CHAPTER - 2
RESEARCH PROBLEMS AND METHODOLOGY

2.1 Statement of the Problem in the study area

The study area - Upper Beas basin is endowed with enormously rich natural resource that enriched its natural landscape through ages. But since from the last two decades, Upper Beas Basin around the Kullu Valley, has witnessed remarkable expansion, growth and developmental activities such as increased constructional works like buildings, houses, hotels, roads along with other anthropogenic activities that resulted in large scale deforestation, soil erosion and erratic climatic pattern leading to imbalance. This has therefore resulted in increased land consumption as well as modification and alterations in the status of the land use / land cover over time. It is thus necessary to evaluate and detect these changes in landuse pattern with the help of Remote Sensing data and GIS techniques and make an attempt to predict the possible changes that may occur in the landuse status so that planners can have a basic tool for planning.

2.2 Aim and Objectives

The Aims of the research are as follows:

- To investigate, analyse and map the characteristic Quaternary geomorphological features
- To make a detail study of the, landuse pattern of the Upper Beas Basin, Kullu valley
- To explore the pattern of the environmental changes with the changes in geographical parameters.

The following specific Objectives are pursued in order to achieve the above mentioned aims:

- Identification of ostensible Quaternary geomorphological (glacial, periglacial & paraglacial) landform features in the field through observation.
- Recording of the extent of occurrence of glacial, periglacial and paraglacial landform features.
Intensive and extensive studies on typical geomorphological features by measuring their morphological attributes. Size measurement of the characteristic quaternary landform features by instrumental survey.

Study the size reduction of the permanent nevé fields and glaciers upon maps, satellite imageries and ground truth verification.

Study of the nature, properties and processes of soil/regolith over the study area through sections and thereby understanding various slope processes.

Prepare detailed Quaternary map of the significant Geomorphological features.

Identify the pattern of hydrological and ecological changes in the catchment area of Upper Beas Basin, subsequent to rapid deglaciation.

To study the existing landuse pattern and explore the pattern of its change over the last 2 decades.

To prepare a land use / land cover map of the study area at different time periods in order to detect the changes in the landuse pattern, particularly in the agriculture, horticulture, forest sectors.

To forecast the future pattern of land use land cover changes

To evaluate the socio–economic implications of predicted change

Analyse the overall impact of geo-climatic changes on the Changes in landuse pattern and human perception of the Kullu Valley area for the past 30 years.

2.3 Database

The database collected on which the study is based on is as follows:

*Primary Data:* The researcher generated primary data in the field through measurement of some selected quaternary landforms. In case of landuse survey the primary data were framed in such a way that a comprehensive data set could be generated through direct contact with the land and people by interviews and perceptual analysis.

*Secondary Data:* This has been collected by the researcher from different government and non-government offices. With the help of secondary data the general geographical parameters and characteristics of the study area, particularly its agricultural, horticultural, forest and
demographic pattern were studied. The different government offices from which data have been collected are:

a. Office of Divisional Commissioner (DC), Kullu (maps of the district-blocks/ tehsils),
b. Forest office, Shimla (data of forest type, area coverage, plantation schemes)
c. Block Development Office, Kullu (general information about the district and tehsils)
d. Agriculture Dept., Kullu & Naggar (data of crop type, area coverage, production, schemes)
e. Horticulture Dept., Kullu & Naggar (data of fruit type and its area coverage)
f. Dept. of Soil Analysis, Kullu. (data of soil fertility status)
g. Directorate of Land Records, Shimla & District Land Record Office, Kullu (data of landuse and land classification)
h. Panchayat Office of Old Manali and Jagatsukh village, Naggar & Head Office at Kullu (village level data).
i. Dept. of Wildlife office, Manali (data on types of wildlife animals and birds)
j. Indian Agricultural Research Institute, Katrain – Kullu (data on vegetables and crop types, Climate data)
k. Indian Institute of Himalayan Studies of the Himachal Pradesh University, Shimla (relevant facts and figures on the study area mainly on the livelihood pattern of the residents)
l. Fruit Growers Association, Kullu (data & schemes for development of fruit production)
m. The Census of India, 2001 – Primary Census Abstract and tables on houses, household amenities and assets (account of various attributes of population of the two blocks, of Kullu district)
n. Survey of India Toposheets – number 52D/16, 53A/13, 52H/3, 52H/4, 53E/1, 52H/7 and 52H/8.
p. Geological Survey of India, Kolkata (Quadrangle map 52D, 52H, 53A, 53 E and books from library)


2.4 Methodology of research:

A meticulously designed set of methodology is adopted for the research work in order to study the geo-environmental status and mans interaction and relationship with it in the Upper Beas Basin. Change of physical environment and the way how humans are adopting are also taken into consideration. Beside this, present human intervention and its impact upon the landuse pattern is also observed with great care. The research methodology can therefore be categorized into two parts:

- Methods adopted for the measurement and analysis of the physical environment or Quaternary geomorphological processes and landforms and their mapping
- Methods adopted for systematic study of the existing land cover / landuse, its changing pattern and the socio economic attributes of the human society during the research period.

