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LAND-USE AND LAND-COVER CHANGE (LULCC) FROM PAST FEW DECADES IN LIDDER VALLEY OF KASHMIR HIMALAYA

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ABSTRACT

The present study was carried out on Lidder valley in Kashmir Himalayas supporting a varied topography and exhibiting altitudinal extremes of 1600m and 5200m (asl). The paper highlights the change in various land use - land cover (LULC) classes during the past few decades. Among the different types of land use/ land cover, viz, forest, shrubs, agriculture, barren land, plantation, meadows, snow covered, buildup land and water, the study revealed that significant reduction in forest land from past three decades has been noticed due to unabated deforestation of rare and precious tree species resulting in intense soil erosion, habitat loss of both flora and fauna conversely agriculture land showed significant increase due to increasing population and increased requirement of food and other resources. Shrubs, barren land including exposed rocks, intermittent meadows and snow covered areas showed significant reduction while plantation and build up land showed an upsurge. Snow was found towards the northern and north-eastern parts of the study area while plantation, agriculture built-up and boulder are present predominantly in the southern parts of the valley. Many other vital changes in the study area are also highlighted in this paper.

Key words: Deforestation, plantation, lidder valley, Kashmir Himalaya, land use - land cover

INTRODUCTION

Land-use and land-cover (LULC) change also known as land change is a general term for the human modification of earth's terrestrial surface. Though humans have been modifying land to obtain food and other essentials for thousands of years, current rates, extents and intensities of LULC changes are far greater than ever in history, driving unprecedented changes in ecosystems and environmental processes at local, regional and global scales. These changes encompass the greatest environmental concerns of human populations today. Monitoring and mediating the negative consequences of LULC changes while sustaining the production of essential resources has therefore become a major priority of researchers and policymakers around the world.

Land cover refers to the physical and biological cover over the surface of land, including water, vegetation, bare soil, and/ or artificial structures. Land use is a more

complicated term. Natural scientists define land use in terms of syndromes of human activities such as agriculture, forestry and building construction that alter land surface processes including biogeochemistry, hydrology and biodiversity. Social scientists and land managers define land use more broadly to include the social and economic purposes and contexts for and within which lands are managed, such as subsistence versus commercial agriculture, rented vs. owned, or private vs. public land. While land cover may be observed directly in the field or by remote sensing, observations of land use and its changes generally require the integration of natural and social scientific methods (expert knowledge, interviews with land managers) to determine which human activities are occurring in different parts of the landscape, even when land cover appears to be the same. Scientific investigation of the causes and consequences of LULC requires an interdisciplinary approach integrating both natural and social scientific methods thus which has emerged as the new discipline of land-change science.

Land use-land cover is an important parameter for hydrological, geographical and ecological modeling. These constitute an important parameter for development, planning and management of natural resources (Shakeel, 2007). The spread of urban land use around the world brings new challenges to both resource managers and ecologists. Land-use practices play major roles in the health and dynamics of aquatic ecosystems (Johnson *et al.*, 1997; Bunn *et al.*, 1999). In the light of above facts, the Lidder valley was selected for evaluation in order to provide holistic view of land use/ land cover status. One of the prime prerequisites for better use of land is information on existing land use patterns and changes in land use through time.

STUDY AREA

The study area is the Lidder valley (Fig. 1), being one of the dozen major valleys of Kashmir, starts around 15 km north of Anantnag and is situated between the geographical coordinates of 33°43′ – 34°15′ N latitude and 75°05′ – 75°32′ E longitude and has an area of 1160 km². The valley is nearly 50 km long and has a varied topography. The lower 1/3rd of the valley is very fertile and hence ideal for paddy cultivation. The middle 1/3rd is not that fertile and is ideal for maize, fruits, etc. The upper 1/3rd of the valley comprises of dense pine forests and above them overlieslush green high altitude pastures.

