This research work is focussed on the southern aspect of the Dhauladhar foothills which needs extensive and intensive surveys so as to assess the ecological loss, generate eco-awareness, prepare remedial package and sensitize the connected institutions.

The Dhauladhar Mountain Eco-system, Photo by: Dr. B.C. Khanna (Fig. 2.1.)
In this chapter review of literature need and scope, objectives, research methodology and limitation of the study have been detailed.

1.1 **Review of Literature**

The following are the important studies relevant to the present context which have been reviewed.

- **Mitchell J F and Vasudev Arjandas** assimilated a lot that was contained in the previous edition of District Gazetteer Kangra, refurbished and updated the same and presented in a more readable form. This compendium relates to the tract known as Kangra proper and comprises the five Tehsils-Dehra, Hamirpur, Kangra, Palampur and Nurpur. This compilation gives the description of valuable information regarding land, people, forests and administrative setup in those times.

- **Rawal R D and Gaur S C** prepared first consolidated working plan for all 70 cooperative forest societies of Kangra and Nurpar forest divisions. In all, there are 14 chapters which detail the summary of the facts on which the proposals for management of cooperative forest societies on scientific lines are based.

- **Maslekar A R** wrote a very comprehensive book on managing forests. First part of that deals with general forestry situation and environment for forestry in India and scope for management. Second part covers the conventional scientific forestry practices. Part third gives new dimensions of forestry which include forest development cooperatives, forest labour cooperatives, social forestry, urban forestry, nature and wildlife, work study and productivity. Focus of the book is on managing the forests in Indian situation. Economic appraisal of forest projects is also given with examples.
Khosla P K and Kohli R K* compiled the proceedings of National Symposium on "Researches in Social Forestry for Rural Development" held at University of Delhi on Jan. 1-2, 1986 as a pre-session of Indian Science Congress under the auspices of Indian Society of Tree Scientists. It incorporates different aspects ranging from research needs of social forestry, case histories of social forestry in different parts of India, choice of species, multipurpose fast growing trees, productivity in social forestry plantations, allelopathy in forestry, tree architecture, introduction trials and rehabilitation of waste lands.

Visscher J T, Paramasivam R, Raman A and Heijnen H A* in overall ten chapters, the concept of slow sand filtration water supply is introduced, designed and applied in specific conditions and then generalised. Thereafter, the detailed operation and maintenance procedures have been outlined and the importance of training highlighted.

Singh Tej Vir* has made an effort in his report to explore on the universe of Kulu Valley in her various aspects of Geography, History, Culture and Ecology which form community's tourism products. Along with impact assessment, it is an projects is also given with examples.

Rustam N K, Ramble Charles* in five parts, focused on general perspective, use and abuse of the environment, religious and cultural resources, political and demographic consideration and artistic and literary heritage of the land and the people of the Himalayas. It is a comprehensive description of the interaction of man and environment in holistic perspective.

Lal J B* describes the forests with a dual purpose-as producers of the precious environmental services and economic goods in ten sections. For a valid assessment of environment necessities and socio-economic constraints that govern the management of forest, it is essential to place in
context the historical background of forests, their geographical variability, silvi cultural practices and the ecological perceptions that shape them. The book demolishes myth after myth and attempts to present realities. It also examine the existing possibilities of integrating ecology with economics and technology.

- **Pirazizy A A** depicted the changes in Himachal Himalayan Environment, causes of damage and necessity for cautions in all operations which interfere with natural environment. The book has four sections attempting to construct a research design which examines the present assumptions through an inter-disciplinary approach.

- **Vandana Shiva, Jafri H Afsar and Bedi Gitanjali**, in six chapters attempted to internalize the shadow of ecological foot prints of global commerce through the issues that the Research Foundation for Science, Technology and Ecology (RFSTE) has been involved in. In each case if ecological costs are accounted for, societies paying more than the Corporations are earning through exports. An internalization of the ecological and social costs shows that the so called competitiveness in globalization is based on hidden subsidies.

- **Werner LWolfgang** made a collection of papers presented during 11th European Conference on Modern South Asian studies in Amsterdam, July 2-5, 1999 covering a few aspects of ecological problems.

