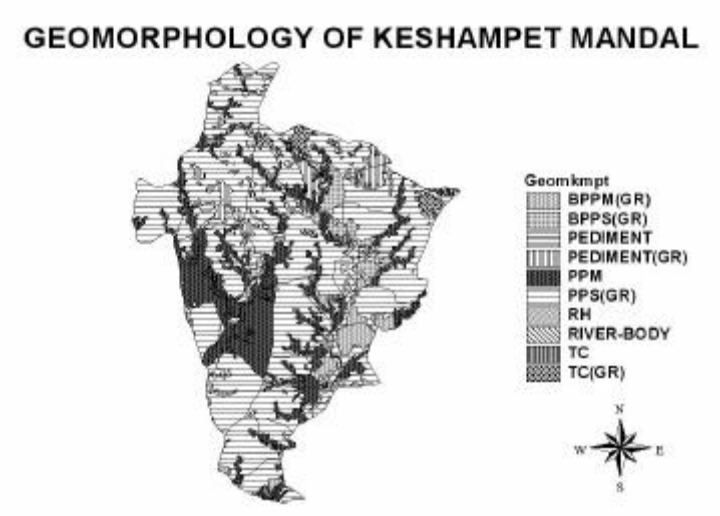

Figure-4

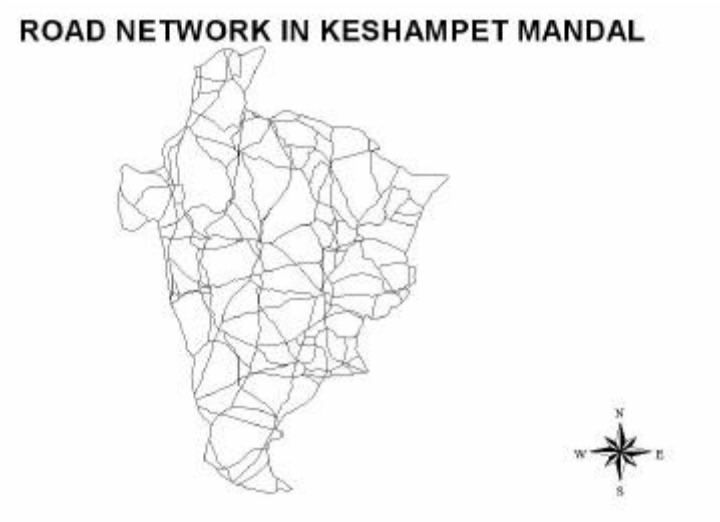

Figure-5

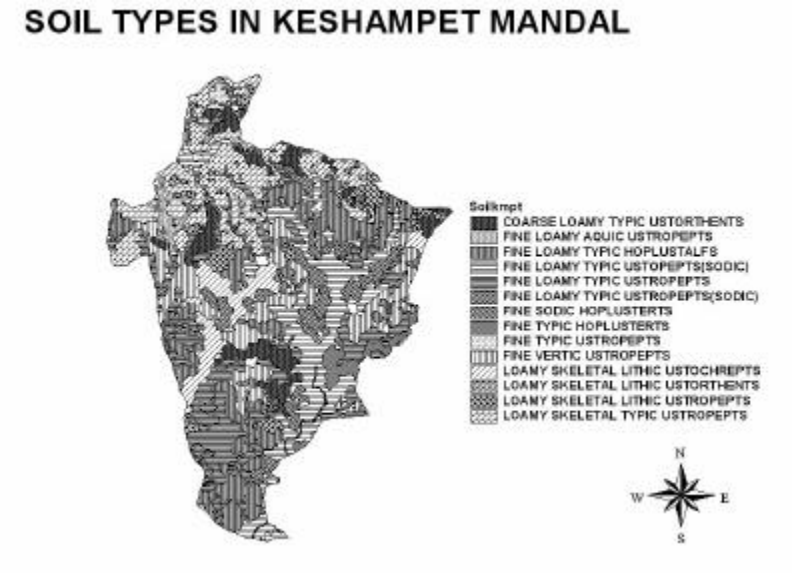

Figure-6

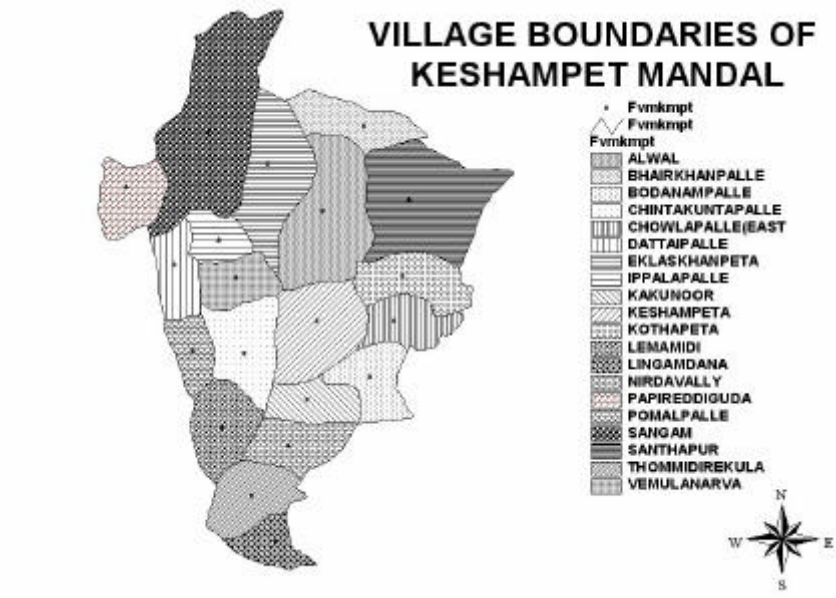

Figure-7

Recommendations for Optimising the Resource Use

1. As the major lineament zones form the important and promising horizons for potential ground water deeper levels of the earth, proper identification of the lineaments using remote sensing techniques (aerial & satellite images) followed by

ground checks would go a long way while selecting sites/areas for assured ground water development.

2. As the well irrigation is the main key in the study area, as the rainfall in the district general erratic and irregular and the average annual rainfall is low. There is every need to utilise as much of rain water as possible by improving the recharge condition in the study area. This is possible by constructing the low-cost rainwater harvesting structures such as percolation tanks, check dams/rivers and farm ponds.

3. It is suggested to go for very high Silvipasture development, controlled grazing, trenching and spoil banks to conserve moisture, plantation of arid horticulture species, high silvipasture development, soil and water conservation on watershed basis, mixed cropping, moderate or mixed and multiple cropping, drip & sprinkler irrigation, plant population adjustment according to available moisture holding capacity, balanced fertilization , low improved cropping pattern, weed control etc are recommended for drought mitigation.

4. BILWRU developed by the scientists of APSRAC , Recommended Optimal Landuse and Farming Systems (ROLUFS) grouped into 12 classes were suggested for the entire block with a map with each group shown in different colour.

Action Plan for Resource Management

Keeping in view the need for rainwater harvesting structures, soil and moisture conservation, development of fodder and fuelwood, social forestry, silvipasture, afforestation etc. the following Action Plan is recommended for implementation in Keshampet Mandal for optimising the resource management:

a) Rain water Harvesting Structures

The areas of dykes, reffs, out crops, lithologic contacts, black soil areas, saline soil areas, etc were avoided in recommending rainwater harvesting structures. In view of the poor permeability and expected faster sitting rate in the black soil areas it is recommended for promoting rainwater harvesting structures in the region.

b) Soil and Moisture Conservation

Soil and water are the basic natural resources whose conservation is of paramount importance, particularly in a semiarid region. The conservation of these resources will not only increase the production of food, fodder, and fiber but also check the on sight of drought. These are to be taken up in the areas where rainwater harvesting structures are not possible.