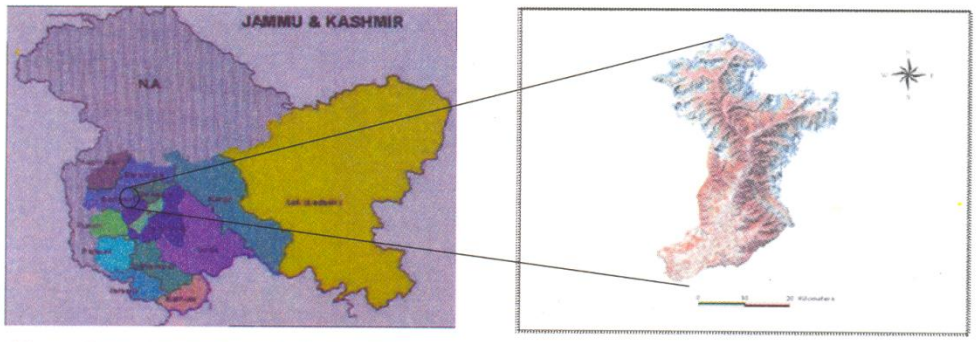

Fig. 1. Location map of the study area

The most important settlement in Lidder valley is the village of Pahalgam which gets its name from *Pahal* which means shepherd and *Gam* meaning village. It has now developed into a small township with many hotels and government offices having modern facilities. The town of Pahalgam in the Lidder valley situated at an altitude of 2598 m (asl) is an important tourist destination and also a gateway to many treks including the one to the Holy cave of Amaranth. The Lidder valley supports a varied topography exhibiting altitudinal extremes of 1600 m and 5200 m above mean sea level. The relief of the valley is diverse being comprised of high steep slopes, alpine meadows and alluvial fans, etc. A number of high altitude lakes like Sheshnag, Dudhnag, Tarsar, Katarnag, Harnag, Chanda Sar, etc. are situated in the area.

Lidder steam, one of the important right bank tributary of river Jhelum, passes through the area almost bisecting it. It is formed by two mountain torrents of Pir panchal range. In its passage through the lower part of the Lidder valley, the stream separates into numerous channels, in the vicinity of Anantnag and finally joins the Jhelum at Gur after traveling a course of 70 km.

MATERIAL AND METHODS

There are two primary methods for capturing information on land cover: (i) field survey and (ii) analysis of remotely sensed imagery. To generate the present Land use-land cover map LANSAT-ETM image of September 2006 having spatial resolution of 28.5 meter with a scale of 1: 50000 scales were used for detecting the change in land use /land cover status of the study area. The geocoding satellite images were obtained for the study on 1: 50000 scale. Then ground truthing was done according to the sample strips. The other information was collected from State Forest Department (subdivision Anantnag). Geology and Mining Department (Srinagar), Environment, Ecology and Remote Sensing Department, Srinagar (Sub-division Phalgam) (1975-2001). SOI Toposheet maps of number 43 N/4, 43 N/8, 43 N / 12, 43 O/ 1 and other ancillary data were used.

RESULT AND DISCUSSION

The land use and land cover of the study area has 9 different classes viz. forest, meadow, water, plantation including orchard of almond, apple, walnut, apricot,

cherry etc, agriculture including wet and dry farming (paddy field wheat, maize, saffron etc), shrubs, barren land including exposed rock, built-up, meadows snow. The total area and percentage of the different land use land cover is given in Table 1.

Table 1. Total area and percentage of area under different land use land cover and %age of area under land use land cover

S. No.	Name of the class	Area (km^2) (% of the total area) 1974- 75	Area (km^2) (% of the total area) 2006	Total Area (km^2) changed (% of the total area changed)	Result
1	Forest	302.87(26.70%)	283.43(24.26%)	- 19.4315 (2.44%)	Reduction
2	Shrubs	321.48(28.34%)	262.96(22.51%)	-58.5013(- 5.83%)	Reduction
3	Barren land	257.37(22.68%)	210.53(18.02%)	-46.8213(- 4.66)	Reduction
4	Agriculture	34.14(3.00%)	118.35(10.13%)	+84.2276(+ 7.13)	Increased
5	Meadow	112.49(10.40)	96.16(8.23)	-16.3224(- 2.17)	Reduction
6	Snow	89.16(7.46)	81.59 (6.98)	-7.5561(- 0.48)	Reduction
7	Plantation	14.54 (1.27)	47.69(4.08)	+33.1664(+ 2.81)	Increased
8	Built-up	2.07(0.15)	2.91(0.24)	+0.8579(+ 0.09)	Increased
9	Water	NA	1.53(0.13)	1.53	-

NA: - Not Available

The different classes of the Land use Land cover (LULC) are depicted in GIS image Fig-2 and the pie diagram of percentage is given in Fig-3. These different classes are discussed below.

