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Impact of land cover change over the agriculture- A case study of Champawat district with the help of GIS and RS techniques

Shanti Singh Researh Schooler HNBGU SRT Campus tehri uttrakhand

**Research Scholar(UGC NET, SET) Dept. Of Geography, SRT Campus,HNBGU Badshahithaul.*

Abstract

Studies have shown that there remain only few landscapes on the Earth those are still in their natural state. Due to anthropogenic activities, the Earth surface is being significantly altered in some manner and man's presence on the Earth and his use of land has had a profound effect upon the natural environment thus resulting into an observable pattern in the land use/land cover over time. The land use/land cover pattern of a region is an outcome of natural and socio – economic factors and their utilization by man in time and space. Land is becoming a scarce resource due to immense agricultural and demographic pressure. Hence, information on land use / land cover and possibilities for their optimal use is essential for the selection, planning and implementation of land use schemes to meet the increasing demands for basic human needs and welfare. This information also assists in monitoring the dynamics of land use resulting out of changing demands of increasing population. Land use and land cover change has become a central component in current strategies for managing natural resources and monitoring environmental changes. Always a particular land cover category increases on the dictate of the other. Thus in this present study an attempt has been made to monitor the LULC change and to identify the impact of this change over the agricultural area with the help of RS and GIS techniques.

Key Words- LULC, RS and GIS, Land cover categories.

Introduction

Land use and land cover change has become a central component in current strategies for managing natural resources and monitoring environmental changes. The advancement in the concept of vegetation mapping has greatly increased research on land use land cover change thus providing an accurate evaluation of the spread and health of the world's forest, grassland, and agricultural resources has become an important priority. Viewing the Earth from space is now crucial to the understanding of the influence of man's activities on his natural resource base over time. In situations of rapid and often unrecorded land use change, observations of the earth from space provide objective information of human utilization of the landscape. Over the past years, data from Earth sensing satellites has become vital in mapping the Earth's features and infrastructures, managing natural resources and studying environmental change. Remote Sensing (RS) and Geographic Information System (GIS) are now providing new tools for advanced ecosystem management. The collection of remotely sensed data facilitates the synoptic analyses of Earth - system function, patterning, and change at local, regional and global scales over time; such data also provide an important link between intensive, localized ecological research and regional, national and international conservation and management of biological diversity (Wilkie and Finn, 1996). Therefore, attempt will be made in this study to map out the status of land use land cover of Champawat between 1990, 1999 and 2010 with a view to detecting the land consumption rate and the changes that has taken place in this status particularly in the agricultural land so as to predict possible changes that might take place in this status in the next 20 years using both Geographic Information System and Remote Sensing data.

Before analyzing in details about the LULC of Champawat district let us first of know about the study area.

Champawat is situated 1615 m above sea level The district of Champawat constituted in the year 1997 is situated between 29 degree 5 minutes and 29 degree 30 minutes in northern altitude and 79 degree 59 minutes and 80 degree 3 minutes at the center of eastern longitude.

