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Analysis of Land Use and Land Cover Changing Patterns of Jammu and Kashmir

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Abstract

The land-use land-cover (LULC) changes have emerged as one of the drastic problems the world is facing in recent times. These changes often manifest in the form of environmental degradation, water shortage and declining food security. One of the most leading forces responsible for changing the global landscape includes the changes in LULC as prompted by a string of interconnected forces. Here an attempt has been made to determine the changes in land-use land-cover (LULC) over the period of 60 years in Jammu & Kashmir. The present study is primary based on secondary data with effect from 1960-61 to 2020-21 in which it was observed that the most notable changes of land use were observed in the form of increase in farmland and a decline in grassland. Over this period the farmland has increased by 22.4 per cent, the grassland has decreased 1.4 per cent of area (64000 ha).The area under Lakes/Water bodies etc was the second most dominant land-use class after grass land which has gradually decreased by 28 thousand hectares since 1960-61.

Keywords
Land-use; land-cover; Analysis; Jammu and Kashmir

I. Introduction

Land is defined as a place on which all human activity is being conducted. Use of land resources by the people gives rise to ―land use" which varies with the purposes it serves, whether they be food production, provision of shelter, recreation, extraction and processing of materials, and the bio-physical characteristics of land itself. Hence, land use is being shaped under the influence of two broad sets of forces – human needs and environmental features and processes. The terms land use and land cover are not synonymous and the literature draws attention to their use and land cover change. Land cover is the biophysical state of the earth's surface differences so that they are used properly in studies of land and immediate subsurface (Turner et al. 1995). It describes the physical state of the land surface; e.g., cropland, mountains or forests (Meyer, 1995 in Moser, 1996). Land cover deals with the quantity and type of surface vegetation, water, and earth materials (Meyer and Turner, 1994). i.e man-made constructions (buildings etc), the type of material used in housing structure (Parveen, 2017). The term land cover originally referred to the type of vegetation that covered the land surface, but has broadened subsequently to include other aspects of the physical environment also, such as soils, biodiversity and surfaces and groundwater (Moser, 1996). In the disaster prone areas of landslides, the destruction of forests and the vegetative cover that binds the top soil at an increasing pace and the conversion of forest land into agricultural and horticultural holdings (Khan et al., 2017) brings changes in land use and land cover.

II. Review of Literature

Land Use/Land Cover:- Land is defined as a place on which all human activity is being conducted. Use of land resources by the people gives rise to ―land use" which varies with the purposes it serves, whether they be food production, provision of shelter, recreation, extraction and processing of materials, and the bio-physical characteristics of land itself. Hence, land use is being shaped under the influence of two broad sets of forces – human needs and environmental features and processes. The terms land use and land cover are not synonymous and the literature draws attention to their use and land cover change. Land cover is the biophysical state of the earth's surface differences so that they are used properly in studies of land and immediate subsurface (Turner et al. 1995). It describes the physical state of the land surface; e.g., cropland, mountains or forests (Meyer, 1995 in Moser, 1996). Land cover deals with the quantity and type of surface vegetation, water, and earth materials (Meyer and Turner, 1994). i.e man-made constructions (buildings etc), the type of material used in housing structure (Parveen, 2017). The term land cover originally referred to the type of vegetation that covered the land surface, but has broadened subsequently to include other aspects of the physical environment also, such as soils, biodiversity and surfaces and groundwater (Moser, 1996). In the disaster prone areas of landslides, the destruction of forests and the vegetative cover that binds the top soil at an increasing pace and the conversion of forest land into agricultural and horticultural holdings (Khan et al., 2017) brings changes in land use and land cover.

