



GIS Technique to Highlight the Socioeconomic Factors for Integrated Micro watershed Development

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Abstract

A watershed is a hydrological unit bounded by natural ridges and allows the runoff due to rainfall to drain in a well-defined drainage pattern of streams flowing within the watershed boundary. The present study reveals the socioeconomic factors for integrated watershed management at the sub catchment of the Beas River in Mandi district, Himachal Pradesh for sustainable development. The use of field-based data, satellite images and quantitative GIS analysis is used for precise information of the study area. This study highlighted the socioeconomic issues for the sustainable development and management activities.

Keywords: Watershed integration development, beas river, sustainable development, GIS.

Introduction

The water is becoming a key factor in socioeconomic development due to under the pressure of population growth and development activity¹. Water is essence for life, any worsening in this can create great harm to human beings as well as to the environment². Therefore sustainable development of local area is very essential that can be only possible with watershed development. The Watershed is a geographical area which is drained by a number of streams³. The regions are diversified as basin, catchment and sub-catchment. These regions are further divided into macro watershed an area of 50,000 hectares, sub watershed an area between 10,000 to 50,000 hectares, mill watershed an area between 1,000 to 10,000 hectares, micro watershed an area between 100 to 1,000 hectares and miniwatershed an area within 1 to 100 hectares⁴. The size /extent of watershed may be varying accordingly to the purpose and objective of the study.

During 1992 the Government of India started an integrated wasteland development programme for the development of watershed management⁵. The waste land area has to suffer from the various problems such as soil erosion, landslide and deforestation. To prevent land degradation and development of natural resources, Government of India adopted the micro watershed approach⁶. These micro watershed projects examined very closely by the local people and experts for the solution of the basic problems of that area⁷.

It is a process of sustainable approach by organizing land resources in such manner that does not show any adverse effect on land resources⁸. The Watershed is a tool for development and conservation of natural resources by involvement of local community for the betterment of their life. It improves the basic need of local people and improves the lifestyle rather than fulfilling the purpose of government or non-government agencies⁹. It is the only India government who is placed plenty of emphases on watershed development¹⁰.

The GIS applications include topographic mapping such as land use mapping, population and location based information for integrated wasteland developers. In recent years GIS and Remote Sensing tools have facilitated the estimation of runoff from the watershed and gained increasing attention among the scientists¹¹.

Study Area: The sub catchment of Beas Micro watershed is located in the north of Mandi district, Himachal Pradesh (Figure-1). It is geographically extended from 76°51'26.176"E and 32°4'28.721"N to 76°58'15.761"E and 31°57'5.635"N. The total area of the watershed is 59.08 sq.km, and the economy is largely based on subsistence agriculture. In this sub-catchment, eleven micro watershed s are present. The average elevation of the study area is 1,044 m (3,425ft) which lies on the midland of the Himalayas. The southern area of micro watershed experience the hot and sub humid tropical climate, northern area has rich in glacial and eastern part of study area have the great mountain ranges.

Material and Methods

The capabilities of socioeconomic aspect are better represented by the Geographic Information System (GIS). An integrated remote sensing and GIS based methodology has successfully demonstrated for estimation of runoff in Buriganga Watershed¹². Geographic Information System tools provide analysis, representation of the capabilities of socioeconomic status. The present research work combines the field based surveys that maintain location information and secondary data. These field-based data had examined and analysis under the GIS environment. The base data for GIS such as Survey of India, Cartosat II, Revenue village data, and Census Data of 2011 has been used to analysis the study area. Demographic characteristics of the study area have been analyzed based on census data and revenue data. Demarcation of the study area is based on the SOI sheet. The landuse and landcover of the study area has been extracted from the Cartosat II. The softwares Arc GIS 10.1 and Erdas Imagine 2011 has used for analysis.

Results and Discussion

Geographical location of villages: Geographical location of villages has been plotted on the figure-2. The most of villages lie in the micro watersheds 1B1C4K2b, 1B1C4L1d, 1B1C4L1a, 1B1C4L1c, 1B1C4L2d and 1B1C4M1c. The rest micro watershed comprises open and forest land.

Resource Map: The resource based study identifies the school and bus stop facilities in the figure-3. The most of the resources / infrastructure is present in micro watershed 1B1C4K2b, 1B1C4L1d, 1B1C4M1c, 1B1C4L1a and 1B1C4L2a. The maximum resources are available in micro watershed 1B1C4L1a. While some micro watershed even lack of their basic needs and resources and these are 1B1C4M1b, 1B1C4M1a, 1B1C4L2c, 1B1C4L2b and 1B1C4L1c.

