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## A Perspective on Ecological View and Ecodevelopment Approach for Land Use Planning in The Drought Prone Areas: A Case Study of United Anantapur District, Andhra Pradesh

N Chendrayudu<sup>1</sup>, T Chandrasekarayya<sup>2</sup>

<sup>1</sup> Associate Professor Dept. of Geography, S.V University, Tirupati 517 502

<sup>2</sup> Associate Professor, Dept. of Population Studies & Social Work, S.V. University, A.P. 517502, Tirupati

### Abstract

*Land is a basic natural resource. It forms the basis for all the biological, human and economic activities. In the developing countries like India, where agriculture is the main source of economy and livelihood for more than two-thirds of the working population, proper utilisation of land resource is vital.*

### Introduction

In recent years, serious concern has been shown on ecological management and optimum utilization of land resources for the benefit of mankind. Hence the use of land resource is “central to all discussions of land problems and policies<sup>(1)</sup>”. Land use at any region is a complex, diversified and dynamic concept. It is due to the operation of whole range of environmental factors but modified by socio-economic and historical elements. In dry areas, the use of land resources is virtually associated with climatic and edaphic conditions, besides the socio-economic needs of the mankind. Undoubtedly, the erratic behaviour of the monsoon, frequent occurrences of drought and prolonged dry spells have had a devastating and debilitating effect on land use pattern and as a result, the landscapes in dry

areas gets continuously varied and modified. Since land itself is one of the important components of the ecosystems, a critical study on landscape ecology and its planning calls for greater attention to be paid to the drought prone areas to keep the ecological balance between the environment and the socio-economic needs of the region.

### Ecological View of Landscape

In the sense of ecology, land carries ecosystems, but is itself also a part of these ecosystems. Although the use of land resource may be considered from abroad view of human welfare, its use is always a process of modifications of ecosystem. The idea that land use is a process of modification of ecosystem was well explored by Simmons<sup>(2)</sup>.

He suggested that land use ecology might form a central theme in biogeography. It is also mentioned that the ecosystem concept provides the necessary modern scientific framework to the study of land use. The form and function of land use is a human enterprise, while the development of landscape is the continuous efforts of man for his needs and sustenance under every possible combinations of terrain, climatic, edaphic and vegetative conditions. By all means, it suggested that any scientific and rational land use planning should see that the ecological balance was not disturbed and that proper equilibrium between the environment and the socio-economic needs of the area be maintained.

### Ecological Problems of Land Use

In the process of land use management and optimisation, ecological problems are becoming a most serious concern. The ever increasing pressure of population and decreasing man-land ratio are posing challenging problems to the land-use planners. Structurally, a land-use system consists of three interacting spheres namely, ecological (environmental), economic and social. Each sphere has its own unique set of human-ascribed goals. Ecological problems are those, which appear in connection with human socio-economic needs, change the quality of the physical environment and indiscriminate use of natural resource base. Ecological problems appear in different types of physical environment and various socio-economic, technological and political conditions.

The negative ecological effects like degree of decertification, land degradation, soil erosion, soil salinisation, chemical contamination and water pollution are frequent in the dry areas but taking place in different intensities and degree of criticality. The other problems related to land use are under-utilisation, over-utilisation and mis- utilisation of land resources. So the question is what are the reasons for the appearance of negative ecological effects in different environmental and socio- economic conditions. Off all, undoubtedly, man's indiscriminate use of land resources has resulted in the creation of negative ecological effects. His failure to recognise the long term implications of deforestation, faulty methods of cultivation, overgrazing, massive application of fertilisers and pesticides, practice of single crop monocultures, imbalances in the input and output factors and large scale exploitation of land and soil resources throughout an entire ecosystem. Results in widespread degradation.

The practice of monoculture was accompanied subsequently by great losses of genetic varieties in the fields, involving high risks of large hectares being destroyed by single drought or pest. To cultivation of the same crop continuously and their synthetic fertilisation year after year has resulted in the disruption of the soil balance. With diminishing organic matter in the soil, its ability to retain moisture is also reduced and as a consequence, the soil becomes sterile and dry. To

circumvent some of these problems a critical examination of landscape ecology is essential for a more rational approach to land use planning and conservation of resources.

### Eco-development and Ecological Planning of Land Use

Generally speaking, ecological planning is a fundamental tool for landscape and regional planning, such that many landscape ecological studies are now done as integral parts of landscape and regional planning projects<sup>(3)</sup>. It offers an effective means of helping mankind to adapt to the dynamic changing environment of which he is but one integral part. Mc Harg<sup>(4)</sup> has defined ecological planning as "an instrument for revealing regions as interacting and dynamic natural systems having intrinsic opportunities and constraints for all human uses.