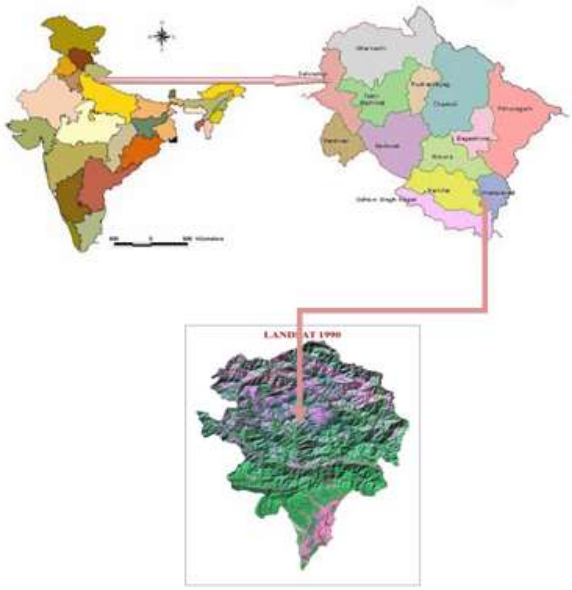

Fig 1 Location of the study area

Result and discussion

In the present study 8 types of land cover categories have been classified like Dense Forest, Open Forest, Scrub Forest, Scrub Forest, Sand/Open Land, River, Rocky exposure /waste land, Settlement, Agriculture of Champawat district has been classified. A Land Use and Land Cover classification system can effectively employ orbit and high altitude Remote Sensor data should meet the following criteria.

1- The minimum level of interpretation accuracy in the identification of land use land cover categories from Remote Sensor data should be at least 85%
2- The accuracy of interpretation for the several categories should be about equal.
3- Repeatable or repetitive results should be obtainable from one interpreter to another and from on time of sensing to another.
4- The classification system should be applicable over extensive areas.
5- The categorization should permit vegetation and other types of land cover to be used as surrogates for activity.
6- The classification system should be suitable for use with Remote sensor data obtained at different times of the year.

7- Effective use of subcategories that can be obtained from ground surveys or from the use of larger Scale or enhanced Remote Sensor data should be possible.

8- Aggregation of categories must be possible.

9- Comparison with future land use data should be possible.

10- Multiple uses of land should be recognized when possible.

Based on these criteria three LULC map has been created for the year 1990,1999 and 2010 with the help of Erdas 9.1 and Arc GIS 9.3 software. The methodology used to complete the work is shown as below.