Literacy status: In the literacy map (Fig.4) of the study area, micro watershed 1B1C4K2b has maximum literate people as 1136, followed by micro watersheds 1B1C4L1d (525), 1B1C4L1a (1075), 1B1C4L1c (74), 1B1C4L2a (405) 1B1C4L2d (142) and 1B1C4M1c (515). Overall, this GIS based map directly helps planners for comparison and identification of the reasons for literacy rate variation in the study area.

Population: The population based study shows the distribution of population in a study area in figure-5. It has observed that the total population in micro watershed 1B1C4K2b has 1831, with the maximum population as compared to all other micro watershed. Micro watershed 1B1C4L1d has a population 964, micro watershed 1B1C4L1a has 1535, micro watershed 1B1C4L1c has 140 and micro

watershed 1B1C4L2b, 1B1C4L2c, 1B1C4M1a, micro watershed 1B1C4L2a has population 405, micro watershed 1B1C4L2d has 142 and micro watershed 1B1C4M1c has a population 892 and micro watershed 1B1C4M1b does not fall any population due to the steep slope and harsh topography.

Work Class status: Work class based study identifies the working class of study area in the figure-6. The micro watershed 1B1C4K2b has 1495 working people, micro watershed 1B1C4L1d has 707, micro watershed 1B1C4L1a has 1079, micro watershed 1B1C4L1c has 91, micro watershed 1B1C4L2a has 534, micro watershed 1B1C4L2d has 198 and micro watershed 1B1C4M1c has 691.

Landuse and Landcover: In a particular area, landuse and landcover pattern is a result of natural and socioeconomic factors which is used by human beings in different time and space¹³. Remote sensing and GIS are well-established information technologies, which are broadly recognized in managing land and natural resources. The spatial features are identified and represented on figure-7. These special features are as follows: Agriculture, Forest, Built up, Grass land

In the study area, the agricultural land is 7.11 sq.km, builtup land is 0.13 sq.km, forest land is 37.4 sq.km., grassland is 1.17 sq.km. and open/barren/shrub land is 13.11 sq. km. Landuse and Landcover of the study area shows that in all the micro watershed, maximum land fall under the forest category and minimum in the builtup area. The more influence of agricultural land is in micro watershed 1B1C4L2d, grassland is in 1B1C4L1d and open/barren/shrubs is in 1B1C4L2c. The less influence of agricultural land is in micro watershed 1B1C4M1c, grassland is in 1B1C4K2b, 1B1C4L2b, 1B1C4L2c 1B1C4L2a, 1B1C4L2d, open/barren/shrubs is in 1B1C4M1c.

Conclusion

The present study reveals that the diffusion of natural resources is not equal in all micro watersheds. The topography of micro watershed is uneven distributed. It results in the uneven socioeconomic development in the study area. The primary resources/infrastructure such as Primary Health Centre, Veterinary hospital and college need to be established. There is a need to motivate people for conservation of the environment, awareness, promotion of hybrid seeds and cash crops for the growth of the agriculture / horticulture sector.

These issues need to be tackled and managed using GIS tools with the active involvement of the local residents and local government. GIS technology is a better approach for the integrated watershed management. It reduces time and budget and provides precise information for sustainable development.