The goals of such planning are derived from the region and its people as proffered by locations where all or most advantageous (safe, healthy and beautiful) factors exist with none or few detrimental factors for any and all anticipated future uses. What constitutes 'detrimental' or 'advantageous' is derived from the use itself and the value system of the initiating person or group. The concept of eco-development forms the main strategy of 'Habitat Ecology'. It helps in explaining the form of planned growth which is concerned with the development of local available land resources within the constraints of local environment with a view to optimise the local capacities of the biosphere to support the welfare of life. The eco-development approach is very close to ecological and environmental planning to balance and harmonise the various enterprises of land use which man for his own benefit has superimposed on physical environment.

The eco-development approach related to land use rests on (i) rational utilisation, (ii) development of mankind pertaining to their well-being rather than in economic sense, and (iii) advancing a true symbiosis between man and environment. To activate and regulate the harmony between landuse development and environment both the demand and supply side of the equation must be acted upon. In the eco-development and ecological planning sense, any land use planning should not be considered merely from the agricultural point of view and bringing more land under the plough making it viable for cultivation, but should include rational utilisation of land resource, conservation of land from erosion, development of nutrients and soil cover through multiple vegetative systems, improving the potential capacity of land, application of modern scientific technology and lastly the preclusion of over exploitation of land.

### Study Region

Anantapur district is one of the chronically drought-prone areas in the country. It is located in the rain-shadow region of



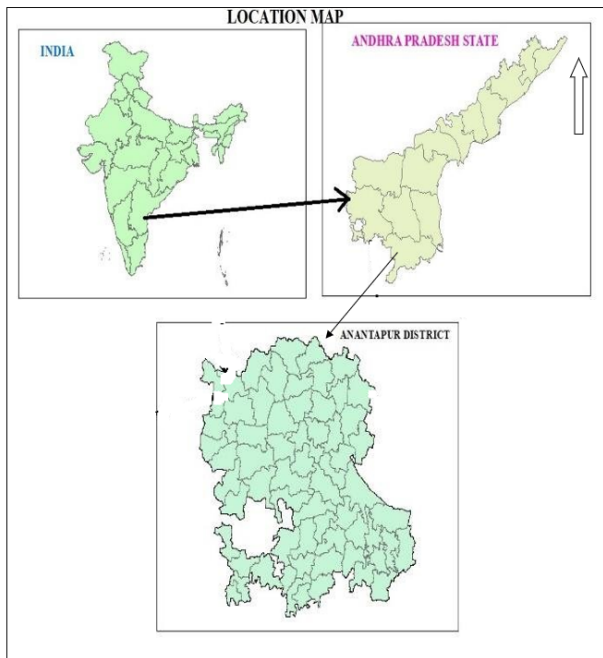


Fig. 1. Location map

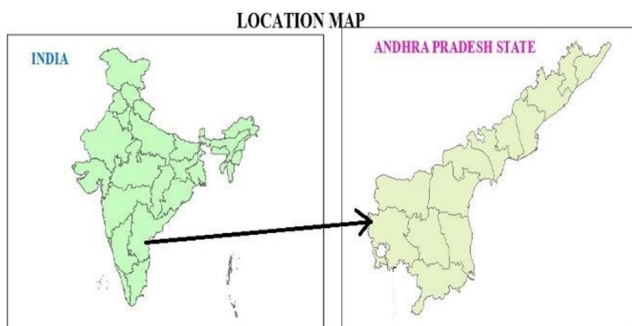


Fig. 2. Location map

the Western Ghats in Andhra Pradesh. It is the largest district in terms of area in the State. The population spread is very sparse with a density of population of 166 persons per Sq.Km. Agriculture is the predominant occupation of the people. The average annual rainfall of the district is 544 mm. with the lowest number of rainy days of 35 in the State. The district has been experiencing a drought once in every two years which is really serious and detrimental to stable agriculture.

## Methodology

The spatial distributional pattern and changes in important land use types namely, forest land, fallow land and crop-land are examined and delineated with the help of both quantitative and cartographic techniques. The quantum of

change is determined through percentages, regression trend and growth rates. The impact of rainfall on land use types is measured with correlation testing.