c) Vegetative and Contour Bunding

Vegetative barriers are closely spaced plants usually a few rows of grasses of shrubs grown along the contours for erosion control in agricultural lands for preventing soil erosion and silting of percolation tanks, check dams and minor irrigation tanks. Contour bunds are essential for delaying the surface run-off and to increase the time of concentration and there by allowing more opportunity for rain water to be absorbed in the soil profile. Planting of soil binding species, gully control works will check the soil erosion. Along with the conservation measures, introduction of optimal farming systems, alternate land use and adoption of crops requiring less moisture in soil and which can supply fodder, will improve productivity which in turn will lead to better economic development of the region. An area of 1,15,931 ha is recommended for treatment with vegetative barriers, contour bunding with stone checks etc. An area of 56.16% for soil erosion control measures including planting of soil bunding species, gully control works, etc is recommended in the Mandal.

d) Irrigation Water Management

In irrigated areas covering 37,269 ha in the Mandal , irrigation water management and horticulture species planting on field bunds is recommended. Efficient method of water application such as drip and sprinkler irrigation along with improved agronomic practices help to economize water and increase water use efficiency. Planting of horticultural species on field bunds would act as shelter belt to prevent wind erosion and reduce evapotranspiration from crops. They also provide additional income to the farmers. Ground water development with conservation measures/check dams if required and development of horticulture / nurseries / sericulture is recommended along the fractures/ lineaments covering an area of 35,633 ha in the Mandal .

e) Fodder , Fuel Wood and Forest Management

Apart from low food grain production, non availability of fodder, fuelwood and degraded forest lands are the major problem in the forest lands are the major problems in the district. Conversion of marginal lands into arable lands has decreased the availability of fodder and fueldwood. Non-availability of grazing lands and pastures has lead to deforestation. The loss of natural forest cover is highly damaging to the soil and to the micro-climate. Hence, to provide fodder, fuel wood and restore the natural forest cover, alternate land use systems have been recommended in the marginal lands, tank foreshore and degraded forest lands.

f) Fodder/Fuel Wood/Silvipasture/Social Forestry

Most of the marginal lands are very poor in productivity and are the source of series soil erosion. By adopting suitable soil and water conservation measures like contour trenches and contour bunding, these lands can be brought under fodder/ fuel wood/ silvi pasture / social forestry development.

An area of 16,174 ha is recommended for fodder/ silvipasture. An area of 14,932 ha is recommended for fuelwood/ silvipasture. In tank foreshore areas, area covering 1242 ha is recommended for fodder/fuelwood development.

g) Afforestation

The entire forest area covering about 2.7% of the geographical area is under degraded/under utilised condition with barren rock out crops. In 15,586 ha of degraded forest lands with gentle to moderate slope afforestation/ silvipasture is recommended. Moderate to steep slope forest areas, afforestation with contour trenches is recommended and in 885 ha of barren rocky areas, afforestation with special efforts is recommended.

h) Shelter Belt/Strip Plantation

Trees play a vital role in the maintenance of the environment and sustenance of mankind. Besides providing income to people, they also provide shade to cattle and human alike. Hence, shelter belt/ strip plantations are recommended along all the major roads/ railway tracks in the block covering 936 km in length.

i) Quarrying

Some of the barren rocky areas identified and demarcated in the block may be taken up for afforestation with cordon wall or used for quarrying provided suitable environmental protection measures taken. This would generate employment and income to the local people.

Conclusion

There is a need to adopt new tools, techniques and technology for proper use and conservation practices for resource use. Geoinformatics have evolved as a proven tool for resource planning . The high resolution satellite data and the GPS use made it possible to plan at land parcel level. Precision agriculture models and judicious use and regeneration of resources can be ensured at local level, at almost real time basis. Thus geoinformatics hold a great promise for resource planning in India in foreseeable future.