

ENVIRONMENTAL MANAGEMENT AND SUSTAINABLE DEVELOPMENT IN MOUNTAINS

Surendra Singh

Department of Geography,
North-Eastern Hill University, Shillong- 793014.

Abstract

In the present paper, an attempt has been made to describe an integrated view of socio-economic development, suitable approaches and strategies for development specially for the mountain areas of South Asia where the physiographic landscape is being threatened by the action of anthropogenic forces (as urbanisation, industrialization and development of infrastructure) and simultaneously by excessive meteorological as well as hydrological processes. The monsoon climate of the region accelerates various processes of landscape degradation and sometimes restricts the functioning of various ecosystems. Thus, the landscape ecology is an approach through which an integrated view of different ecosystems and the effect of anthropogenic forces on them may be analysed in order to find optimal limits of interactions and the ensuing levels of development.

INTRODUCTION

The continuously increasing population pressure and the technological advancements alter relationship of the man with the earth systems, analysed and interpreted by various disciplines ranging from biological sciences to physical as well as agricultural and social sciences (Starkel, 1994). Infact, earth systems of landscape of a region or an area generate natural resources and their sequences evolve the varieties of distributional pattern of their co-association complex nature. It provides a sound base for the development of human activities and attracts people of plains in such mountain areas of beautiful landscape and available natural resources. The creation of socio-economic space for the development of human activities in the physiographic landscape where earth systems are prevalent with the provision of varieties of natural resources, is a

Arunachal Pradesh : Environmental Planning and Sustainable Development
Edited by : R.C. Sundriyal, Trilochan Singh and G.N. Sinha
HIMAVIKAS Occasional Publication No. 16 (2002), p. 501-508
G.B. Pant Institute of Himalayan Environment & Development
Kosi-Katarmal, Almora, Uttaranchal, India

question of imposition of limit to technological advancements and enhancement of infrastructure of development. This question is more relevant in the case of the South Asian mountain areas where anthropogenic forces are far more significant while climatic changes have been altering fast the earth systems and consequently, changing the physiographic forces in sculpturing landscape (Singh, 1999). However, mountains have some specificities, which must always help for self sustained growth and better organization of socio-economic activities in these areas. International Centre for Integrated Mountain Development (ICIMOD), Kathmandu (Nepal) has interpreted such specificities in its literature as they are mainly considered six in number for the South Asian mountain areas specially the Himalayas. They are as: (i) Inaccessibility (because of verticality of space, relief slope and drainage constrains), (ii) Fragility (sensitivity and sudden changes in soil-rock structure, hazards, uneven distribution of natural resources as well as population), (iii) Niche (unique resources and advantage of various resources ecology) (iv) Diversity and Limitations (in bio-mass, flora, fauna and therefore scenic beauty), (v) Socio-politic Marginality (weak and undeveloped socio-political systems and transitionality) and (vi) Adaptation (which refers to population clusterization or concentration, ethnic diversity and weak linkages of living communities) (Papola, 1996, 1997, 2000; Baskosta and Karki, 1994; Jodha, Baskota and Tej Pratap, 1991). Here an attempt has been made to describe an integrated approach for environmental management and sustainable development in maintains considering various specification.

LANDSCAPE - ECOLOGY AND DEVELOPMENT

The concept of landscape was developed by geomorphologists following physical landscape is the function of structure, process and stage. Therefore, the alternations in physiographic attributes of landscape which evolve its ecology are directly controlled by some physical forces/processes which are related to geomorphic parameters of landscape like (elevation, relief, slope, drainage and so on). Broadly, it can be said that they form the geo-systems and interact with man in different ways (Starkel, 1994). The areas of physio-geographic studies are concerned with the physiographic processes and physical features of landscape and land forms which are changed over time. On the other hand, the areas of socio-economic studies are generally rested upon the interactions of human activities where physiography plays only as factors in socio-economic development. Thirdly, the concept of geo-ecology and development of human activities has an integrated view and also suitable for the study of hill area development within the frame of some specificities as elaborated earlier (Singh, 1999). The interactions of anthropological and institutional attributes with the geo-ecological basis of landscape form a concept of landuse systems'. In prevailing landuse systems in an area, insufficient adaptation to the prevailing constraints of land resources may lead to land 'degradation' because of population pressure

and unsystematic organization of socio-economic activities on the landscape (Vink, 1975). Thus, landuse systems show true picture of interaction of human activities and geo-ecology of the landscape.