- **Goudie Andrew** in his book demonstrates convincingly the important role of human activity in shaping Nature in nine parts. It synthesizes a wealth of material, and serves as a clearly organized introduction to further research in the field. The book further takes into account the increasing
emphasis in environmental impacts, particularly deforestation, desertification, ecological invasions such as marine pollution, climatic changes and climatic future.

- **Trivedi P.R.**\(^4\) explains the process of environment research, methods of data collection, analysis of water quality, system approach to environmental problems, solid waste management and management and handling of hazardous substances—all in six chapters.

- **Trivedi P.R.**\(^5\) further highlights in nine different areas, the concept of environment impact assessment (EIA) for all components of environment—physical, socio-cultural and biological stands well explained. There is also a chapter each for public participation and EIA related case studies.

- **Ravi Sri N**\(^6\) in an annual survey of “The Hindu”, an English Daily being published from Madras focused on the issues: shelter and cities, managing protected areas, conflicts and controversies, people’s initiatives and survey of housing in urban India.

- **Shiva Vandana**\(^7\) in Seven chapters traces the continuity from the European colonization of native peoples— to the present appropriation of the natural resources they need for their physical and cultural survival. The volume gives a better understanding of the global threats by technological transformations of organisms, cells and molecules and by their exploitations for profit.

- **Paranjapa Suhas, Joy KJ, Machado Terry, Varma Ajaykumar and Swaminathan S**\(^8\) complied a source book on water shed based development. It has three parts mentioning (i) elementary/basic books to be used for water shed management (ii) The books which will make one think in a better way vis-à-vis water shed management and (iii) books which
can contribute something important to contribute in different specialized areas. This reference book is of practical importance to the users.

- **Singh Vir, Sharma M**\(^{19}\) acquaint the readers with the mountain ecosystems that are facing a state of uncertainty in three sections. First part portrays the general perspective of development in the mountains; the second provides details on various factors and processes contributing to uncertainty and delineates the present state of natural and socio-economic base. The third part focuses on controversial Tehri Dam in Garhwal Himalayas.

- **www.colorado.edu/conflict/peace/ltreating_overlays.html**\(^{20}\) The website gives useful information on strategies for (i) treating framing problems (ii) treating scoping problems (iii) treating communication problems (iv) treating fact findings problems (iv) treating procedural problems and (vi) treating escalation problems.

- **National Policy and Macro-level Action Strategy on Bio-diversity**\(^{21}\) highlights bio-diversity, its conservation. National Policy and goals in India in detail. Current status, gaps and action points for bio-diversity conservation in implementation, monitoring and funding have also been detailed for biodiversity conservation.

- The article on special Integrated Coastal Area Management Conflict Resolution\(^{22}\) describes the techniques and strategies for conflict resolution.

- **Agarwal Anil, Narain Sunita and Sen Srabani**\(^{23}\) have documentation how India’s natural resources are being managed and how Indian citizens whose life depends on these resources are faring. The first part is a comprehensive dossier on environment issues, events, policies and practices. The second part provides a data base on different aspects of Indian environment.
• **Bhatia A, Karki’s** edited the proceeding of a workshop on policy and human resource development in Hindukush Himalaya which brought together forest management personnel from various parts of the region. The basis of their discussion was the people centered forest policies to ensure that the need of the mountain people receive the priority they deserve.

• **Cross Susan, Rosenthal Robert** discuss three models of conflict resolution and their operationalization for application to various situations.

• **Sustainable Livelihoods Guidance Sheets: 2** details seven sustainable livelihood frame works and examines it with reference to vulnerability context, livelihood assets, human capital social capital, natural capital, physical capital, financial capital and transforming structures and processes.

• **Black Jeremy**, in the Atlas of World history offers a history of world as relevant as we started new millennium and as to look back how the present day world has got here. The first part covers the eras of world history while the second one details the regional history.

• **Rawat GS** edited third special issue on Joint Forest Management after July 1994, June 1997- covering the approach, research, development results and cost benefit analysis of Joint Forest Management (JFM). The issue focuses on participatory monitoring and evaluation and some success stories from the field.