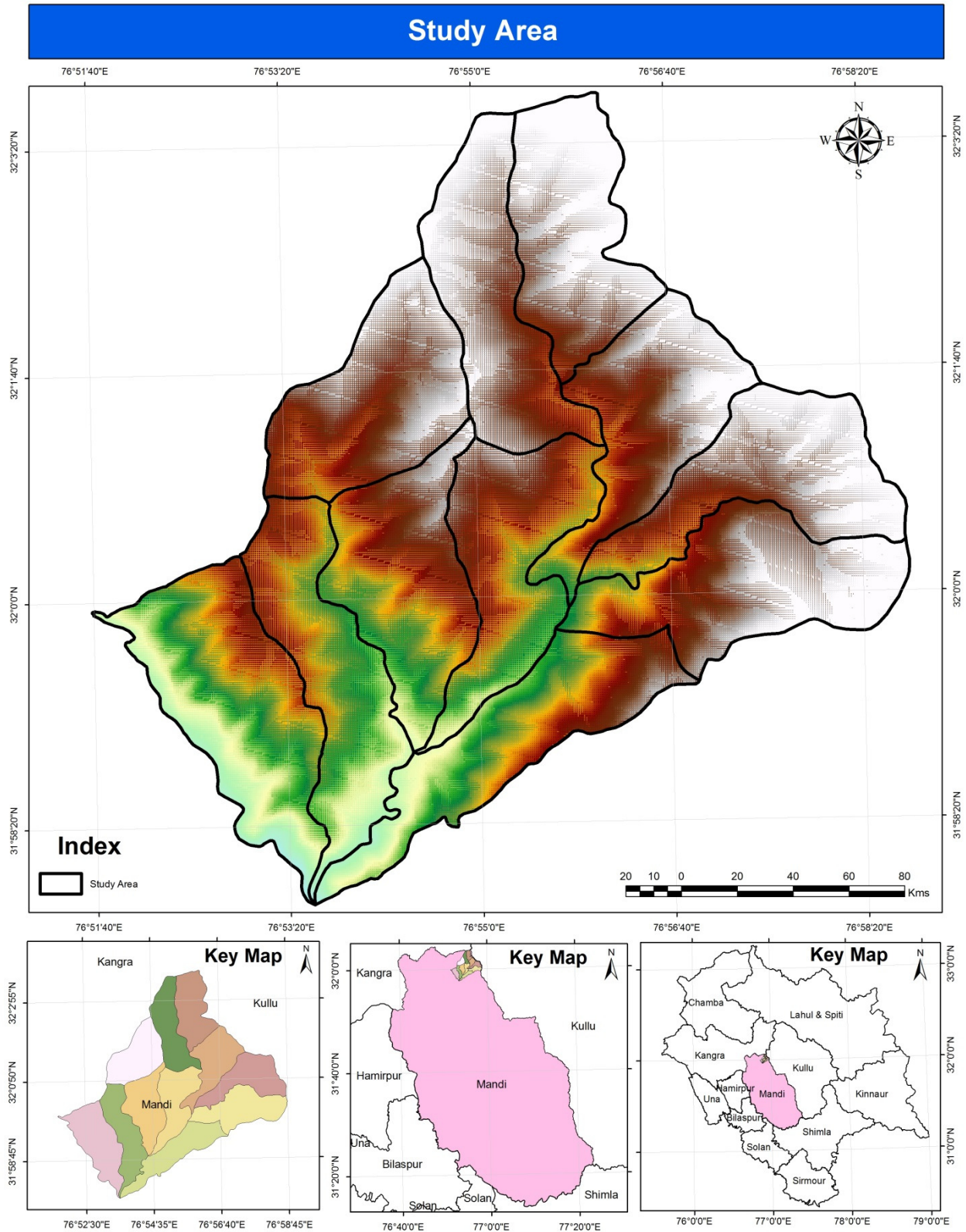


Figure-1
Study Area

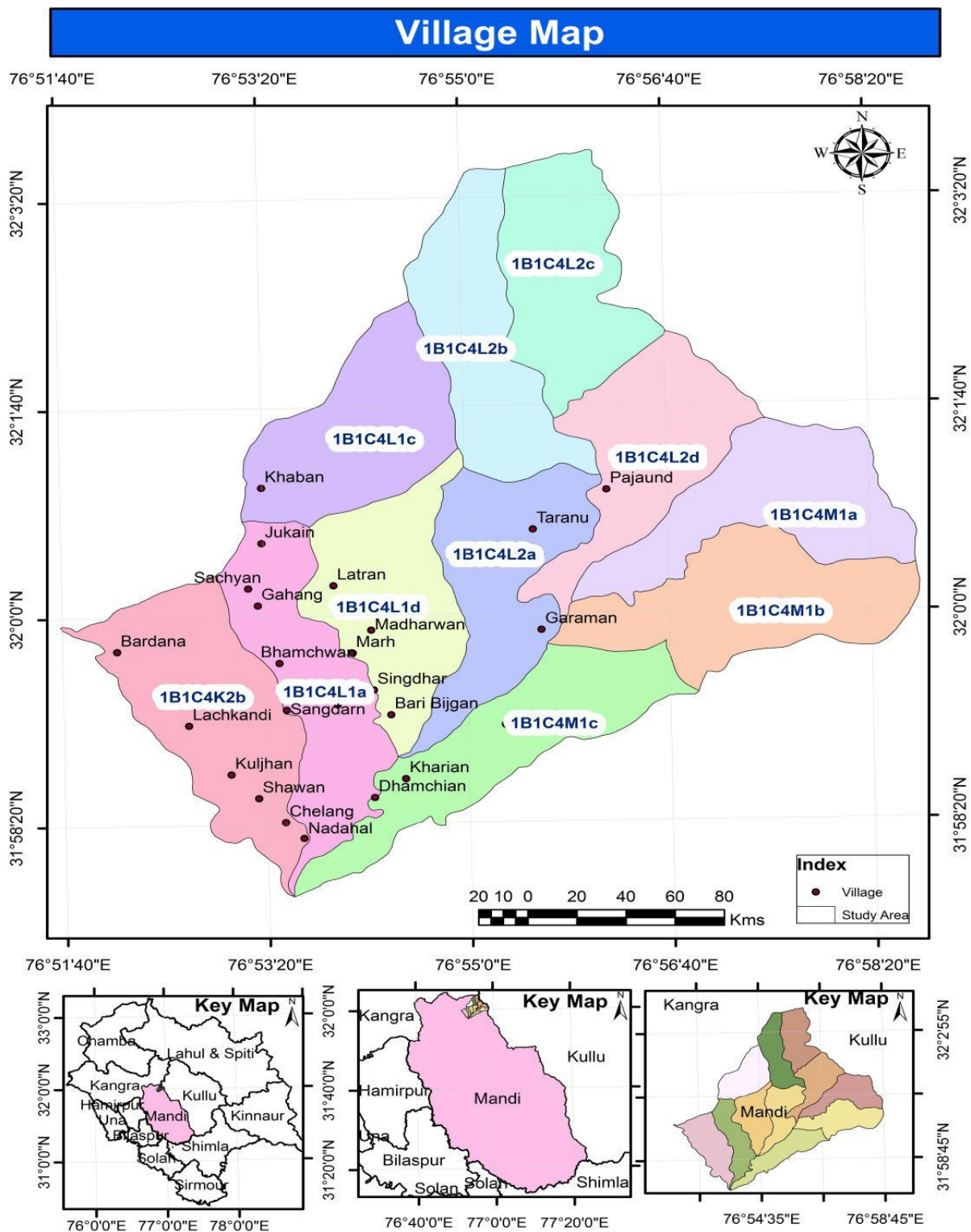