Ecosystems of landscape provide the benefits to mankind, reflect over all intensity, and kinds of natural resources and inches in landscape. The organization of human activities and acceleration of developmental processes are associated with the availability and potential of natural resources. In short, ecology provides the interacting nature of biotic phenomena with abiotic forces of landscape, which are aerially differentiated and are intertwined among them. However, specially in hill and mountain areas, the population and activity concentration or clusterisation has more specific nature of development because of isolation, weak linkages and under developed conditions of natural resources. The resulted interacting patterns of a confined nature of development and the geo-ecological constraints of landscape require a specific kind of approaches of development of the mountain areas in general.

APPROACHES TO MOUNTAIN AREA DEVELOPMENT

There are numerous researches on the approaches of development specially for the hills and mountain areas. Broadly, it can be summarised from the review that two school of the concerned studies have put forward two different approaches of development : (a) the School of ecologically based development in which specific ecosystems and interactions among them are the central themes of development paradigm, and (b) the school of technologically forced development under which economic parameters and evolving market forces are recognised as the bases of landscape development.

(1) Integrated Ecological Preservation:

Ecology of a landscape is an important aspect of its development. Ecological imbalances refer to environmental degradation while, socio economic deprivation refers to poverty of mankind living in and is a part of landscape development. Environmental degradation and poverty are simultaneous processes. The deficiencies of eco-system result in degradation and poverty. The following are the major aspects of integration and development:

(a) *Interaction* between human population and ecological phenomena of landscape and *Adoption*, which is related to technological advancement and human knowledge, are the processes by which ecology of the landscape gets disturbed requiring ecological preservation.

(b) The *Bio-diversity vis-à-vis Traditional Ecological Knowledge* is to be integrated for self-sustained growth of economic parameters on the mountain areas.

According to Ramakrishnan (2002) there is an inverse relationship between bio-diversity index (which is purely an ecological phenomena) and intensity of agro-ecological systems (that depend on human interactions and agro-product intensification). He explains that bio-diversity diminishes as agricultural systems are intensified from shifting cultivation to settle farming and then to modern mixed farming in hill and mountain areas. For example, when there is a change in landuse on hill slopes from 'jhum' to 'broom' cultivation in the hills of the North Eastern region, the bio-diversity is bound to diminish. In mining hill areas, the ecology of such areas is disturbed which can only be reclaimed through understanding biological attribute of the landscape of these areas.

(c) The mountain ecology offers advantages for certain kinds of income generation because of specific resource niches in different pockets. A specific kind of interaction and nature of socio-economic development may take place, if these pockets of specific resources and favourable developmental conditions are identified. The specificities and ecological conditions of these identified pockets must be studied to integrate human activities as specified in the recommendations of DSE/ICIMOD Conference in Kathmandu in February 2000 (Papola, 2000). It appears that the anthropogenic forces and ecological conditions are put together for finding out the strategies integrating various systems of landscapes like diversified agriculture, enterprise development, forest products, land system, natural resource management, accessibility, social equality and highland-lowland linkages. Considering the development of socio-economic activities through ecology and eco-system approach, the protection and optimal utilisation of natural resources may be studied by understanding the changes in the structure and functions of the following three major ecosystems of the landscape.

(i) *The Forest Ecosystems*: It has a broad scope of forest ecology and its stability. A variety of human activities ranging from tourism and recreation to techno-economic (as associate with forest products and its processing) activities have greatly increased the burden of human population and created imbalances in the forest ecosystems (Motta and Haudemand, 2000). The stability of forest ecosystems is threatened anthropogenic disturbances (increasing urbanisation and expansion of industrial setup as well as road network in mountain areas) and climatic and hydrological changes. Therefore, meteorological as well as hydrological attributers of landscape would also help in understanding the stability of forest ecosystems. Deforestation not only has impact on human life in mountain areas but also has great impact on shaping the landscape through changing its slopes and river valleys (Froehlich and Starkel, 1993). In more detail, forest ecosystem may be classified in various ways by looking at the dominance of ecological attributes in

structure of ecosystems. The varieties of forest ecosystems, namely, the climate based forest ecosystems as tropical or temperate forests ecosystems; the resource use based as timber forests or non timber forest ecosystems; the species based like oak or pine forest ecosystems and so on are prevalent in landscape. In tropical forest ecosystems, a study on non-timber forest resource management concludes that there are many non-timber species, which can be used for diverse purposes without disturbing the ecological balance (Hertog and Wiersum, 2000). It means that there is a specific kind of interaction between man and forest ecosystem, which can only be studied by understanding landscape ecology.