• **Singh Gurmel, Vennkataramanan, Sastry G and Joshi B P** in all nine sections of manual of soil and water conservation practices provide the present and prospective soil and water conservations with information to plan and implement such programs on water shed bases effectively. It also provides formally specifications, charts and drawings that can be used as a reference in the field.
- **Bhatta R N** aimed at providing a systematic analysis on tourism's interaction with the environment and ways to achieve sustainability, the discussion in the book in 11 chapters revolves round three concepts: tourism, environment and sustainability. Also topics on the tools of sustainable tourism, the carrying capacity analysis, EIAs, economic valuation of environment resources are included.

- **Himachal Pradesh Forest Sector Review** in executive summary raised three groups of related issues (i) participation in Forest Management for livelihoods (ii) increasing the goods and services available through improving Forest Management (iii) Governance, Law and Policy coherence to achieve above. It presents findings on physical status, use economics, laws, institutions and polices concerning valuable forest asset base. It also offers policy and change recommendations which have the weight of wide spread participation behind them. These recommendations emphasize continuing participation, strengthening of local institutions, so that they become effective forest stewards, funding ways to realize the high forest values to help social and economic development.

- **Negi SS**, deals with various aspects of forests and forestry in Himalayan region in 12 chapters. The chapters included are on forest types, important trees, forest policy forest laws, forest products, regeneration, management and protection of forests besides forestry researches, participatory forest management and wildlife management.

- **State of the Environment Report** discusses the issues of environmental concern and action required for the State of Himachal Pradesh in 4 volumes covering 22 different sectors having implications on environment management.
• Thapliyal Vandna compiled of 15 articles including biodiversity, minerals, agriculture and horticulture, changing land use patterns, hydel project and their impact on environment, unconventional sources of energy, people's participation in natural resources management, health and environment, natural disasters and need for change in related laws and policy frames.

• Negi SS in his volume on participatory resource management in 14 chapters covers various aspects of participatory natural resource management, its approaches, PRA, communication, micro plans, monitoring and evaluation, capacity building, gender issues and success stories.

• Hosur C Girish critically examines the historical background, present status and reasons for failure of cooperative forest societies scheme—an attempt of community management of forests during forties onwards in erstwhile Kangra district in 7 sections of his project report. In the last suggestions for improving the working of such an old institution have been given.

• Ahal Rajiv in six segments of his book on 'The Politics of Cooperation', has attempted to cover the history of Kangra cooperative forest societies, the political developments concerning them, connected initiatives in district Kangra and the current situation of community management of forest. The document seeks to project the future scenario of forest cooperatives in the district.

• An Environment Education Manual and Information Handbook for Teachers in three sections attempts to activate teachers by echoing concerns of environment, eco-tours and learning by doing. It is a very useful document highlighting methodologies for ecological awareness among the students.
Catch Water-The CSE Campaign for People's Water Management is the compilation of the minutes of the workshop to promote the movement to revive dying urban wet lands held on Oct. 3-4 in New Delhi. Main objective was to motivate the urban population to understand the manifold uses that these decaying water bodies once served, and to emphasize the urgent need to protect and revive them.

Sobti RC and Sobti Vipin compiled the outcome of a refresher course organized by the Department of Biotechnology, Punjab University, Chandigarh in Dec. 2000. It contains articles of divergent nature covering various aspects of environment and have been arranged in four broad categories i.e. awareness about the components of environment, problems, remedies, and international concerns.

A Proposal for Natural Resource Management Program, Bhajan Khadd Watershed Development Plan covers water shed project area management implementation under the different segments for three of the five wards of Kand-Kardiana Panchayat of Nagrota Bhagwan development block of Kangra district.

Sopan Joshi explores that area of minor forest produces is secretly exploitative and further examines its manageability.

Sarin Madhu argues, forest conservation, is, too complex an issue to be resolved by executive fiat. He further concludes that improving forest governance requires making community institutions key actors in the process. They need to be empowered with genuine management authority based clear common property rights.

Singh HIR and Kumar Neeraj in their book dealing with the fundamentals of ecology and environment science in 30 sections put an emphasis on the
impact of environmental factors on their functioning. There are detailed chapters giving update information on behavioral and conservation ecology, biodiversity and application of ecology and environment science for sustainable development.