2.1 Existing Literature on Land Use/Land Cover Change Studies

Existing Literature on Land Use/Land Cover Change Studies:- Human populations and their use of land have transformed most of the terrestrial biosphere into anthropogenic biomes. Such transformation has caused a variety of new ecological patterns and processes to emerge and has been significant for more than 8000 years (Ellis, 2011). Recently, issues related to LULC change have gained interest among a wide variety of researchers, ranging from those who favor modeling spatio-temporal patterns of land conversion to those who try to understand the causes, impacts and consequences (Verburg et al. 1999; Brown et al. 2000; Theobald, 2001). Land use affects land cover and changes in land cover affect land use. A change in either however is not necessarily the result of the other. Changes in land cover by land use do not necessarily imply degradation of the land. However, many shifting land use patterns driven by a variety of social causes, result in land cover changes. These changes affects biodiversity, water and radiation budgets and other processes that come together to affect climate and biosphere (Riebsame et al. 1994). Human activities which are mainly driven by socio-economic factors bring out changes in non-built-up and built-up land despite restrictions by physical conditions (Long et al. 2007). Land use change, including land transformation from one type to another and land cover modification through land use management, has altered a large proportion of the earth's land surface. The aim is to satisfy mankind's immediate demands from natural resources (Meyer and Turner, 1992; Vitousek et al. 1997).

The worldwide changes to forests, farmlands, waterways and air are being driven by the need to provide food, fiber, water, and shelter to more than six billion people. Global croplands, pastures, plantations and urban areas have expanded in recent decades. This expansion is accompanied by large increases in energy, water, and fertilizer consumption, along with considerable losses of biodiversity (Foley et al. 2005). Land cover can be altered by forces other than anthropogenic. For instance, Natural events such as weather,

flooding, fire, climate fluctuations and ecosystem changes may also initiate modifications upon land cover. There are also incidental impacts on land cover from other human activities such as forest and lakes damaged by acid rain from fossil fuel combustion and crops near cities damaged by tropospheric ozone resulting from automobile exhaust (Meyer, 1995). Kuemmerle (2009) observed the conversion of cropland to grassland in Arges¸ County in Romania which he related to the rapid changes in socio-economic, demographic and institutional conditions after 1989. Similarly, Brown (1995) states that more recent changes in land use have been dominated by losses of agricultural land. In particular, in eastern China there has been an unprecedented conversion of arable land into built-up uses following rapid industrialization. While Kebrom Tekle and Hedlund (2000) reported increases in the size of open areas and settlements at the expense of shrub lands and forests in twenty eight years (between 1958 and 1986) in Kalu District, Southern Wello, Ethiopia. Similarly, Woien (1995) reported increase of homestead in studies made in the central highlands, during 1957 and1986 attributing it to increase in population density. Mark and Kudakwashe (2010) in a study in Shurugwi district in Midlands Province of Zimbabwe observed the increase in cropland. He attributed this increase to the Land Reform and Resettlement Program.

Large areas of forests were cleared for different farm related activities like opening new farming plots, wood for fuel, poles for building both homes and cattle pens, among other activities. The built-up area around the water bodies in Davangere city, Karnataka, India has almost doubled between 1970 and 2005, at the cost of the agriculture land and scrub land (Begum et al. 2010). Prakasam (2010) studied land use/land cover change over a period of 40 years in Kodaikanal taluk, Tamil Nadu. In this study major changes has been observed like area under built-up land and harvested land has increased whereas the area under forest and water body has decreased. Javed and Khan (2012) studied land use land cover change during due to mining activities from 2001 to 2010. The study revealed that significant decrease has been observed in dense forest area, cultivated land and water body, however settlement, wasteland land and uncultivated land has increased mainly due to anthropogenic activities. Bisht and Kothyari (2001) have carried out land cover change analysis of Gurur Ganga watershed in Uttaranchal. The study from 1963 to 1996 and 1986 to 1996 revealed that the area under agriculture and settlement has increased whereas the forest and barren land show decline in area. Dhinwa et al. (1992) studied land use change of Bharatpur district, the analysis in the study reveal that forest cover has been depleted whereas wasteland undulating terrain with or without scruband rock out crops has been increased during 1986 to 1989. Different land use changes may affect one another.

Most of the ecological consequences of land use change reflect interactive effects under different land use changes. For example, deforestation has led to the degradation of freshwater habitat through due to the siltation of rivers. Similarly, the role of the Asian forest as a carbon sink and source varies from year to year or from place to place as a result of interactive effects between deforestation, afforestation and reforestation. Therefore, the interactions of different land uses along their change trajectories represent a 53 challenge for a better understanding of the land use change issue. Changes in land and ecosystems and their implications for global environmental change and sustainability are a research challenge for the human environmental sciences (Omenn, 2006; Turner et al. 2007). Studies on lulc has been done for different megacities like , Kolkata (Mandal et al., 2019; Mukherjee et al., 2018), Delhi (Naikoo et al., 2020; Sharma et al., 2020).