Figure-2
 Geographical location of Villages

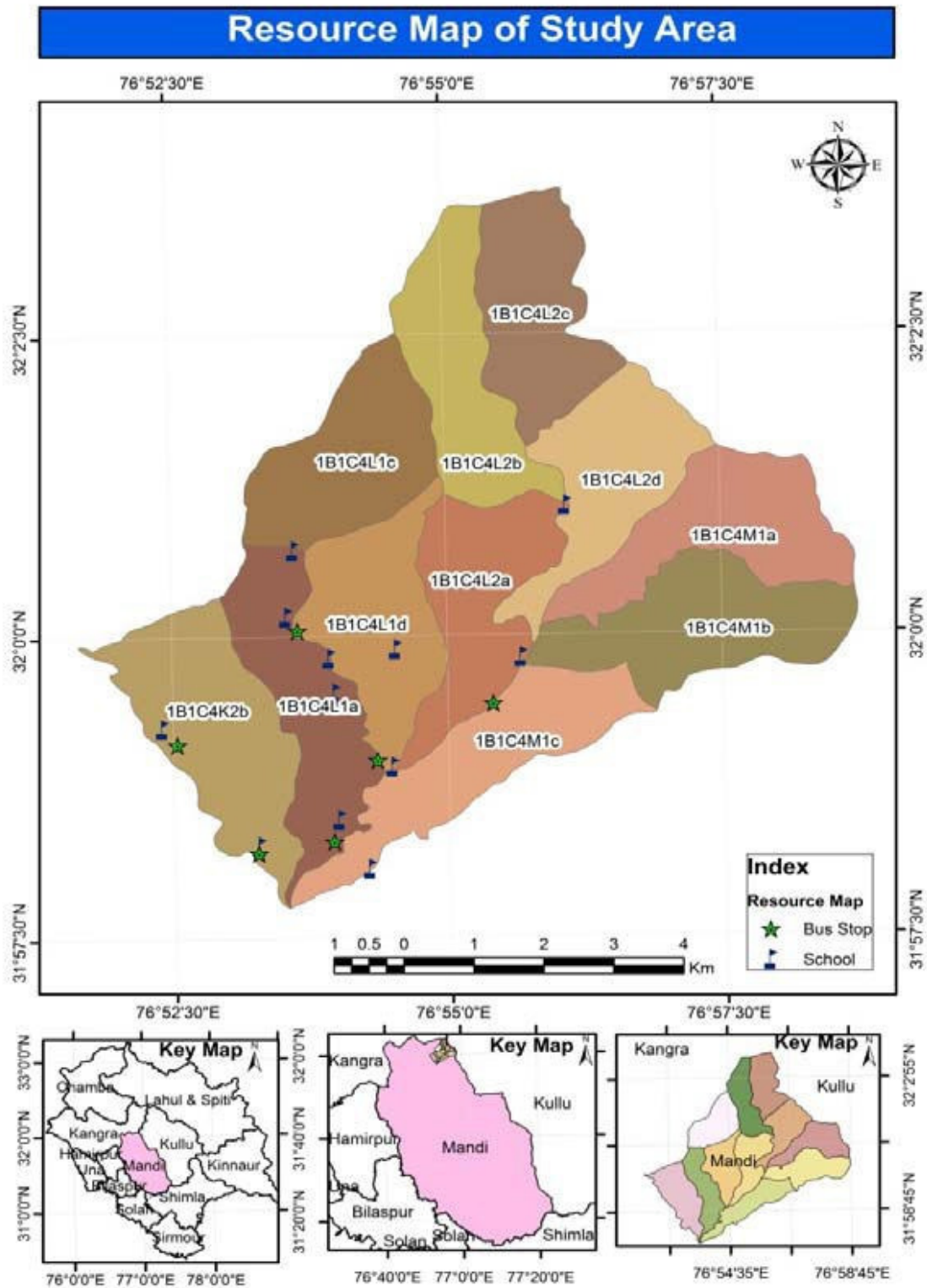


Figure-3