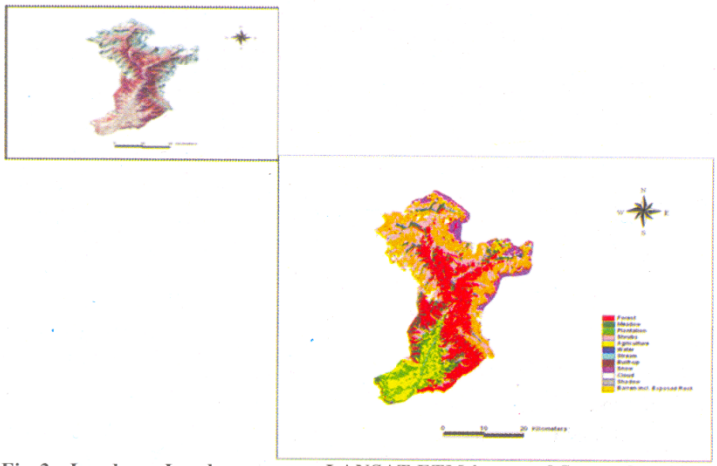

Fig-2. Land use-Land cover map LANSAT-ETM image of September 2006

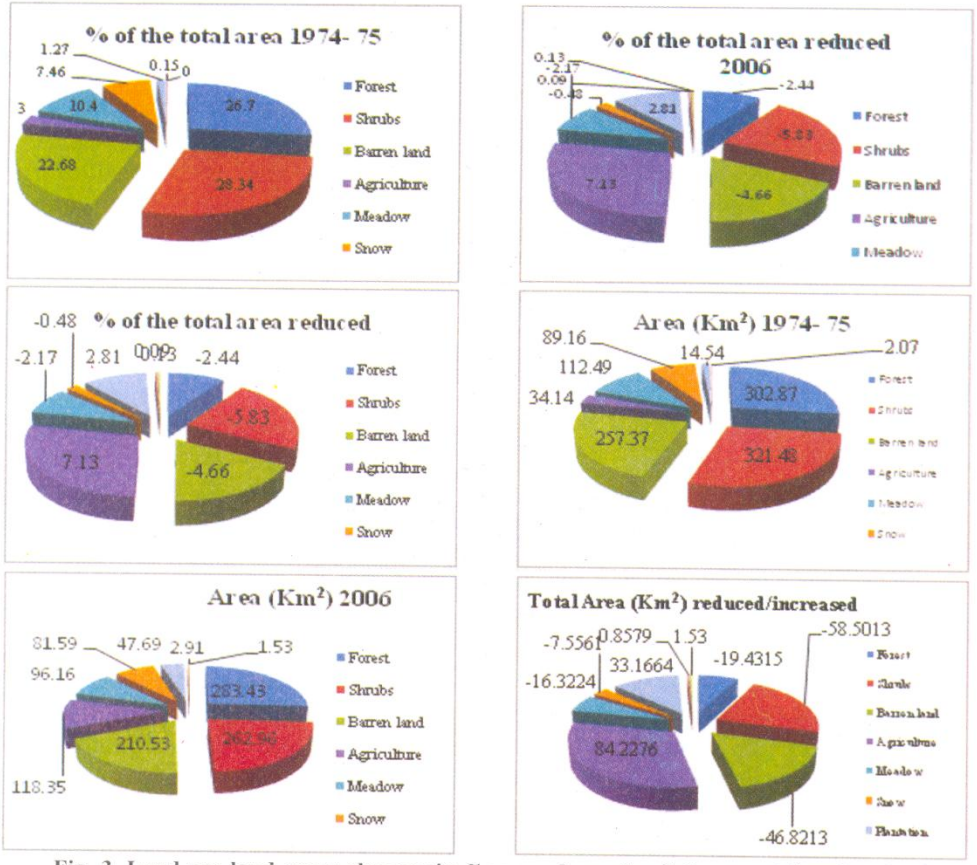

Fig. 3. Land use-land cover changes in %age and area(km²) from past few decades

i. Forests

The total area under this class in the year 1975 was 302.87 km² which was 26.70 percent of study area while in 2006 it was about 283.43 km² which was 24.26 percent of the study area. The total reduction was 19.4315 km² that is 2.44%. Forest dominates the study area covers 24.26 % of the total area. It ranks fourth in reduction. The most important tree species like deodar, kail, pine and fir are found in this region. The wood of these tree species are very expensive and durable which increases its demand and it is riotously cut down and smuggled to the other parts of the state. Illegal smuggling of forest wood is the most convenient and easy source of income for the people living in the study area. Due to above reason, deforestation increased and forest cover reduces.