## Forest Land Use

Forests form distinct ecosystems. In fact, Anantapur district is very poor in forest cover with only 10.3% of the total geographical area of the district. The nature and character of forests in the district does not indicate any dense growth of tree population with different variety of plants. The forests of the district may be described as dry mixed deciduous and thorny open scrub types.

The distribution of forest-cover in the district is not only very low in proportion but also most uneven. Relatively, higher concentrations (15.1-20% and >20%) of forest-cover are found in southern, south-eastern and north-eastern parts of the district. In these areas, the amount of rainfall is comparatively higher than the other parts of the district. The western part of the district is found with very thin forest cover with discontinuous thorny thickets and scrub woodlands whose vegetative growth is stunted due to poor edaphic and very low isohyetal conditions.

During the three decades under consideration (1960-90) total area under forest has not shown any substantial change but showed a small increase of 0.1 per cent or 2000 hectares. The regression analysis has also revealed that the trend of forest land is marginally positive with 2 per cent of the goodness of fit. The annual compound growth rate has also shown a negligible rate of increase of 0.003 per cent.

## Planning for the Development of Forest Land

In drought-prone areas, maintenance of ecological balance is one of the most important considerations to build-up the humus contents in the soil, avert soil erosion, increase the moisture in the atmosphere, raise the ground water level and heap in ground water recharge and storage besides other economic purposes. However, the poor quantity of forest cover in the district is too short to fulfil the requirement of ecological balance and is seriously jeopardizing the ecosystem of the region it is necessary to take up massive efforts on war-footing to develop forest-cover in the district

The development of forest-cover in the district heavily depends upon the (i) plantation of drought resistant species in large parts of the reserve forest areas, which are devoid of any vegetative cover, (ii) there are number of tanks in the district which are silted and do not fill up with meagre rainfall. The foreshore of these tanks can be planted with eucalyptus and subabul plantations., (ii) depending upon the suitability of site and topography, particularly in the slopy agricultural lands and cultivable wastelands and all along the road sides the species like tamarind, neem, gulmohar, eucalyptus, fruit and flowering plants can be planted extensively. Agave species

can be planted in 'estate concept' mainly to yield raw material for fibre extraction and to put otherwise unproductive areas to productive use and (iv) pasture development can be taken up on the barren hills, slopy soils, community lands and village poramboke lands. Having all the afforestation schemes, it is utmost necessary to convert this dry belt gradually into a green belt for balancing the ecosystem.

### Fallow Land Use

Land under fallows accounted for 17 per cent of the geographical area of the district. which is indeed a high proportion. More than one fifth of the geographical area under fallows is found in 17 mandals mostly located in western and north-eastern parts of the district.

During thirty years period, the proportion of fallow land has increased by 5.6 per cent amounting to about 106 thousand hectares. The increase is found in many parts of the district. The regression analysis has also confirmed this trend of increase of fallow land but is accounted by 22 per cent of co-efficient of determination. It indicates that the increase in the area under fallows is not perpetual from year to year but highly fluctuating. The annual average rate of increase is 0.6 per cent.

It is suggested that an increasing trend of fallow land should be controlled and utilised at optimum level through scientific land use management systems. If possible all the fallow lands should be brought under dry farming cultivation with suitable drought resistant rain-fed crops like millets, pulses, fodder crops and agro-forestry. A considerable change in the outlook of farmers is to be brought out from traditional practices to new methods of dry farming for optimum use of fallow lands with multi-tier vegetations in different ecological systems and the sound management of Sylvi-Agri-Pastoral Systems.

### Agricultural Land Use

The district has vast agricultural land resource base but suffers from instability due to vagaries of monsoon. The net area sown in the district accounted for 49.9 per cent of the total geographical area which is significantly. Higher than the average proportion of net sown area in Andhra Pradesh State (41.3 per cent)

The quantum of change in the proportion of net area sown during 1960- 1990 showed a significant decline of 5.5 per cent amounting to 105 thousand hectares. The trend of net area sown in the district has been negative. The goodness of fit of the regression trend states that the present negative trend is to the tune of 11 per cent only. It means that the negative trend of the net area sown is not exactly perfect but it is highly fluctuating from year to year depending on the variation of rainfall. On an average, the annual compound growth rate declined at 0.03 per cent.

### Impact of Rainfall on Arable Land

In the drought-prone region, where rain-fed farming is predominant and irrigation development is very low, it is a common assumption that the increase or decrease in either cropped area or fallow land will be in close association with the success or failure of monsoons. In the present study, the correlation analysis has revealed that there has been a positive correlation between rainfall and net area sown in the district to the tune of 0.55 Co-efficient value and negative correlation between rainfall and fallow land to the tune of 0.62 co-efficient value. A high negative correlation of 0.85 is found between net area sown and fallow land. It shows that if there is an increase in rainfall, the land under cropping may increase or if there is decrease in rainfall, the land under fallows may increase. It indicates that these two land use types are inversely correlated and functionally related with each other.