Resource Map of Study Area

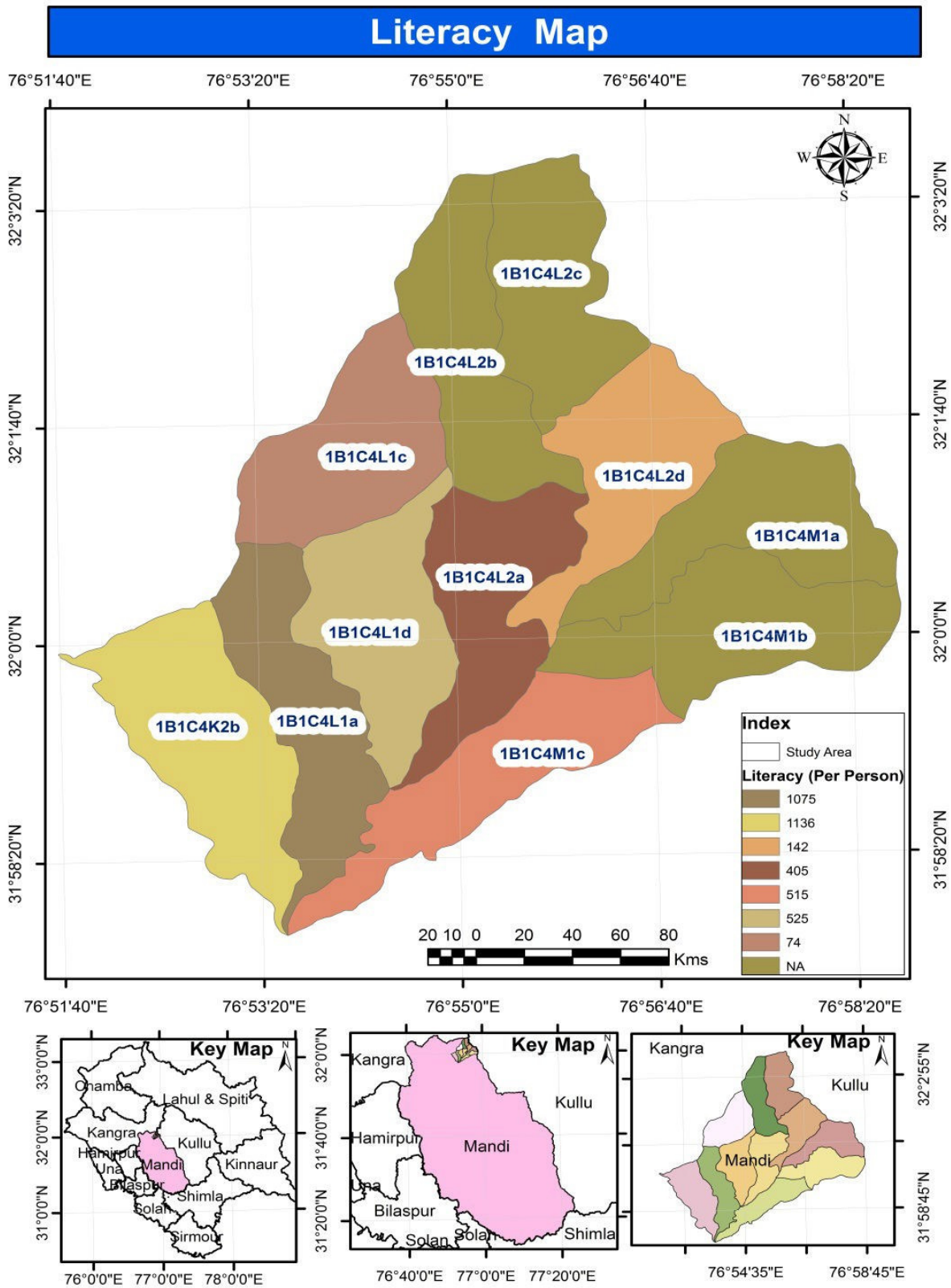


Figure-4
 Literacy map of study Area