- Deb Debai in his monograph sequenced into eight sections, the present monograph presents an empirical and theoretical comparison of the system of farming for the better promotion of sustainable use of the earth's vital resources and promotion of technologies that benefit the small producers and human health.

- Website: www.environmentalfutures.org\images mentions the current decision making process, analytic frame works for decision making, risk assessment in decision making, MCDA (Multi Criteria Decision Analysis) process (Yoe2002), modular uncertainty, parameter uncertainty, review of decision analysis applications, realistic decision matrix and people process and tools-as essential decision making gradients.

- Roundtable Conference on “National Himalayan Policy for Mountain Development, Palampur, January 8-9, 2005” focused on to develop a better understanding of the needs of mountain development and formulate a strategy action plan for making the idea of “National Himalayan Development Policy”- a reality. It outlines key outputs and policy recommendations on the issue.

- National Himalayan Policy for Mountain Development—concept note is intended to make the stakeholders aware of the current correct perspective of sustainable mountain development. The paper highlights the stresses of the Himalayas, sustainable development approach for Himalayan reign and suggests policy areas and interventions specific for mountain development.
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HP Forest Department, Revised Policy on Development of Eco-Tourism in Himachal Pradesh elaborates the concept of eco-tourism development mechanism so as to make the state of Himachal Pradesh a leading eco-tourism destination in the country by 2010. This is the revision of the eco-tourism policy, 2001. The main focus will be community based eco-tourism (CBET) promotion. To achieve the mission, the forest department has constituted an "Eco-Tourism Society of Himachal Pradesh", under the Society's Registration Act, 1860.

Soni Anil edited the proceedings of the conference on Development of Himachal Pradesh organized at the club house, Mcleodganj, Dharamshala, by Divya Himachal—the state's leading Daily on June 2, 2005. The agenda included unleashing the hydro power potential, building innovative strategies for tourism and expanding the horizons of industry. Government officials, industry leaders from power, tourism, communication and education sectors along with local industry and entrepreneurs participated in the conference. It was an attempt to indicate the action agenda and strategies to contribute to the prosperity of the people of Himachal Pradesh.

The article on 'Greening of China', The Economist contains the details of green GDP—which allows for environment costs in national accounts. China Government has identified 10 regions including Beijing to carry out a pilot project in green GDP assessment. With the proposed framework China will become the pioneer of such statistical approach. Pros and cons of the concept are weighed in this article.

The review of available relevant literature on the subject shows that a number of studies have been conducted on different aspects of the environment. They cover only one or other component of the environment i.e. Land, water, air,
other natural resources, tourism, agriculture, forestry and human environment. They are sectoral efforts in isolation and none of them attempts to attend the issue of environment management in a synergized, holistic, participative and integrated manner. Thus there is an urgent need of such study.

2.2 Need and scope of the study

Every developmental activity while improving the quality of life, must take into account the environment aspect as well. And, organisations/institution/communities are better equipped to do something concrete in this direction. What is required is that efforts of the different agencies should be coordinated and properly managed at some level. What is needed is that we must translate different concepts into a reality for which a holistic strategy must be developed.

There are two ways of approaching the environmental management problem (of the Dhauladhar foot hills).

It can be asked: "what the facts are and what would the concerned agencies want the facts to be".

While managing ecology of the foot hills, emphasis is to be laid on both the approaches, through the generation of -

- baseline data
- resource maps
- master plans
- land use patterns
- study reports/environmental impact assessments (EIAs)
- and satellite imageries

These can offer explanations of the vast uncertainties that are a marked
feature of this seismic highland. Long term changes in environment through
geological evolution, or short term modifications or hazardous changes such as
earthquakes, landslides, forest fires, extinction of species have always threatened
survival and adaptation on the seismic highlands of the Dhauladhar.

One has to agree with Pirazizy that highland environments are highly sensitive
to the presence of human beings; and this vulnerability actsuates a great deal of
irreconcilability between utilization of resources and environmental integrity
maintenance.