(ii) *The Aquatic Ecosystems*: The stability in such ecosystems may be maintained by observing and monitoring the changes occurring in physio-chemical properties of water and accumulation of pollutants and heavy metals in water. The changing relationship between algal population and physiochemical properties of river shows the degree of stability of aquatic ecosystem and growth of aquatic biota in Arunachal Himalayas (Sabata, 1998).

(iii) *The Anthrope Ecosystem*: It is generally concerned with human ecology where activities specially socio economic in nature are directly or indirectly influenced and often controlled by abiotic factors of the landscape. Under this approach, socio-economic development may be conceived by understanding the degree and extent of interaction and utilisation of natural resources by man. Abilities of man that are related to science and technology is a major aspect of interaction and environmental degradation which must carefully be studied to integrate and accelerate the developmental processes within the specific set of environmental conditions of landscape. Increasing population pressure and needs of human beings may destroy and even have been disturbing the forest as well as aquatic ecosystems and are influencing bio-diversity of the landscape. Bio-diversity conservation approach should be adopted to check the human interference with nature. Therefore, the economic principles of development may not be appropriate to adopt them in such scenario.

(d) *Optimisation vis-à-vis maximisation of socio-economic activities*: When there is social transformation and economic changes in mountain as well as other areas from under-developed to developing stages, the labour force of the society is engaged to maximise the profit of a particular activity following the concept of consumerism and welfare according to micro-economic theories of development. It does not suit the preservation of ecology of the landscape. Environmental sustainability and ecological balance are secondary considerations for profit-maximisation. There is a need for environmental economics where ecosystem and ecological preservation are to be considered as an integral aspect of development. The development and intensification of technology must be kept under certain environmental limits as McCarty and Lindbugry (1967) have rightly suggested in

their theory of 'optima and limit' for balanced development. For achieving optimal limits of economic activities, ecological specificities of landscape must always be considered.

(e) *The identification of income-generating activities*: It must proceed on the basis of available niches and natural resources but not on the basis of market forces alone. Market centres must be treated as growth centres for socio-economic activities, linked with other centres of development. Such activities which suit environment should help in utilising land potentials and preservation of ecology as well as traditions of the people living in such environment.

(2) Development-Forced Approach:

It is based on the second school of thought and paradigm of forced development in which economic benefits and intensification of resource use through modern technology are the main priorities rather than ecological preservation and integration of natural forces. However, it is realised that poverty has persisted and environment degradation has continued unabated in mountain areas of South Asia that can be checked by fast economic transformation based on comparative advantage and successful fusion of environment and developmental goals. In such a philosophy of development, environmental attributes are considered as factors for development and not as structural element of the landscape. Therefore, the approach of Environmental Impact Assessment (EIA) includes the concept of economic benefits, environmental energy and its conservation. The assessment priorities are fixed according to economic benefits rather than environment conservation. The sustainability of socio-economic development and decision-making processes are primarily based on technological advancement and maximisation of economic benefits. The consequences are many and varied. The infused technological forces and, resultantly, the 'imposed-activity clusters' of development may create imbalances in environment and ecosystems of landscape in the mountain areas. Such approaches require specific development strategies.

DEVELOPMENT STRATEGIES

There are various criteria for the preparation of strategies for self sustained growth and well-balanced development of landscape considering its integrated elemental view. There are few basics strategies for development of hill and mountain areas. These are :

(a) *The Linkages and Interactions*: The economy of mountain areas is surviving in isolation due to inaccessibility and fragility; the important specificities controlled

by the verticality of space and frequent climatic changes. The identification of major sectors of economy and its intersectoral linkages may help in speeding up the growth rate. New growth may persist on small locations and, later on, these growth nuclei may spatially be linked with higher order growth centres. Therefore, rural urban linkage is possible. Such a strategy of growth may solve the problem of urbanisation and may also be helpful in decentralizing the economy of mountain area.