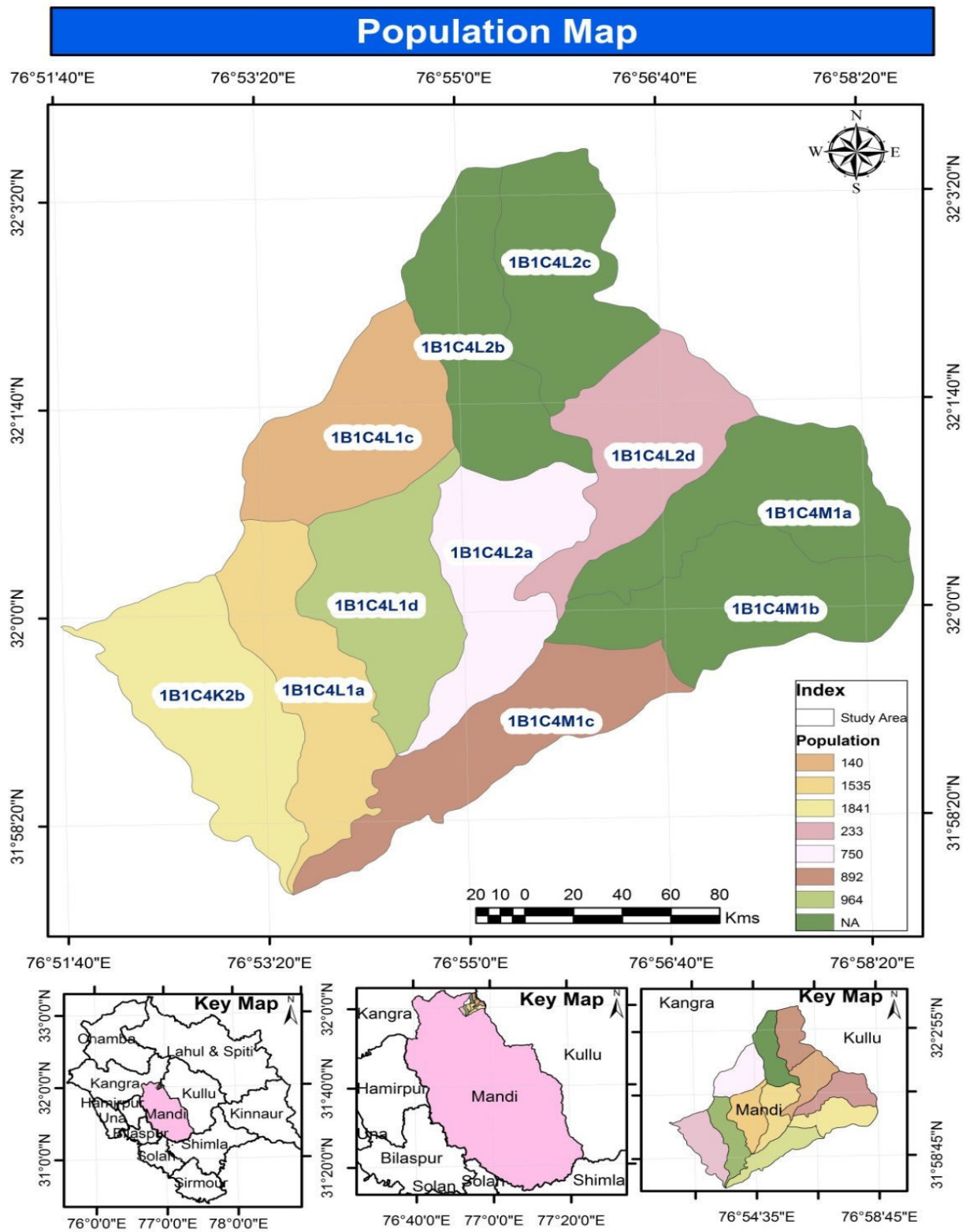


Figure-5
 Population Map

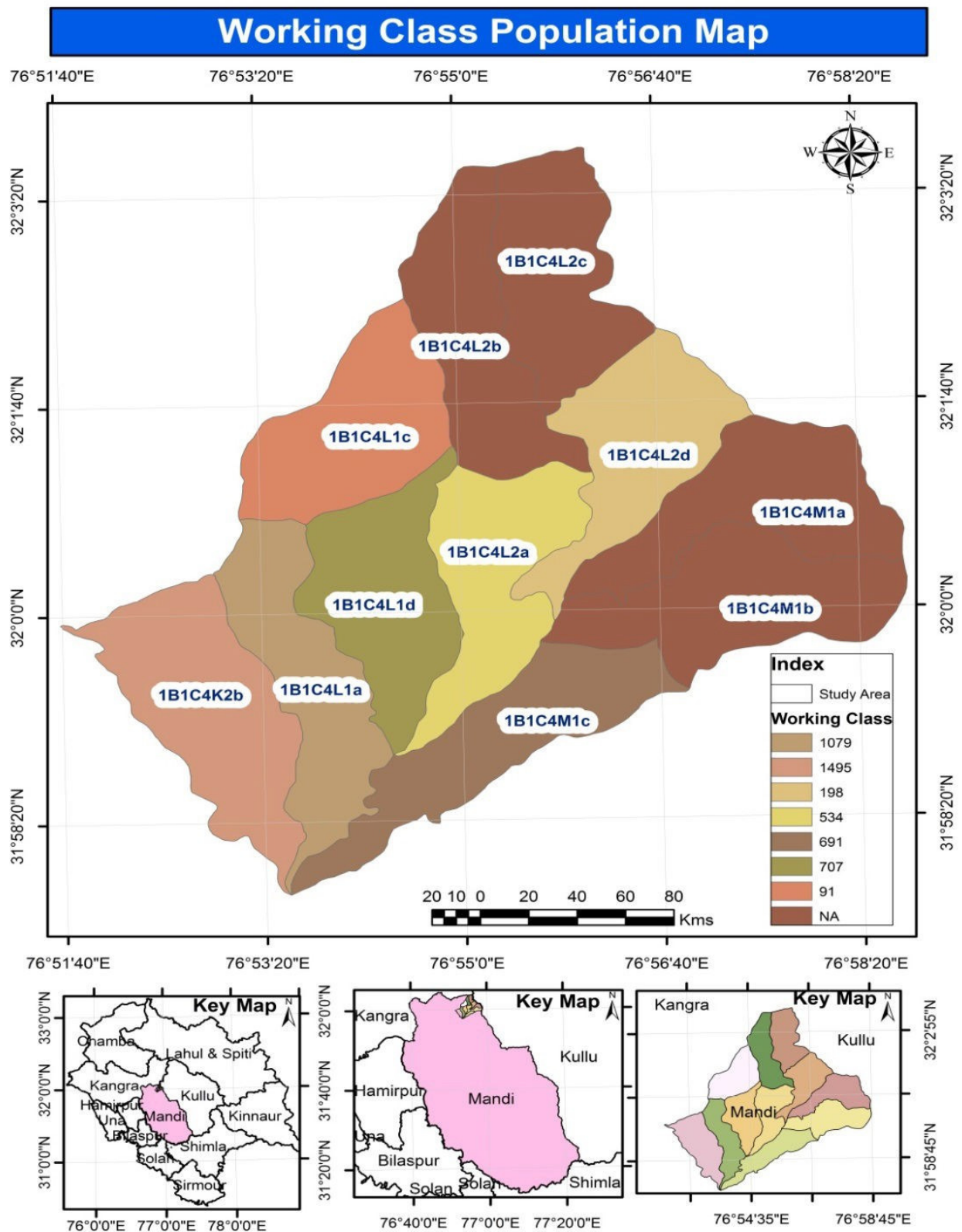