Stressing the role of eco-management, Pirazizy emphasizes that though on
macro-scale human-environmental interactive systems are perceived to be of no
critical impact, yet on micro-scale these interactive systems can face vigorous
change with a visible shift towards deterioration. There is an urgent need, therefore,
to collect authentic data at the micro-scale/sub-system level as well. The fragmented
data generated by different agencies at present can be erratic and misleading.
Moreover, there is no authoritative text or incisive research devoted to the
Dhauladhar mountain eco-system at present. Hence the need for this study.

There is urgent need for authentic database, accurate resource maps, and
correct perceptions: Much of the data available at present is erratic, unreliable
and leads to misleading conclusions. Thus, there is an urgency to generate original
baseline data for correct analysis/research work/remedial package.

"Nature can not be reduced to fundamental entities but has to be understood
in its entirety". The purpose of the present research is a collective summation of
the following:

1. Agent  2. Causes
3. Pace Rate  4. Sure Remedies
In fragile environs, economic activity or any development plan needs to be re-oriented, redirected and properly managed and every institution has a managerial role to play in this direction. There can be long term & short term strategies at macro and micro levels. Management has a very important role to play through its objectives, culture & commitments so as to repair the damage and restore ecological order in the area. The corner stones of environmental management are:

a. Environmental Planning
b. Environmental Status Evaluation
c. Environmental Impact Assessment
d. Environmental Legislation, Policies, Institutions/Administration
e. Conflict Management.

There are a number of environmental management models available for guidance & every institution is expected to lay down its environmental policy, stating its overall intentions and directions.

In the light of the above, the present study focuses on integrating the systems, sub-systems, planning concepts, policies programmes, the thought streams of ethno ecology, the base line data & the resource maps of different agencies/institutions so as to evolve a holistic "information - system - models" to preserve the ecology of the Dhauldhar foothills and bring about the socio-economic transformation of the chosen area. Thus the scope of research is both limited and wide.

The area chosen for present study lies between “GAJJ KHAD” to the west side & “MANUNI KHAD” in the east; the Dhauldhar Range to the North & Chilghari – Dharamshala – Sidhbari areas in the south. Forest reserves of Banoi, Dharamshala, Naddi, Sudher, Gharoh, Sidhbari and Dharamkot having total area
of about 8400 hectares\(^4\) fall in this area.

The area comprises of thirty five revenue villages\(^5\) including two urban areas of Dharamsala Municipal Committee and Mant Khas. Other revenue villages are Bagni, Barmet, Batala, CB Khaniyara, CB Gharoh, CB Sidhbari, CB Sudehd, Chhowani, Chohla, Chelian, Dhial, Gabli Dar, Khaniyara Khas, Gharoh Khas, Hodal, Jurigal Reserve Banoi, Jhidi Darol, Jhidi Dar, Juhal, Kajiot, Kharota, Naddi, Patola (i), Patola (ii), Sheela, Sidhbari, Sidhpur, Sokni the Kot, Sudehd Khas, Tahu, Uprii Dar, Uprii Barol. Thus the scope of study is both general and area specific.

2.3 OBJECTIVES OF THE STUDY

As an ecologically fragile and sensitive area of the outer Himalayan foothills has been chosen for exploration, the aim, of course, is to evolve a remedial package in managing the eco-restoration work. The major objectives thus are:-

i. "Action examination" of the current policies, plans, forest acts and environmental laws as applicable to the "chosen area".

ii. "Environmental impact assessment" to establish relationships among various components of the targeted eco-system.

iii. Evolve an "Integrated Approach" through information system in managing ecology of the "chosen area" in the southern aspect of the Dhauladhar.

However following Subsidiary objectives to be fulfilled by the undertaken research are:

i. "The research work, may ultimately sensitise the network of institutions impacting ecology of the area and stimulate the planners/decision/policy makers to modify their plans on the suggested line."
ii. “As the area under focus is developing fast, local administration/govt. does not have any elaborate policy for dealing with environmental cost of development and social cost of conservation, the present study will set a developmental trajectory in harmony with environmental ethos.”

iii. “At the cultural level, the idea is to generate awareness regarding sustainability of hill traditions/native livelihood issues on natural resources and their preservations.

iv. “Since the area under study has high tourist potential in Himachal Pradesh, the research will help resolving the conflict between the conservation and development and promoting eco-tourism.”