(b) *Delineation of Planning Units*: Infact, mountains have diverse characteristics in the distribution of resources as well as in population due to available niches for land-man interaction. Therefore, delineation of planning zones and specific development pockets is essential. The 'watershed planning unit' is a suitable unit rather than 'administrative' one. Watershed is based on geo-hydrological criterion, where most of the specificities and ecosystems of mountain landscape can be seen and integrated for further development can be planned. Optimal socio-economic linkages and environmental conservation can only be possible through watershed concept of development. An integrated and well-conceived infrastructure may also be provided for accelerating growth processes and well-balanced organisation of socio-economic activities through the watersheds of micro or macro-areal unit.

CONCLUSION

Increasing pressure of population in mountain areas specially the mountains of South Asia has influenced the ecosystem and natural resources of its landscape. As a result, environmental degradation, imbalances in developmental processes and unsteady growth can be observed in such areas of rich resources and strong eco-systems. An integrated approach of ecological preservation is suitable for the development of socio-economic activities. The forced technological advancements in these areas create instability in ecosystems and environmental degradation. Mountains have their own specificities, and specificity based development of lead sectors of the economy with their proper spatial interactions may allow for technological advancements in optimising production processes in these areas. Watershed is an ideal natural unit which integrates the physiographic attributes of landscape with its natural resources and human activities, may be adopted as a basis of socio-economic development in mountain areas.

REFERENCES

- Baskota, M. and S. Karki (eds.) (1994). Sustainable Development of Fragile Areas of Asia, Regional Conference Report, ICIMOD, Kathmandu.
- Froehlich, W. and L. Starkel (1993). The Effects of Deforestation on Slope and Channel Evolution in the Tectonically Active Darjeeling Himalaya. *Earth Surface Processes and Landforms*, 18: 285-290.

- Hertog, W.H. and K.F. Wiersum (2000). Timur Production in Nepal Dynamics in Non-timber Forest Resource management. *Mountain Research and Development* 20(2): 136-145.
- Jodha, N.S., M. Baskota and Tej Pratap (1991). Sustainable Mountain Agriculture-Perspectives and Issues, Vols.1 & 2. Oxford & IBH Publishing Co., New Delhi.
- Mc Carty and Lindbug (1967). A Preface to Economic Geography.
- Motta, R. and J.C. Haudemand (2000). Protective Forests and Silvicultural Stability An Example of Planning in the Aosta Valley. *Mountain Research and Development* 20(2): 180-187.
- Papola, T.S. (ed.) (1996). Integrated Planning for Environment and Economic Development in Mountain Areas. Report on Regional Meeting of Planners and Experts, ICIMOD, Kathmandu.
- Papola, T.S. (2000). DSE/ICIMOD Conference in Kathmandu (Jan-Feb 2000). *Mountain Research and Development* 20(2): 195-197.
- Popola, T.S. (1997). Regional Planning for Integrated Development-The Case of Mountain Areas. Professor Moonis Raza Memorial Lecture delivered at XIX I.G.C., Centre for Earth Science Studies, Tiruvananthapuram.
- Ramakrishnan, P.S. (1990). Biological Concepts for Reclamation of Mined Areas. *International Journal of Ecological Environment*, 16:
- Ramakrishnan, P.S. (2002). Bio-diversity and Ecosystem in North East India. This volume.
- Sabata, B.C. (1998). Conservation and Management of Sensitive Ecosystems of Arunachal Pradesh. In : Sundriyal, et al. (Eds) *Proceedings of the National Workshop on Perspectives for Planning and Development in North East India*, HIMAVIKAS occasional Publication No. 11, GB Pant Institute of Himalayan Environment & Development, pp. 111-114.
- Singh, Surendra (1999). *A Resource Atlas of Arunachal Pradesh*. Department of Planning, Govt. of Arunachal Pradesh, Itanagar.
- Starkel, L. (1994). The Place of Geography in the Studies on the Man and the Earth System, *Geographia Polonica*. 63: 13-19.
- Vink, A.P.A. (1975). *Landuse in Advancing Agriculture*. Springer-Verlag, New York, pp. 3-7.