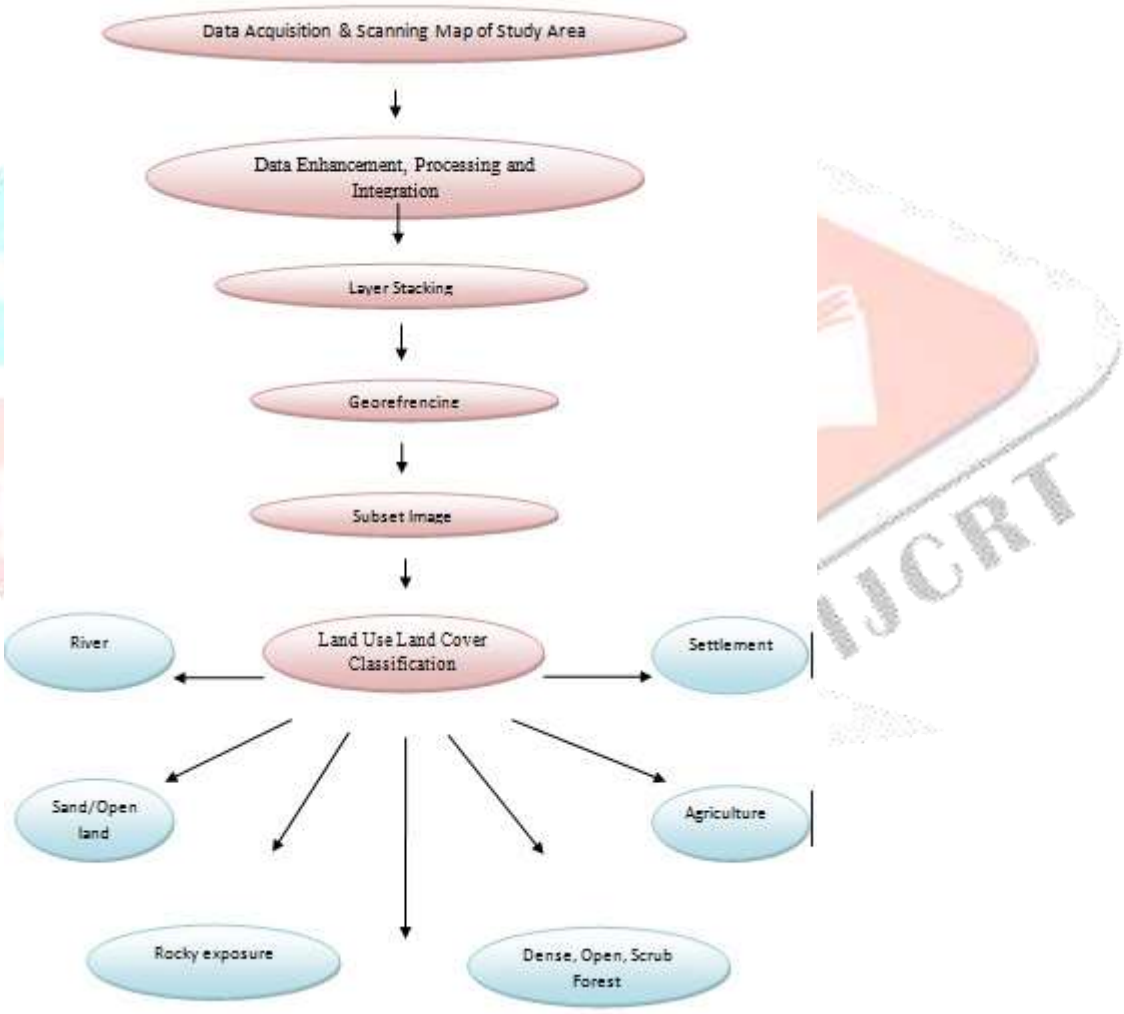

Fig 3- Methodology Scheme

Based on this methodology the following LULC maps highlighting the different LULC categories for the year 1990, 1999 and 2010 were abstracted.