2.4 RESEARCH METHODOLOGY

The research in real term is aimed at “knowing” the so far “unknown”. The essence of empirical research is gathering and analyzing the data. The scientific research, however can be-termed as scientific under taking a which by means of logical and systematized tools and techniques endeavors rediscovering new facts, analyze their sequence, inter relationship and casual explanation which are derived with in an appropriate theoretical frame of reference. The use of appropriate tools and methodologies are a must for a successful scientific research.

In the present endeavour the methodology of scientific research using both primary & secondary data, its analysis has been used to find out resultant impact on the environment to evaluate and resurrect the strategy for sustainable development through integrated approach in the area of study. Broadly these methods have been classified into four categories: i) structural equation methods (ii) empirical methods (iii) networking methods (iv) models and conceptual framework methods. The application of these methods individually and / or
collectively is aimed at collecting of data both from primary and secondary sources to generate authentic base line data and its categorization.

It will include the following:

i. Generation of Authentic Baseline Data and its Categorization:

From Primary Sources:
- Community based information
- Field Studies/Reports

From Secondary Sources:
- EIAs
- Research reports of Agriculture University Palampur/IHBT. (Indo Himalayan Biotechnology Centre at Palampur, CSIR)
- Surveys/Projects of the NGOs
- Related information from the Departments of Forests/ IPH/ Town Planning/ Municipal Body/Tourism/Statistical Department.
- Village Panchayats covered under the targeted area
- Data on Bio-physical sub-systems
- Data on Economic Sub-systems (Demographic, Cultivation sub-systems, Grass Land Sub-systems and Forest Sub-systems.

ii. Accurate Maps and available Satellite Imagery:

Ecological Foot-printing and spatial data of the area under research.

Resource Maps:-
- Bio-diversity Maps
- Land use maps and cropping (agro-land use maps) patterns
- Geo-hydrological maps
- Water Resources/ Lakes/ Rainfall patterns/Climates.

58
- Available satellite imagery of the forests in the area.
- Soil type maps of the target area.
- Sheep, goats and cattle count.
- Comparative population density maps of the area.
- Disease Mapping of the district and healthcare issues.

iii. E.I.A.s. (Environment Impact Assessments)

iv. Action Examination of eco-policies, related plans (Micro/ Macro) and eco-laws/Forest Sector Reviews/ Integration of the planning approaches.

v. A study in Rural Solar Technologies.

vi. Land suitability evaluation models for eco-restoration.

vii. Calculation of susceptibility of land to erosion process and erosion risk maps.

viii. Integration of Information systems in managing ecology of a hill-habitat.

During the course of present study, the primary sources formulated the core of the data bank generated on various issues and alternatives, strategy and future plan. Since the area of study, the focus group was rural, semi-literate population, especially women and nomadic males, workers; the various questionnaires designed and interviews conducted were very simple but detailed so as to extract maximum information.

The entire empirical methodology and tools and techniques used are based on experience sharing and field studies. The secondary sources and various maps facilitated the cross checking/ verification/authentication of the primary data generated. Various analytical methods including the statistical models/formulae helped in establishing the extent and impact of environmental degradation. Networking of
information supplied by various line department and institutions and agencies including web/internet i.e. insillico information formed the skeleton of the total available information. These sources enable to device /suggest /evolve the future strategy for environmental management especially natural resources in the area of the study. Some of the conceptual framework of the models were preexisting but were modified according to the need felt during the course of the study also some alternative/future models for integrated approach have been devised.

Main Management models applied for the present study are as under:

**Multi-resource Forest Management Model:**

![Diagram of Multi-resource Forest Management Model](image)

However geographical information system model given as under has also been used for land use planning.
### APPLICATION OF GIS TO LAND-USE PLANNING

**(CONCEPTUAL DIAGRAM OF A DEMONSTRATION EXAMPLE)**

<table>
<thead>
<tr>
<th>TASKS</th>
<th>TASK A</th>
<th>TASK B</th>
<th>TASK C</th>
<th>TASK D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objectives</td>
<td>Intensify Agricultural Production to increase household income</td>
<td>Ensure the Environmental sustainability of Agriculture in the watershed</td>
<td>Balance croplands and supportlands (forests)</td>
<td>Identify opportunities for High Value Crops (HVC)</td>
</tr>
</tbody>
</table>

