

**INTEGRATED PLANNING MODEL
FOR
SUSTAINABLE DEVELOPMENT OF MOUNTAIN AREA**

by

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CERTIFICATE

This is to certify that the thesis entitled, **"INTEGRATED PLANNING MODEL FOR SUSTAINABLE DEVELOPMENT OF MOUNTAIN AREA"** being submitted by **Mr. Sandeep Kumar Raut** to the Indian Institute of Technology, Delhi for the award of Doctor of Philosophy is a record of bonafide research work carried out by him under my guidance and supervision in conformity with the rules and regulations of Indian Institute of Technology, Delhi.

The research report and results presented in this thesis have not been submitted, in part or full, to any other university or Institute for the award of any degree or diploma.


(Prof. R.C. Maheshwari) 17/11/2022

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ABSTRACT

Mountain and upland areas provide the direct life support base for about a tenth of the human population of the world.) But, mismanagement of mountain ecosystem and overuse of mountain land resources are perceived to be having, major deleterious effects on the well being of several hundred million people of the plains. Himalayan Mountain with natural endowments has large economic potentials, which need to be utilised in rational and sustainable manner.) This is surely a cause of concern for planner to evolve a development model which endows proper growth and development of Mountain area and assumes importance for ensuring sustainable development on this green Earth. In this context, a study was envisaged with the aim to develop a Integrated Planning Model for mountain area in order to prepare cluster level development plan for sustainable development of mountain environment and people living in harmony with ecological development.

In order to achieve the goal of sustainable development* and to analyse the environment with its complex ecological and socio-economic dynamic inter-relationship, Bapru cluster of Champawat district has been selected for the present study.

The detailed household survey, village level survey and opinion poll was conducted for collection of primary data. Participatory Information Generation Technique and actual field measurements technique were adopted for collection of spatial data on land use. Existing system is analysed at two level a) non-spatial data and b) spatial data. Both spatial and non-spatial data are combined through GIS software that is PC ARC/INFO.

The Existing system like physiography, drainage, location, linkages, climate, vegetation, soil type and population dynamics is studied. It also studied in detail the water and land resources and socio-economic base of the study area.

The Bapru cluster is a typical example of a backward mountain area and has been neglected for years due to its own inherent physical constraints among other reasons. Out of many deficiencies in this area, the three most crucial ones are, the absence of a well-coordinate and efficient water management system, the lack of accessibility, and, the severe pressure of population on the limited amount of land available. All of these deficiencies emanate from the basic topographic characteristics of the area which, unfortunately, is given and cannot be changed. In spite of 80 percent economic activities concentrated in agriculture, Bapru cluster not able to meet the requirement of food crop. The production of food crops is 5605160.21 kg/year whereas demand is 859967.28 kg/year. Integrated planning Model formulated for the development of Bapru cluster takes this basic limitation into account.

Although the cluster supports sufficient carrying capacity in term of water but due to lack of efficient water management system, the area suffers from serious problems of soil erosion and paradoxically, water shortage. Because of the steep slopes, the run off of water is very heavy. It flows down to rivers, which are too deep to be of any use for agriculture except in the valley areas. There are innumerable mountain streams and springs, which provide nominal irrigation and drinking water in some areas. Only 0.60 percent of the surface water is being used and rest 99.04 percentage of surface water is lost by surface runoff. Development plan of Bapru cluster developed on the basis of integrated planning model given emphasis to a better water management techniques (like Gul system of irrigation, Kund and small ponds) and recommended specific proposals for soil conservation (like contour planting of tree, construction of bench terraces, contour ridge and broad based ridge terrace).

The pressure of population on land is to the topography of the area. Most of the land areas, which could possibly be brought under cultivation under the present circumstances, are already being cultivated. As the arable area remains limited, the growth of population increases the pressure on land. According to the problem matrix analysis, first five higher magnitude of problem in the Bapru cluster (study area) are a) poor economic condition (magnitude 1125.00), b) erosion of agriculture land or soil and

environmental sensitivity (702.00), c) poor agricultural development (590.63), d) lack of adequate modern inputs (567.00), e) lack of economic diversification (396.00) Over cultivation of land particularly on the slopes have added to the soil erosion of the area. Before making recommendations for easing the situation, study analyses the existing land-use pattern of the Bapru cluster. (With the help of new techniques, new areas are identified which could be brought under agriculture, value added medicinal plants crops and floriculture without affecting the growth of other sectors such as horticulture, forestry, animal husbandry and so on.

In order to assess the existing resources for sustainable development the concept of carrying capacity has been used to assess the extent to which development activity could proceed without endangering the environment.) Two aspects of carrying capacity: one the supply side of the environment life support system; and, another the demand side of human dynamic system, are analysed to estimate the carrying capacity of water, food, fodder and fuel at two level, village level and cluster level.) With the help of slope analysis method, potential of water, and land resources like agriculture, horticulture, medicinal plants, fodder, forest, fuel, floriculture are identified for optimum use of new investments.

The problems and felt needs of the villages as well as the magnitude of problems are analysed through problem matrix analysis techniques.) Attempts also made to identify the potential of water and land resources, like agriculture, horticulture, medicinal plants, fodder, forest, fuel, floriculture by analysing the slope analysis method.) In order to find out the potential sites for tourism development in Bapru cluster, on-site photographic inventories and field measurement methods are also analysed.

As a result in order to have effective and balance development without destruction of the study area, Integrated Planning Model is proposed. The Integrated Planning Model envisages mainly two types of integration in overall strategy. First, the spatial integration of various economic and social activities in which development in one sector opens up possibilities for the development in another. Secondly, techno-ecological integration

refers to integration of physio-biotic and socio-cultural component of human habitat through Land-use Zonation Water Harvesting technology and also interlinked and interacts with each other. 'Land use Zonation Water Harvesting Techniques' (LZWHT) is an integrated Land and Water management technique through vertical zonation of land-use, keeping in view the need for efficient and judicious utilization of land and water resources in Bapru cluster and mountain area. Through proposed model 873.92 hectares of cultivated land has been estimated to put under irrigation so that food production can support 18878 people which is more than the proposed population of Bapru cluster in 2020.

Policy guidelines and strategies are also recommended for sustainable development of Bapru cluster. Not only conservation of natural resources figures as top priority but also possible ways of building upon the economic potential linked to infrastructural development, and advanced technology, and increased cash flow through a well developed market economy are the primary concerned of the sustainable policy for Bapru cluster.

* The development plan of the year 2020 on the basis of better land-use practices is proposed. As in the case of agricultural land, extension of land under forest, fruit trees, medicinal plants, floriculture and community forest have also been found feasible. As per the economics of the land production medicinal plants has maximum return in the ratio of 1:16:37:90, agriculture: horticulture: floriculture: medicinal plant. Further more attention to ecological sustainability is given for expanding and including the many off-farm and non-farm activities (like tourism) or options that make up sustainable livelihoods in order to have a sustainable development of Bapru cluster. Thus, the study presents radical change in the land-use pattern on scientific and economically more remunerative lines, and developed the transport system so as to enable the natives of the area to derive maximum benefits from the above stated land-use transformation.

Thus, all development related to physical as well as economic should be appreciated in the integrated development or multipurpose resource use strategies can

reduce conflicts that arise in various sectors of local economy such as agriculture, forestry, horticulture etc. This would increase the multiplier effect for the benefit of the mountain community.

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