Figure-6
 Working Class status of study Area

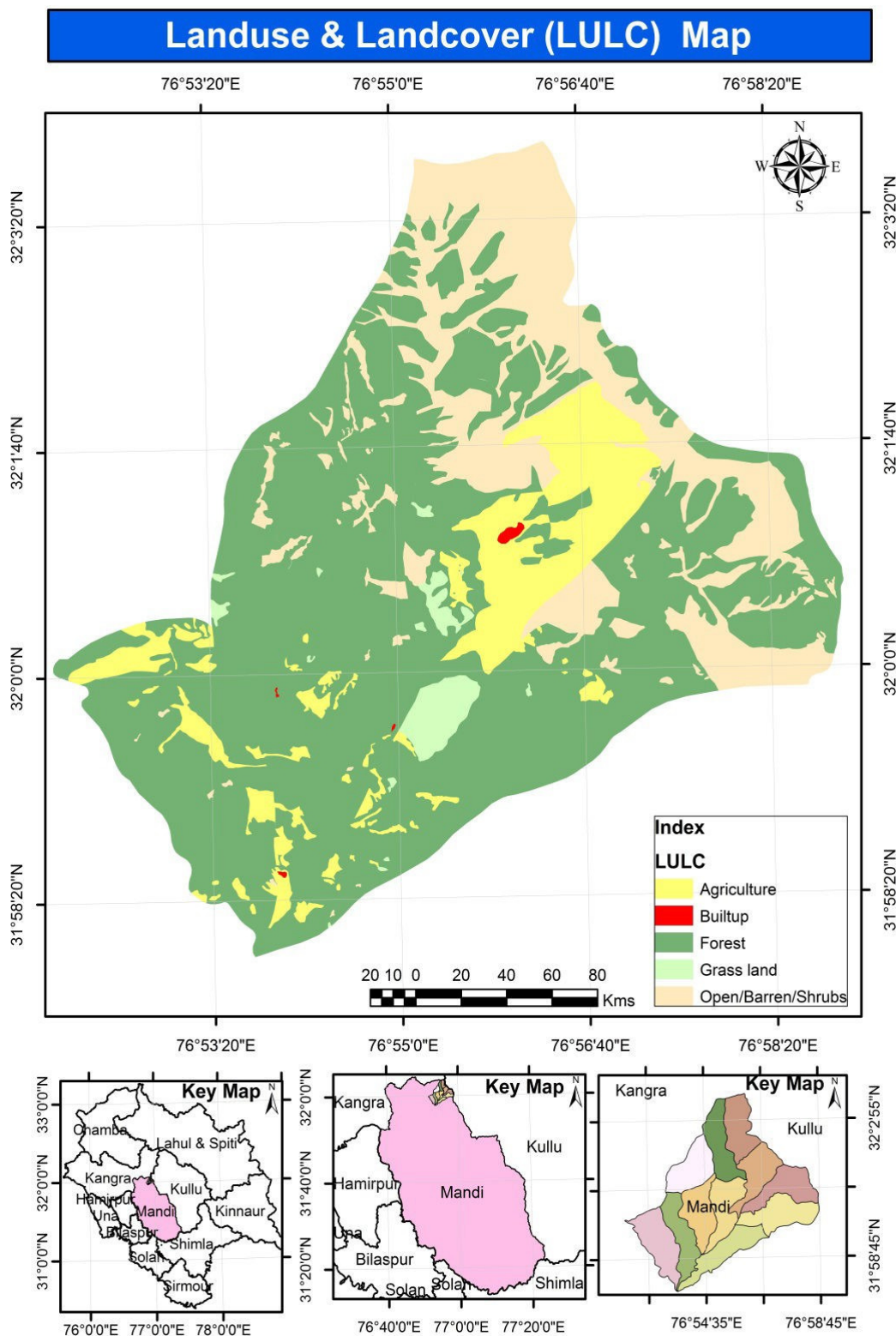


Figure-7
Landuse and Landcover of Study Area

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