#### Step 1
- **Analysis of the agricultural Framework in the chosen watershed**
  - Identify the Main Land conversions from 1970-90 and 1990-2000
  - Analyse distribution of main land uses vs. elevation and slope.
  - Prepare land capability map
  - Identify trends of forest/ population ratio
  - Analyse characteristics and present HVC production pockets

#### Step 2
- **Presentation of Findings of Primary land use issues in the watershed**

#### Step 3
- **Identification of additional information requirements and preparation of field work**

#### Step 4
- **Field visit I:** Familiarization with the watershed, verify analysis, and enquire about reasons

#### Step 5
- **Identification of 'lands used unsuitably'**
  - Identify lands that are used below their capacity
  - Identify overexploited lands
  - Identify settlements with inadequate access to forest resources
  - Identify potential HVG growing areas
  - Identify potential forest/crop land ratio

#### Step 6
- **Prioritisation:** Identify areas that are used unsuitably for several reasons

#### Step 7
- **Preparation of proposals for land use change.**
  - Recommend suitable type of intensification with regard to land capacity
  - Recommend types of conservation (deintensification)
  - Indefit areas suitable for afforestation
  - Recommend road developments and their impacts

#### Step 8
- **Identification of conflicting proposals**

#### Step 9
- **Discussion with officials / stakeholders.**

#### Step 10
- **Field visit II:** Discussion of proposals with relevant people.

#### Step 11
- **Reporting and presentation of findings.**

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*Main steps in which GIS can be used.*

Modified from ICIMOD (3/99), Kathmandu

Fig. 2.4

61
Other models used occasionally are:

- Statistical Models for assessing degradation of resources.
- Culture-Specific Models for studying human - nature relationship.

The proposed models including those propounded for participatory management of available natural resources in the region making inconsumptive use and to uphold the ecological symbiosis with sustainable development through integrated approach are the key resultant factors of the study.

To ensure better data collection, analysis and illustrative graphical representation various computer techniques for making bar, pie and linear curves have been used. The preparation of regional resource maps and other management techniques listing PRA's and RRA methods have been followed.

The existing reports, books and publication on various subjects / related fields of present study formed the core of base line data to make selection of these reports, the availability and accessibility was the primary concern.
2.5 Limitations of the study

The concept of managing ecology of the “chosen area” suffers from a serious “error of perception” that data collected from several sub-systems of the hill-habitat and its interpretation, howsoever accurate and incisive, cannot completely solve the ecological riddle of that area. One reason for that is that remedial models and insight and reasoning generated through such works has to pass through hundreds of heads and hands of a long chain of men in a series of departments. And there is every chance of losing the aspects anywhere along the chain. Therefore, a holistic approach, howsoever integrative, cannot be the consummate solution for a big “ecological riddle” of Dhauliadhar dimensions. Highland ecosystems, low land eco systems, wet land eco systems, desert eco systems or, for that matter, ecologies are intricately linked through subtle like-processes, which many of them are difficult, if not impossible, to perceive and even beyond the scope of the present research-work.

Poor and insufficient documentation of the past trends of degradation especially in the field of geological, geomorphic and geo-demographic attributes is another limitation.

Disruption in free communication with leading researchers (like those working in ICIMOD) in the world on the subject like mountain livelihood and poverty alleviation, mountain agro-forestry, mountain farming techniques, glaciations, earth quacks etc. all have limited to some extent the scope of research which can hinder futuristic application of remedial packages. The reason for this has been the non-availability on e-mail / web communication.

Some “errors of perception” can, therefore, certainly creep in designing the
strategy for managing the expansive Dhauladhar mountain ecosystem and planning its eco restoration. To a limited extent, such invisible, constraints can vitiate the exploratory work.

Then, there is some limitation of ascertaining the practical linkage between policies and actions and commitment to implementation by the concerned authorities/departments.

Insufficiency of secondary data or lower quality can be another reason for not arriving at error-free alternatives. Indeed, this is a paramount research hurdle.
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