2.2 Study Area

The present study was conducted in Jammu and Kashmir union territory of India, located in the northern part of the Indian sub-continent centered on the plains around Jammu to the south and the Vale of Kashmir to the north. It is situated between 32o 17′ to 37o 05′ N latitude and 73o 26′ to 80o 30′ E longitude (Fig.1.1), and has a geographical area of 101,387 Sq. kms. With diverse land forms; plains in the Jammu region and uneven rugged mountainous terrain in the Kashmir valley. The major part of the union territory is mountainous, and the physiography is divided into five zones that are closely associated with the structural components of the western Himalayas. From west to east, those zones consist of the plains, the foothills, the Pir Panjal range, the valley of Kashmir, and the great Himalayan zone. The union territory extends 640 km in length from north to south and 480 km from east to west in breadth.

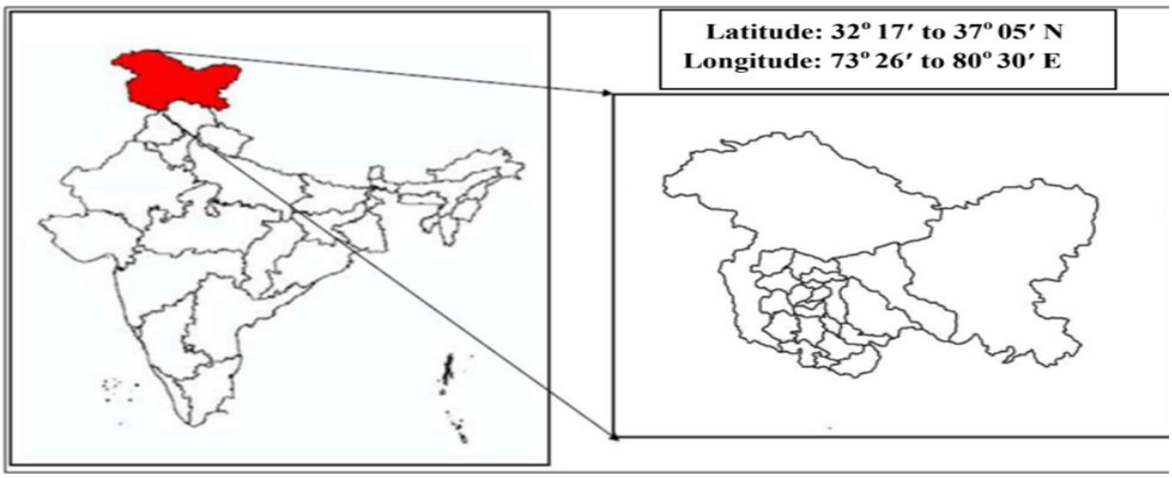

Figure 1. *Location of study area*

III. Research Method

The present study made use of secondary data obtained from diverse sources. The state-level information on land use pertaining to the period from 1960 to 2020, has been collected from the Directorate of Economics & Statistics, Government The present study made use of secondary data obtained from diverse sources. The state-level information on land use pertaining to the period from 1960 to 2020 has been collected from the Directorate of Economics & Statistics, Government. Change detection of land-use land-cover classes were computed to describe the extent of changes between periods.

Area change = (A2 – A1)

Where;

A1= Area in year/decade 1st

A2=Area in year/decade 2nd of a land-use land-cover class (ha.)

IV. Results and Discussion

In the present study land use classes were six major classes for decade endings (Table 1). Between 1960 and 2020, the most notable changes of land use were found in the form of increase in farmland and a decline in grassland. The farmland has increased by 22.4 per cent, the grassland has declined 1.4 per cent of area (64000 ha). The Union territory of Jammu and Kashmir has a dearth of fodder for most part of the year owing to

increasing demand in livestock that led to fodder imports. The Union territory of Jammu and Kashmir is 40 per cent deficit in fodder on dry matter basis and the deficiency is more pronounced in the segments of green fodder and concentrates (Wani et al., 2014). The area decline under this category may worry livestock owners. Strategies need to be framed for improving the productivity of pasture lands, grazing lands and other supporting lands. The forest area has decline by 6000 ha since 1960s in the mountainous region like J&K should be a concern for ecologists and planners. This decline could be well acknowledged by forestation and these trends are more likely to pose severe implications, including adverse agro-climatic changes (Baba et al., 2019).