### Strategy for the Development of Suitable Cropping Pattern

The present cropping pattern dominated by groundnut, cannot be treated as inappropriate and it appears to be a more or less natural consequence of the poor natural resource endowments of the district. Now that it required all the more is the optimisation and strengthening of present cropping pattern without further spatial extension of monocrop groundnut. In view of varying drought conditions and agricultural drought which differs from one crop to another crop in an area, an extending monoculture groundnut farming to wider area may not be advisable, as a wide-spread drought may adversely affect the agricultural economy of the district. In such circumstances, all rainfed crops which are of high value and low water consuming must be preferred. The risks from droughts could be reduced by popularising suitable inter-cropping methods. If there is failure of rain, at least one of the component crops will yield something and thereby minimise the risk of total loss. The non-traditional crops like sunflower, safflower and castor etc. should also be grown in the suitable soil and moisture conditions.

### Soil Characteristics and Problems

The soil is a dynamic layer which immediately reacts to the pattern of its use or changes in the soil forming environment. The district has 82 per cent of red soils and 18 per cent of black soils. The phosphorus and organic matter content is poor in 82 to 90 per cent of the soils. But more than 90 per cent of the soils are moderately rich in potash more than 95 per cent of the soils are neutral or weakly alkaline. Less than 5 per cent of the soils are having severe saline and or alkaline problems.

The results of studies made by different organisations reveal that the soil characteristics are being changed in a short span of time by such activities of man like (i) removal of vegetation cover, (ii) application of heavy irrigation, (iii)



change of cropping pattern and (iv) change of morphology. The conclusions are that (1) in the undulating piedmont regions where dry farming is practiced there is an increase of rill and gully erosion, (2) there is steady increase in the salinity and alkalinity problems in the canal irrigated mandals like Rayadurg, Gooty, Tadipatri and Anantapur, (3) there is a decreasing tendency in the potassium content of the soils particularly in the paddy cultivated areas and (4) with the shift from millet oriented to groundnut oriented cropping pattern, the soils have shown sulphur and zinc deficiency. Iron deficiency is also predicted in the near future.

## Soil Management

The soil management programme in a semi-arid region like Anantapur district should be comprehensive and integrated one. First and foremost adequate importance should be given to the extension programmes to create the awareness in the farming community about the dangers of the mismanagement of the soil ecosystem and to motivate them to follow proper soil management 2 guidelines. The soil forming environment could be improved by managing catchments at a micro-level. Construction of check dams and watersheds on small catchments serves as a multi-purpose schemes in this direction. Both agronomic and engineering measures of soil conservation should be implemented in a complementary manner to achieve better results. The alkalinity and salinity problems of the soils have to be solved with suitable measures like gypsum application and leaching of excessive salts with suitable dosage of irrigation respectively. Proper care should also be taken to minimise water seepage from the irrigation canals which will lead to the problems of salinity and alkalinity.

## Conclusion

It has been observed that man, rather than the nature is bringing considerable change in the quality of land in a short

span of time. The short-sighted and unplanned commercial and subsistence gathering of resources from the nature's bounty have caused considerable damage to the land system. Many of his activities though fetching short-term gains, are causing long-term and sometimes irreversible damages to the quality of landscape system in this dry region. In view of very low proportion of forest cover, high proportion of fallow land, instability in agriculture land followed by mono-cultures and poor nature of soil cover, the landscape ecosystem of this region is delicate and is being easily disturbed.) The maintenance of ecological balance is one of the most important 4 considerations and is to be looked into it very seriously. To achieve the required goals, "Sustainable Land Use Development" is the way of environmental feature. Jacobs<sup>(5)</sup> has referred to sustainable development as "the offspring of ecological planning". To understand both and carry them out, environmental education is essential at all levels and in all sectors of the population.

It is also often emphasised that the transformation of rural habitat is the fundamental lead for the eco-development of the region. The integrated Rural Development (IRD) is to be concerned with ecological and environmental issues in addition to the integration of sectors and policies in space-time dimensions. The IRD concept is also to be conceived as strategic design of problem solving planning process for the effective involvement of local human and physical resources to improve the socio-economic and ecological situation of the rural habitat.

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