Step I: Stage of Preparatory Work (Pre-Field work)

[A] Selection of the study area: As mentioned in chapter 1.3 the study area is selected on the basis of its varied landform and landuse attributes.

[B] General assessment of the existing environment of the area: In order to have a basic and general idea of the study area to conduct survey, various secondary sources were consulted and published literature as mentioned above in the database. This study covers physical elements (like studying the geo-historical background of upper Beas Basin - topography, drainage, natural vegetation, soil types, and rainfall-temperature pattern) as well as socio-economic elements demography and population, educational and occupation status of the people etc.).

[C] Identification of the study area on the map: After the selection of the study area to get a clear picture of the location of the study area it is marked on:

- the Survey of India Toposheets number 52D/16, 53A/13, 52H/3, 52H/4, 53E/1, 52H/7 and 52H/8 (R.F. 1: 50,000) and mosaiced by Erdas 10 software


**[D] Selection of the problem for study and preparation of questionnaires:** The survey will be oriented towards understanding the Geo-environmental conditions and socio-economic aspects of the study area. For this purpose questionnaire(s) are prepared for the generation of primary data in the field though direct investigation.

**Step II: Stage of Fieldwork**

After preparing the base map and having basic knowledge about the area through available literature and statistical data fieldwork was undertaken. The systematic survey methods and techniques followed and applied in the field were the following:

**[A] Survey on physical attributes:** is done by

- Identifying the various glacial, periglacial, paraglacial and fluvio-glacial landform features, processes that help in its formation and measuring their morphological attributes.
- Studying the areal coverage of freshly fallen snow in the regions above tree line during the pre-monsoon, monsoon, and post monsoon seasons.
- Measuring the terrain condition by instruments like Dumpy Level, Abney Level, Prismatic Compass, measuring tape etc.
- Morphological divisions and their associated land units were identified on the topographical maps.
- Ground truth verification was done with Global Positioning system (G.P.S), Laptop, and satellite imageries with *Erdas* software to identify the physical features showing land use change detection.
- Observation of the drainage pattern in the study area.
- Collection of soil samples from 55 selected spots in the study area for determination of the physical characteristics and fertility status of the soil in the laboratory.
- Most of these data have been taken in numerical form for statistical and mathematical analysis as well.
Relevant photographs of the physical aspect in different seasons of the year have been taken during the fieldwork.

[B] Land use survey: Land use survey is done by:

- Identifying the present land use pattern (agriculture, orchard, forest, fallow land, settlement, water body, roads etc.) of the area under study.
- Some selected villages were surveyed in detail for land evaluation – capability and suitability analysis.
- Relevant photographs of the cultural aspect in different seasons of the year have been taken during the fieldwork.

[C] Socio-economic survey: In order to do these surveys following methods are adapted:

- Detection of problems and hazards in the study area through personal observation as well as through conducting door-to-door questionnaire survey (both household survey and perception study) in the study area.
- This investigation will have to be done upon methodically and systematically prepared questionnaire on their occupation, household size, male female ratio, education etc.

Step III: Stage of Post-Field work and Compilation of the Research Report

In the post fieldwork a wide range of primary and secondary data collected is processed and carefully analysed to prepare a proper set of information of the study area. The post-field methods followed are the following:

- Various statistical techniques have been employed mainly in the morphological measurements of the quaternary landforms and according to requirement they are analysed, interpreted and represented graphically.
- Analysis of satellite imageries with the help of Remote Sensing software and finalisation of map preparation on the basis of Ground Truth Verification by GPS and GIS softwares.
- Final preparation of geological maps, geomorphological maps, topographic maps and land use pattern maps, maintaining cartographic accuracy decency and covering all possible aspects.
- Determination of chemical and physical characteristics of soil samples including pH, N. P. K, organic matter, texture etc in the soil test laboratory with the help of standard analytical methods.
- Formulation of suggestions for planning strategies in terms of sustainable development
- Compilation of the entire research work pertaining to fulfill the aim of the research.

2.5 Literature Review:

The detail literature review has been given in respective chapters.

2.6 Limitations and Difficulties:

- Relevant reports, research literature and other scientific documents on this area are very limited as little work has been done on the quaternary landform study of the Kullu valley of himachal. Hence research is mainly dependent primary data generation through fieldwork and on limited authentic previous literature.
- The primary survey method has its own limitation and it was quite difficult to obtain the exact information on various social, economic and occupational aspects.
- Sophisticated instruments are not available for measuring the processes involved in Quaternary landform evolution.
- In case of landuse / land cover pattern study, secondary data sought from the government and non-government offices were not easily available.
- Micro level data on landuse classification was unavailable, hence for landuse pattern analysis and identification of its changes is done with the help of satellite imagery of two years with an interval of 9 years.