The present study have shown that the area under lakes/ rivers/dams etc have also reduced over the years and this share is hypothesized to have come in the form of marshy land or got in some other uses. The land use depiction keeps no separate account of land under built-ups as it is combined with land put to non-agricultural uses. The data indicates that the area under this category has shown a marginal increase which seem under-estimated compared to the ground level observations where residential pockets have come up as sporadically across all land use categories though more widely across farmlands. The increasing land demand for creation of infrastructure and urbanization is expected to further bring more area under non-agricultural uses/built-up area.

The Union Territory of Jammu and Kashmir is losing its prime agricultural land and wetlands to rapid urbanization and flawed land-use policy. The unplanned construction with respect to residential colonies, factories, brick kilns, shopping complexes and other commercial infrastructure has harshly damaged the agricultural and ecological resources of the Jammu and Kashmir. Also the conversion of prime agriculture land and wetland area including the karewas come under the mallet of public infrastructural projects like railways, four lane highway projects, ring-road projects as well as hospitals, schools and colleges etc.

Land Use changes from 1960 to 2020:

During the period of six decades, the area occupied by farm land increased by about 6.7 per cent primarily as a result of shift of land from grass-land to this class. This increase in the area under farm-land was more significant during first decade (1960 to 1970) following by the decade of 2000-2010 and the increase was mostly due to expansion of area under fruits and vegetables. Consequential increase in area under farm land, the area under grass lands has decline and the scale was more during 1980s followed by 1970's and 2000's. Similar to grass land, forest area have also decreased by about 6 thousand hectares from 1960s to 2020's.The area under Lakes/Water bodies etc was the second most dominant land-use class after grass land which has gradually decreased by 28 thousand hectares since 1960-61.

Table 1. Change in land-use from 1960 to 2020 years (000 ha)

Sl. No.	**Land use**	**1960-61**	**1970-71**	**1980-81**	**1990-91**	**2000-01**	**2010-11**	**2020-21**	**1960-2020**
1	**Forests**	2693 (59.9)	2673 (59.5)	2676 (59.6)	2676 (59.6)	2681 (59.7)	2685 (59.9)	2687 (60.1)	-6.02
2	**Farmland**	938 (20.9)	960 (21.4)	964 (21.5)	971 (21.6)	978 (21.8)	995 (22.2)	1001 (22.4)	63
3	**Grassland**	251 (5.6)	243 (5.4)	227 (5.1)	200 (4.5)	198 (4.4)	185 (4.1)	187 (4.2)	-64
4	**Marshy land**	—	—	—	—	—	05 (0.1)	06 (0.1)	06

5	**Lakes/Rivers/ Dams etc.**	68 (1.5)	62.4 (1.4)	56.8 (1.3)	53.4 (1.2)	51.2 (1.1)	45.6 (1.0)	40 (0.9)	-28
6	**Built-up/ Land put to Non-agricultural uses**	549 (12.2)	551 (12.3)	565 (12.6)	586 (13.1)	582 (13.0)	569 (12.7)	552 (12.3)	03
	Total	4499	4489	4489	4486	4490	4485	4473	-26.02

Figures within parentheses indicate percentage of reported area.