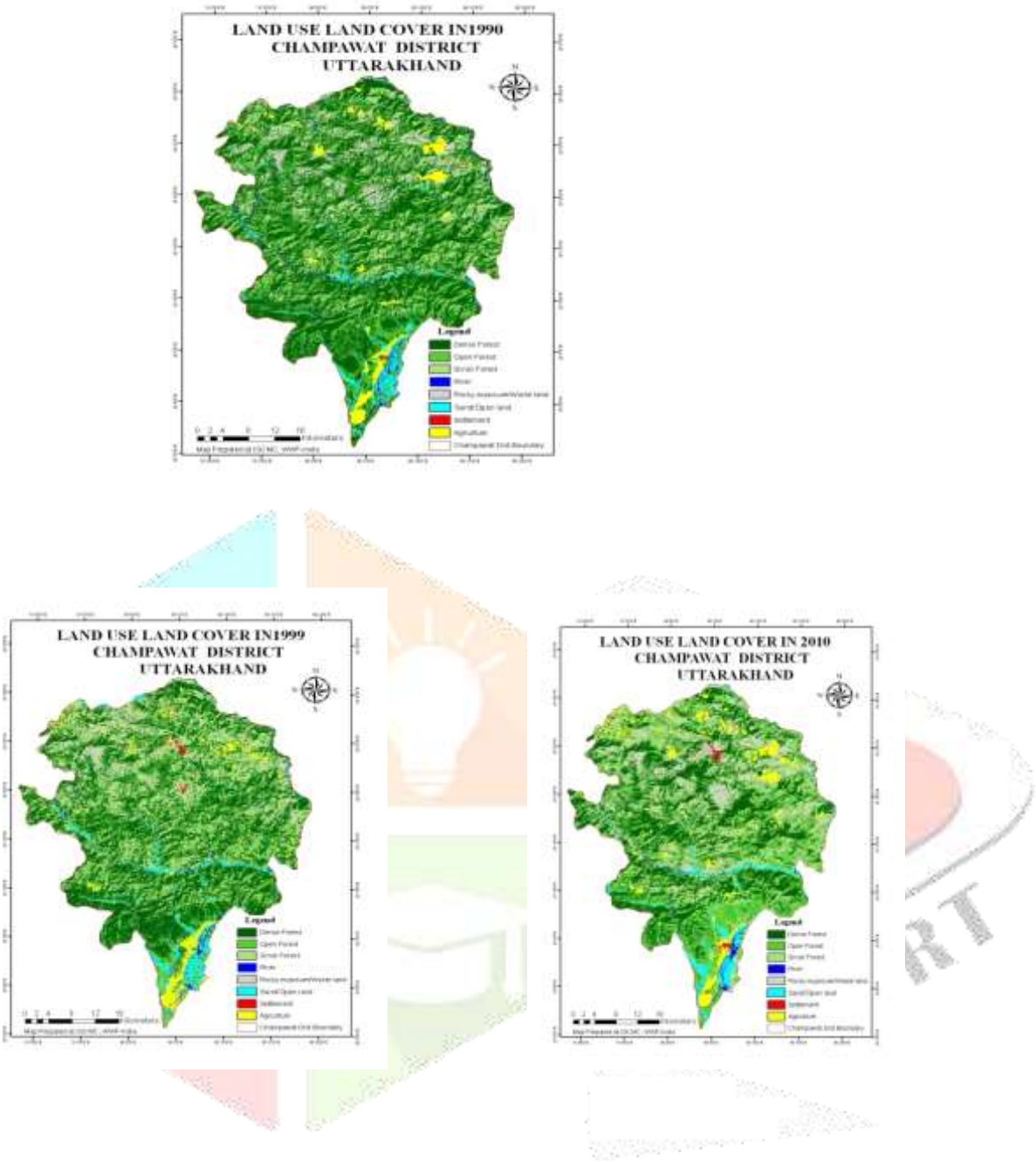

Fig 3 The LULC Maps of 1990,1999 and 2010.

From these LULC maps we find the following distribution

Class Name (Ha.)	1990 Area	1999 Area (Ha.)	2010 Area (Ha.)
Dense Forest	89237.7	75426.91583	56782.8288
Open Forest	31495.14	26112.5379	37890.3744
Scrub Forest	31802.22	49629.85583	16171.0272
sand/Open Land	4665.87	5840.23995	49710.1824
River	2194.65	1683.063225	5683.69
Rocky exposure/waste land	11596.5	12260.26395	2035.2384
Settlement	531.9	421.23285	646.0416
Agriculture	4363.74	4483.62	6893.1072
Total area	175887.72	175857.7295	175812.48

Table 1 LULC distribution

From the table we can find that within the three years the area under the forest has decreased and its area has been encroached by settlement and agriculture. There has been a huge increase in the area under agriculture. Most of the forests are being cut down for fulfilling the needs of the human being. Besides this from the maps we can also state that that growth of the settlement and agriculture is rather happening in a much unplanned manner.

Nature and location of Changes

An important aspect of change detection is to determine what is actually changing to what i.e. which land use class is changing to the other. This information will reveal both the desirable and undesirable changes and classes that are "relatively" stable overtime. This information will also serve as a vital tool in management decisions. This process involves a pixel to pixel comparison of the study year images through overlay.

In terms of location of change, the emphasis is on settlement. Fig.No2 shows this change between 1990 and 1999, 1999 to 2010 and 1990 to 2010. The observation here is that there seem to exist a growth in and around the earlier Forest cover change existed and took the shape of cluster pattern of Forest cover.

Recommendation

Uttarakhand is one of the mountainous state of India it is also a rest place of forest and natural habitat and Champawat is again one of the most green district of this state. But at the present time its serenity is being hampered due to constant rise of population. All the forest land are being encroached mainly for settlement and agriculture besides this the greatest setback is that all these are happening in a much unplanned manner. Thus effort should be made to develop these areas in a planned manner. RS and GIS techniques can be very helpful in doing so because it provides us the facility to analyse detect and predict the changes.

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