Forest fire is another vital reason for the reduction of forest cover.

ii. Shrubs

The total area under this class in the year 1975 was 321.48 km² that was about 28.34% and in 2006 it was about 262.96 km² is 22.51%. Total reduction was 58.52 km² which was 5.83%. Shrubs rank second with 22.51 % of the Lidder valley. Highest reduction was seen in the LULC class.

iii. Barren land

It includes exposed rock and is next to the shrubs. The total area under this class in the year 1975 was about 257.37 km² that was about was 22.68 % and in year 2006 it was about 210.53 km² which is accounts about 18.02 %. Reduction in the area was 46.84 km² which accounts 4.66 % over the period of study, this is being so because the nomadic people practice dry farming during summer and use this land as grazing field for their livestock during summer. Conversion of this class of land in to agriculture is the main cause for the reduction.

iv. Agriculture

Agriculture is presently dominant in the floodplains of Lidder stream forming the southern part of the valley. It is confined to floodplain belt having better physical condition overlain by alluvial soils. The main crops grown in the area are rice, maize, pulses, and horticulture produce including apple, almond and walnut. The total area under this class in the year 1975 was 34.14 km² which was 3.00 % of the study area and in 2006 it was 118.35km² which was 10.13% of total Lidder valley thus showed increment of 84.23 km² being 7.13% of land. Highest increment was seen in this class because of the requirement of more agriculture land, as population increase necessity of food resources also increase. The increasing in land use land cover class is the result of conversion of forest land into agriculture.

v. Meadows

The major portion of land is barren and soil texture is course loamy and sandy with pebbles. The total area under this class in the year 1975 was about112.49 km² which was 10.40% of the study area and in 2006 it was 96.16km² which was 8.23 %. The total reduction in this class is about 16.33 km² which was 2.17%. Meadow rank fifth constituting 8.23 % of the Lidder valley.

vi. Snow

This area lies in highly mountainous peaks with an average altitude of 5200m. Snow is found towards the northern and north-eastern parts of the study area and remains permanently under snow

round the year but in winter whole of Lidder valley is covered with heavy snow. The total area under this class in the year 1975 was 89.16 km^2 which was 7.46 % of the study area and in 2006 it was 81.59 km^2 which was 6.98 % of total Lidder valley. The total reduction in this class is 7.56 km^2 which is 0.48% which is moderately less as compared with other classes.

vii. Plantation

Occurring dominantly in the southern parts of the Lidder valley had a total area of about 14.54 km^2 in 1975 that was 1.27 % of the study area while in 2006 it was 47.69 km^2 which is 4.08 % of total Lidder valley thus registering a total increment in this class to the tune of about 33.1664 km^2 which is 2.81%.

viii. Built-up

Built-up land is present dominantly in the southern parts of the valley all along the floodplains of Lidder stream. The total area under this class in the year 1975 was about 2.07 km^2 being 0.15% of the study area which in 2006 it significantly increased to 2.91km^2 which was 0.24 % of total Lidder valley. Thus total increase is about 0.8579km^2 making 0.09% was noticed for this class..

ix. Cloud and shadow cover

Cloud and shadow cover forms about 3.75 % of the area.

x. Water

It covers total of 1.53 km^2 in 2006 which is about 0.13% of the study area.

The overall classification accuracy was found to be 88.60%.

CONCLUSIONS

During the various LULC classes, forests dominate the Lidder valley and showed significant reduction as against the agriculture, build up land and plantation showed moderate to high increment. Shrubs, barren land meadows and water showed reduction. Shrubs are next to the forest and barren lands including exposed rocks are next to the shrubs with intermittent meadows in the upper reaches of the valley. Snow is found in the upper reaches of the northern and north-eastern parts of the study area. Plantation, agriculture built-up and boulder are present dominantly in the southern parts of the valley.

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