Table 2. Change (ha, %) in land-use classes in 1960 to 2020

Land use	**1960 to 1970**		**1970 to 1980**		**1980 to 1990**		**1990 to 2000**		**2000 to 2010**		**2010 to 2020**		**1960 to 2020**	
	Change	**%**	**Change**	**%**	**Change**	**%**	**Change**	**%**	**Change**	**%**	**Change**	**%**	**Change**	**%**
Forests	-20.0	0.7	3.0	0.1	0.0	0.0	5.0	0.2	4.0	0.1	2.0	0.1	-6.0	0.2
Farmland	22.0	2.3	4.0	0.4	7.0	0.7	7.0	0.7	17.0	1.7	6.0	0.6	63.0	6.7
Grassland	-8.0	3.2	-16.0	6.6	-27.0	11.9	-2.0	1.0	-13.0	6.6	2.0	1.1	-64.0	25.5
Marshy land	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0	1.0	20.0	6.0	0.0
Lakes/rivers/ dams etc	-5.6	8.2	-5.6	9.0	-3.4	6.0	-2.2	4.1	-5.6	10.9	-5.6	-12.3	-28.0	41.2
Built up/land put to non-agricultural uses	2.0	0.4	14.0	2.5	21.0	3.7	-4.0	0.7	-13.0	2.2	-39.0	6.9	-19.0	3.5
Total	-9.6		-0.6		-2.4		3.8		-5.6		-33.6		-48.0	

Area under barren land including area put to non-agricultural use after increasing during first three decades has shown a declining trend and has decreased by 3.5 per cent of its area during 1960 as shown in (Table 2). Despite the rare formation of residential pockets on farm and non-farm property, the region accounted for less coverage, and the data's showed an overall fall in the land-use class.

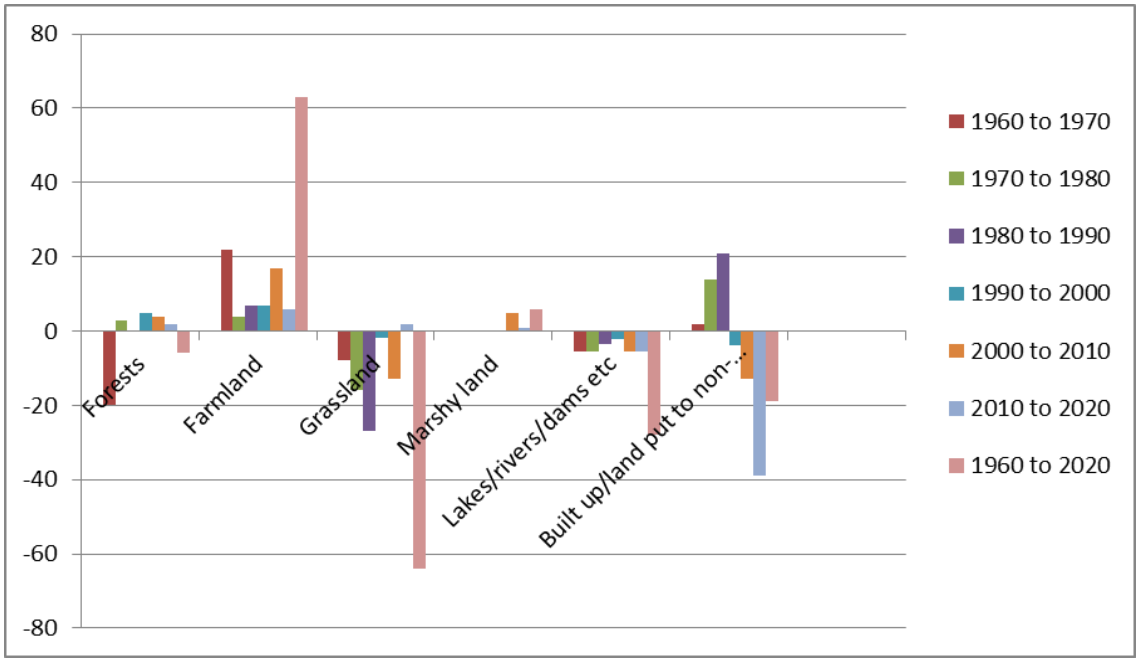

Figure. 2. *Change (ha, %) in land-use classes in 1960 to 2020*

V. Conclusion

In conclusion, the most notable changes of land use were observed in the form of increase in farmland and a decline in grassland. Over this period the farmland has increased by 22.4 per cent, the grassland has decreased 1.4 per cent of area (64000 ha).The area under Lakes/Water bodies etc was the second most dominant land-use class after grass land which has gradually decreased by 28 thousand hectares since 1960-61.

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